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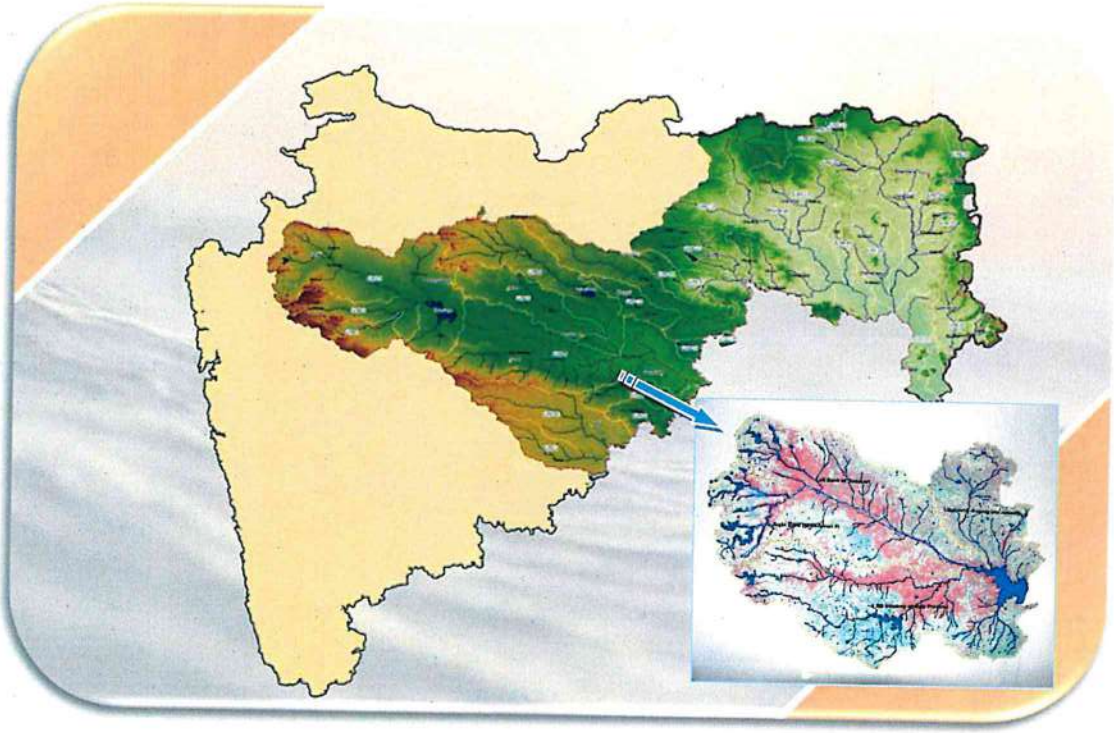
सत्यमेव जयते

Government of Maharashtra
Water Resources Department



Godavari Study Group II Report

Formulation of Guiding Principles on Integrated Operation of Reservoirs for Conservation Uses in Upper Godavari (upto Jayakwadi Dam) Sub-basin

October 2024

: PREFACE :

Water, a prime natural resource, is used for multiple uses as domestic, irrigation, industry, power generation navigation etc. Water which was once considered as abundant and has now become a scarce and economic resource. The distribution of water resources is uneven over a large part of the state. The state water policy formulated by Government of Maharashtra in 2003 and 2019 envisages that the water resources of the state shall be planned, developed, managed with a river basin and sub basin as the unit. This policy states that the distress in water availability during deficit period shall be shared equitably amongst different sectors of water use and also amongst upstream and downstream users.

Upper Godavari Sub-basin includes the entire catchment of the Godavari river from its source to Jayakwadi dam including the catchment areas of the Pravara river, Mula river and that of all other tributaries which falls into the Godavari river in this reach. Large number of major, medium, minor irrigation projects, K.T. weirs, local sector schemes are constructed for conservation purposes and utilization of available water resources.

The Upper Godavari (up to Jayakwadi dam) sub basin is having total geographical area of 21,774 Sq km. The sub basin is divided into two parts viz. Upper reach along Sahyadri range and lower downstream reach. The upper reach (Western Ghats) receives heavy rainfall while the lower reach falls under rain shadow belt having low rainfall. This subbasin is a well developed from water storage considerations. However, the factors like rapid urbanization due to high increase in population and faster industrial development are putting stress on available water resources The development in agriculture and urban sectors has not only posed substantial increase in water demands for various uses, but resulted in conflicts which are critical in nature now it self. The fact that the sub basin water resources remain more or less fixed and demands would go on increasing rapidly. There is a water stress situation now in this sub-basin. At present, the water resources projects are mostly operated and managed considering them as a single entity, instead of attempting integrated operation for deriving optimum and equitable benefits. The water management is now a challenge for water resources engineers to adopt a strategy for the integrated operation of reservoirs in the filling period .

The Water Resources Department, Government of Maharashtra has constituted the Godavari Study Group (2013) for formulation of guiding principles on integrated operation of reservoirs in Upper Godavari (up to Jayakwadi dam) sub basin. Study Group (2013) under Chairmanship of Shri H.T. Mendhegiri, Director General, WALMI, Chh. Sambhajinagar, vide Marathi Resolution No. Misc-2012 / (891/12) / 2012/IM(P) dated 29th January, 2013 for formulation of regulations/ guiding principles on integrated operation of reservoirs during filling period in Godavari basin (up to Jayakwadi dam). The other members were, Chief Engineers of Pune and the said region i.e. Nashik and Chh. Sambhajinagar. The Water Resources Department under Marathi Resolution No. Misc-2012/ (891/12)/2012/ IM (P) dated 7th March, 2013, has included Executive Director, Godavari Marathwada Irrigation Development Corporation, Chh. Sambhajinagar as Special Invitee in the Study Group. Herein after mostly referred as Godavari Study Group-I (2013). The Shri Mendhegiri Committee submitted it's report on 8th August, 2013. According to this , GSG report (2013) and as per orders of MWRRA & Hon. High Court the Executive Director, Godavari Marathawada Development Corporation, Chh. Sambhajinagar issued order to release water from upper dams in the scarcity year 2015, 2018 & 2024 respectively.

Since the Shri Mendhegiri Committee submitted it's report on 8th August, 2013, then almost 10 years have been completed and there is a need to revisit the said Shri Mendhegiri Committee Report (2013), considering Kharif water use utilisation, Evaporation and conveyance losses, changes in Water use pattern of Jayakwadi project and the field difficulties occurred during execution to release water from upper upstream reservoirs to the Jayakwadi Reservoir, when there is shortfall in reservoir capacity, in a drought / water scarcity situation.

Also, as per the recommendation No.4 of Guiding Principles, of Shri Mendhegiri Committee Report (2013), it is stated that, the "Review and updating of operating rules (guiding principles) as presented in Table: 7 may be done after lapse of 5 years or at shorter period as decided by the Government, taking into account the difficulties faced in the implementation and changes in water planning scenario of sub-basin."

Based on the afore mentioned background, the Water Resources Department of the Government of Maharashtra established a Study Group chaired by the Director General of Design, Training, Hydrology, Research and Safety, MERI, Nashik. This initiative was formalized through Marathi Resolution No. Misc -2024/ File No 186 /

2024/IM(P) dated 26th July, 2023 and 1st Augst 2023. Herein after mostly referred as Godavari Study Group-II (2024) The scope of the study given in TOR is broad.

Drought is a complex phenomenon that occurs primarily due to significant deviations in rainfall from the normal and/or uneven spatial or temporal distribution. This deviation can adversely affect crops over a single agricultural season or successive seasons. Defining drought precisely and universally is challenging because of its multifaceted nature and varying characteristics across different agroclimatic regions. Additionally, it is difficult to determine the exact beginning and end of a drought.

In India, drought is generally considered to coincide with the monsoon season. The severity and spread of this calamity depend on several factors, including the status of surface and groundwater resources, agro-climatic conditions, cropping patterns, and the socio-economic vulnerabilities of the local population.

A deficiency in rainfall leads to the depletion of soil moisture and a decline in surface and groundwater levels. This, in turn, negatively affects agricultural operations due to the insufficient availability of water for crops, particularly during critical stages of plant growth. The relationship between rainfall quantity and drought triggers varies across agroclimatic zones in India. Although deficient rainfall is generally seen as the primary cause of drought, the occurrence, spread, and intensity are influenced by multiple factors, including climate change vulnerabilities, hydrological and soil profiles, soil moisture availability, crop choices, agricultural practices, fodder availability, and socio-economic factors.

An attempt has been made by the Godavari Study group committee II for Integration of Water Release with MahaMADAT plug in software developed by Maharashtra Remote Sensing Application Centre (MRSAC), Nagpur. The overall project execution workflow is elaborated in the report. The precise determination of the storage levels within the command areas of dams situated upstream of Jaykwadi (Jayakwadi Dam) and those within the Jaykwadi project area is conducted annually on the 15th of October using the PRAVAH App of Maharashtra WRD. Also, MRSAC will provide the list of circles under drought with the help of MahaMADAT software. WRD will provide the water utilization data for fodder growth for each circle, based on which plug in software will calculate exact amount of water required for growing the fodder for the quantum of livestock in each circle.

Specially developed software will, also, provide precise calculations regarding the amount of water to be released, taking into account various factors such as the prevailing drought conditions, the storages in dams i.e. Jaykwadi and upstream dams levels as of 15th October , the utilization of water during the kharif season, and the requirements for non-irrigation purposes, including drinking and industrial usage. This comprehensive approach ensures effective water management and allocation in accordance with the prevailing conditions and demands.

MRSAC with the help of skilled software developers who will collaborate with WRD officials to accurately determine the amount of water to be released. This determination will be made after assessing the severity of the drought situation in the command areas of Jaykwadi (Jayakwadi Dam) & Upstream dams of Jaykwadi. MRSAC will develop specialized software that takes into account five key parameters related to drought, as well as the storages of all dams within the study area and the utilization of water for Kharif crops and non-irrigation requirement, also, irrigation requirement as per prevailing strategy of Godavari Study Group report (2024) at each dam by 15th October of every year. The software will be designed to operate autonomously, without requiring human intervention, streamlining the process and ensuring accuracy in water release decisions.

A study group has also discussed "Reservoir sedimentation work done by MERI for Upper Godavari basin up to Jayakwadi project" and "River diversion schemes / River link projects, diverting surplus water from Konkan region to deficit region of Godavari basin." A separate chapter on both these issues is included in the study group report.

A detailed report on such important issues is put forth by the study group along with few important recommendations. Possible efforts are made to address on Terms of Reference and peripheral issues. We sincerely hope that the report would be useful for integrated water resources management of limited available water resources to meet the increasing demands.

Methodology elaborated in this Report will ensures a systematic approach to water management, leveraging technology and collaboration between MRSAC and WRD to optimize water utilization and mitigate the impacts of drought in the region.

We are thankful to Water Resources Department, Government of Maharashtra for selecting this critical subject for further study Mr. Sanjay Belsare, Secretary (WRM & CAD), encouraged study group and whole heartedly participated during discussions. Study Group appreciates Mr. Deepak Kapoor, Additional Chief Secretary (WRP & D)

for his technical guidance and cooperation. We specially acknowledge the contribution made by Mr. M S Amale, Superintending Engineer (Retd.) of WRD in collection, validation and analysis of various data during his tenure as Member Secretary of the study group.

We are specially thankful to Dr. Ashok Kumar Joshi, Director, MRSAC, Nagpur, Dr. Prashant Rajankar, Associate Scientist, MRSAC, Nagpur & his team members, also, Shri. Rajendra Badhan, Deputy Engineer (Retd.), Shri. Deelip Pahade, Deputy Engineer (Retd), Shri. Prashant Govardhane, Sub Divisional Officer, Smt. Bharati Shinde, Assistant Engineer-II, Smt. Anupriya Jadhav, Assistant Engineer-II, who assisted whole heartedly and very sincerely in preparation of statements, drawings, pie charts, and report related jobs. We acknowledge the technical support received from various member of Study Group. We cannot forget to acknowledge day to day assistance received from Mr. Gautam Waghmare, Higher Grade Stenographer and Mr. Jagannath Mali, Lower Grade Stenographer.

14th October, 2024

(Pramod G. Mandade)
Director General,
DTRHS (MERI), Nashik and
Chairman, Godavari Study Group - II

CONTENTS

CHAPTER : 1

INTRODUTION

1.0 General :

The Water Resources Department of the Government of Maharashtra has established a Study Group to address the challenges of water management in the Upper Godavari sub-basin up to the Jayakwadi dam. This initiative stems from concerns regarding the increasing water demands due to rapid development in agriculture, industry, population, and urbanization, which have led to heightened utilization of upstream resources. This heightened utilization has resulted in decreased inflows into the Jayakwadi dam, exacerbating water stress in the lower reaches, particularly in the Marathwada region.

In Public Interest Litigation Petition No. 100/2012, in the Hon. High Court of Judicature of Bombay Bench at Chh. Sambhaji nagar, the Petitioner has requested Hon'ble High Court to direct the State Government and Maharashtra Water Resources Regulatory Authority to release water in Jayakwadi dam from upstream dams so as to ensure the approximate equitable distribution of water contemplated under clause (c) Section 12(6) of the MWRRA Act, 2005. An Affidavit in reply was filed by the State Government, in which it was submitted to the Hon. High Court that the equitable distribution of water as per Section 12 (6)(c) of MWRRA Act is not technically and practically implementable in toto as demanded by Petitioners. However, some principles for regulation of reservoirs operated as a part of integrated system of reservoirs in a sub-basin can be formulated for filling period (i.e. Monsoon period), so that Jayakwadi dam will receive some quantum of water before surplus from upstream dams.

In consideration of the afore mentioned context, the Water Resources Department of the Government of Maharashtra established a Study Group chaired by Shri Mendhegiri, who was then Director General of WALMI, Chh. Sambhajinagar. This initiative was formalized through a Marathi Resolution dated 29th January, 2013, with the objective of formulating regulations and guiding principles for the integrated operation of reservoirs during the filling period in the Godavari basin, up to the Jayakwadi dam. The Shri Mendhegiri Committee completed its task and submitted its report on 8th August, 2013, in which the committee suggested guiding principles which will limit the reservoir storages/levels in the different systems of reservoirs /

complex to be synchronized with the Jayakwadi dam storage during monsoon period. Accordingly, as per Report of Godavari Study Group established under Chairmanship of Shri H T Medhegiri, the mechanism of releasing water in scarcity situation was set as per the guiding principle in Table no. 5 & various operating strategies mentioned in Table no. 6 as per the scenario. Since 2013, these guiding principles & operating policies is being followed by Executive Director, Godavari Marathawada Irrigation Development Corporation Chh. Sambhajinagar .

As per Mendhegiri Study Group Report recommendations these guiding principles shall have to be reviewed & updated after lapse of 5 years or shorter period as decided by the Government, taking into account;

1. Additional data regarding water availability.
2. Climatic or hydrological changes might have occurred subsequently.
3. Technologies for water resources development & management may have changed significantly.
4. Difficulties faced in the implementation of the proposed guiding principles.
5. Changes in water resources planning scenario of sub-basin.

However, nearly a decade has passed since the submission of the Shri Mendhegiri Committee Report in 2013, there arises a pressing need to revisit its recommendations. This reconsideration is necessitated by various factors such as the utilization of Kharif water, losses due to evaporation and conveyance, alterations in the water usage patterns of the Jayakwadi project, and the challenges encountered in releasing water from upper upstream reservoirs to the Jayakwadi Reservoir, particularly during periods of yield shortfall. Furthermore, recommendation No. 4 of the Guiding Principles outlined by the Shri Mendhegiri Committee emphasizes the importance of reviewing and updating the operating rules, or guiding principles, presented in Table 6. The committee suggests that this review should occur after a lapse of 5 years, or at shorter intervals as determined by the Government. This periodic review is essential to address any difficulties encountered during implementation and to adopt the changes in the water planning scenario of the sub-basin.

2.0 Constitution of Study Group :

Based on the aforementioned background, the Water Resources Department of the Government of Maharashtra established a Study Group chaired by the Director General of Design, Training, Hydrology, Research and Safety, MERI, Nashik. This initiative was formalized through Marathi Resolution No. Misc -2024/ File No 186 / 2024/IM(P) dated 26th July, 2023 and 1st August, 2023.

2.1 The composition of the Study Group (2023) is as under:

1	**Shri. P. G. Mandade** Director General, Design, Training, Hydrology, Research and Safety, MERI, Nashik	Chairman
2	**Shri. S. R. Tirmanwar** Executive Director, Godavari Marathwada Irrigation Development Corporation, Chh. Sambhajinagar.	Member
3	**Shri. H. T. Dhumal** Chief Engineer (SP), Water Resources Department, Pune	Member
4	**Shri. S. S. Pagar** Chief Engineer, Hydrology and Dam Safety, Nashik	Member
5	**Shri. P. B. Misal** Chief Engineer, (WRD) North Maharashtra Region, Water Resources Department, Nashik	Member
6	**Shri. Jayant Gawali** Chief Engineer & Chief Administrator, Command Area Development Authority, Water Resources Department, Chh. Sambhajinagar.	Member
7	**Shri. M. S. Amale** Superintending Engineer & Administrator, Command Area Development Authority, Nashik	Member Secretary
8	**Shri. R. M. More** Superintending Engineer (Dams), Central Design Organization, Nashik	Special Invitee
9	**Shri. S. K. Sabbinwar** Superintending Engineer & Administrator, CADA, Water Resources Department, Chh. Sambhajinagar.	Special Invitee

2.2 Terms of Reference for the Study Group :

The Study Group (2023) was tasked with the following Terms of References:

1. To formulate guidelines for the integrated operation of reservoirs during the filling period in the Upper Godavari sub-basin to prevent potential water scarcity situations in the Jayakwadi dam.
2. To develop mechanisms for the effective implementation of these guiding principles.
3. To recommend reforms pertaining to technical, financial, and management aspects to improve water management practices in the sub-basin.

This initiative underscores the government's commitment to addressing water scarcity challenges and ensuring sustainable water management in the Upper Godavari sub-basin. Through collaborative efforts and comprehensive reforms, it aims to optimize water utilization, mitigate conflicts, and enhance the resilience of water resources for present and future generations.

Meanwhile, The Executive Director, Godavari Marathwada Irrigation Development Corporation, Chh. Sambhajinagar instructed the Chief Engineer (Water Resources), North Maharashtra Region, Nashik, to release 243.637 MCum (8.603 TMC) of water from upstream storages during November, 2023. This was based on a strategy outlined in the Shri. Mendhegiri Committee report's Table 6. This order was in concurrence with the Hon. High Court, Mumbai and the Maharashtra Water Resources Regulatory Authority, Mumbai. It also aligned with the priorities set in the State Water Policy of 2019. The decision was made considering factors like evaporation losses from reservoirs and transit losses from the river system, ensuring it was both technically and practically feasible.

2.3 Time Frame:

Original time period was up to 30th September, 2023 for submission of Study Group report. Looking to the wider scope, complexity involved and the time period required for data submission, the extension was granted i.e. Up to 30th May 2024. However, on 3rd September, 2024, the Hon. High Court, Mumbai Bench, Mumbai has directed the Study Group to prepare and submit their final report within one month time i.e. up to 3rd October 2024, and submit the

same to the MWRRA within a fortnight from completion of report. The MWRRA shall invite objections and suggestions from the general public giving fortnight time for submitting objections and suggestions. Thereafter, the MWRRA shall consider the entire matter and submits its recommendation to the State Government within a month. Thereafter, which shall be considered by the State Government and Final Decision on their own shall be taken by the State Government. In continuation to the direction given by the Hon. High Court, Mumbai bench, Mumbai, this report is now been submitted on 14th October, 2024.

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CHAPTER : 2

GENERAL APPROACH

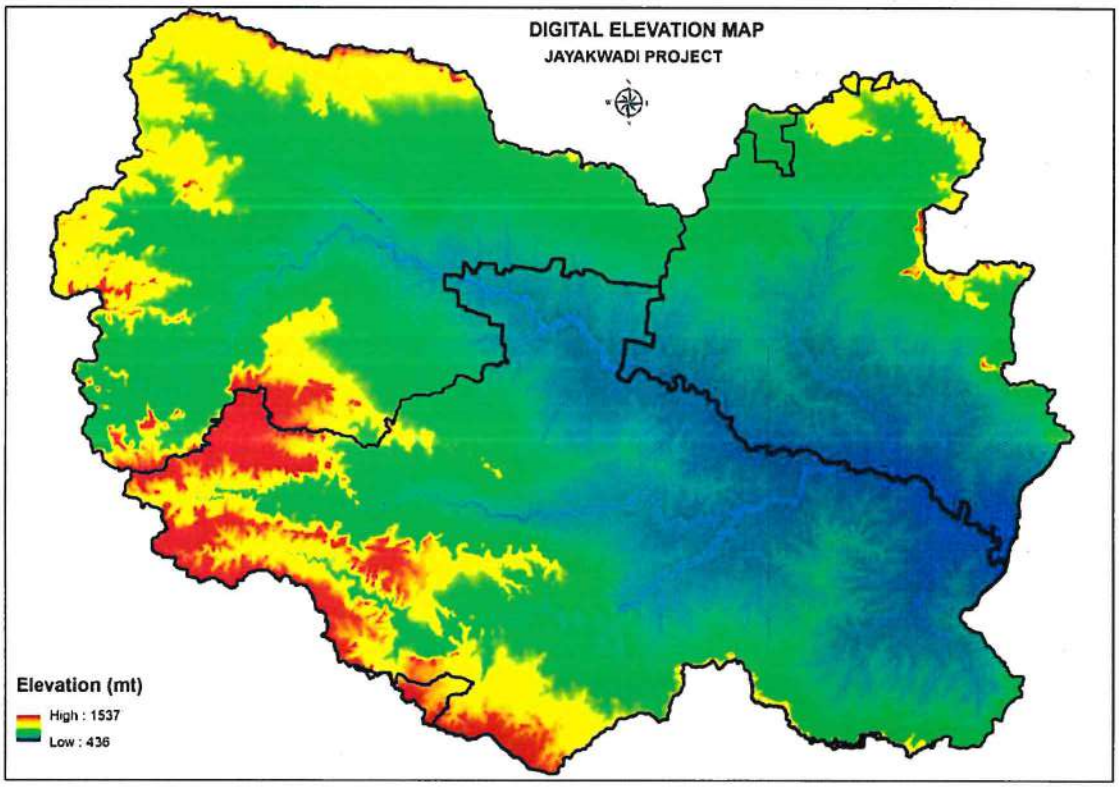
1.0 : General

Maharashtra State is geographically divided into 5 river basins, namely Godavari, Krishna, Tapi, Narmada, West flowing rivers in Konkan. A river basin is such a hydrological natural unit within the territorial limits of which all activities that are taking place are interdependent. A Sub-basin is a hydrologic sub-unit of a river basin within the State. The River Godavari originates near Trimbakeshwar in Nashik district in Sahyadri hill ranges. It further flows down to Andhra Pradesh after having flowed through Ahmednagar, Chh. Sambhajinagar, Nanded districts and joins the Bay of Bengal near Rajahmundry. The total geographical area of this basin is 3,12,812 Sq. Km. of which 1,52,811 Sq. Km. fall within Maharashtra.

The Upper Godavari sub-basin, extending up to the Jayakwadi dam, covers a total geographical area of 21,774 Sq Km and is divided into upper and lower reaches. The upper reach, located along the Sahyadri range (Western Ghats), receives heavy rainfall, while the lower reach falls within a rain shadow belt, experiencing lower rainfall. Despite being well-developed in terms of water storage infrastructure, factors such as rapid urbanization and industrial development, driven by population growth, are stressing available water resources. This development has led to a substantial increase in water demands across agriculture and urban sectors, resulting in critical conflicts due to fixed water resources and rapidly increasing demands.

Numerous major and medium dams have been constructed in the upper reach to conserve water and utilize available resources effectively, with many situated in ideal locations within the Ghats. Currently, reservoir operations are conducted independently for each reservoir, treating them as separate entities. However, increased water demands from agricultural and industrial sectors, alongside population growth and urbanization, have surpassed initial projections made during the planning of projects like the Jayakwadi dam. Consequently, this has led to reduced inflows into the Jayakwadi dam, exacerbating water stress in the lower reaches, particularly in the Marathwada region.

The challenge for Water Resources Engineers lies in devising a strategy for the integrated operation of reservoirs during the filling period. This strategy must prioritize the approximate equitable distribution of water at the sub-basin level to optimize the utilization of available water resources and maximize the benefits derived from the reservoir system or systems. By adopting principles of equitable distribution and optimizing system operations, Water Resources Engineers can address the complexities of water management in the Upper Godavari sub-basin, ensuring sustainable water use for all stakeholders. Map showing elevation in Upper Godavari is depicted in figure 1 (Source MRSAC, Nagpur).



2.0 Background for the Study:

The Water Resources Department of the Government of Maharashtra has established a Study Group to address the challenges of water management in the Upper Godavari sub-basin up to the Jayakwadi dam. This initiative stems from concerns regarding the increasing water demands due to rapid development in agriculture, industry, population, and urbanization, which

have led to heightened utilization of upstream resources. This heightened utilization has resulted in decreased inflows into the Jayakwadi dam, exacerbating water stress in the lower reaches, particularly in the Marathwada region.

In consideration of the aforementioned context, the Water Resources Department of the Government of Maharashtra established a Study Group chaired by Shri Mendhegiri, who was then Director General of WALMI, Chh. Sambhaji Nagar. This initiative was formalized through a Marathi Resolution dated 29th January, 2013, with the objective of formulating regulations and guiding principles for the integrated operation of reservoirs during the filling period in the Godavari basin, up to the Jayakwadi dam. The Shri Mendhegiri Committee completed its task and submitted its report on 8th August, 2013.

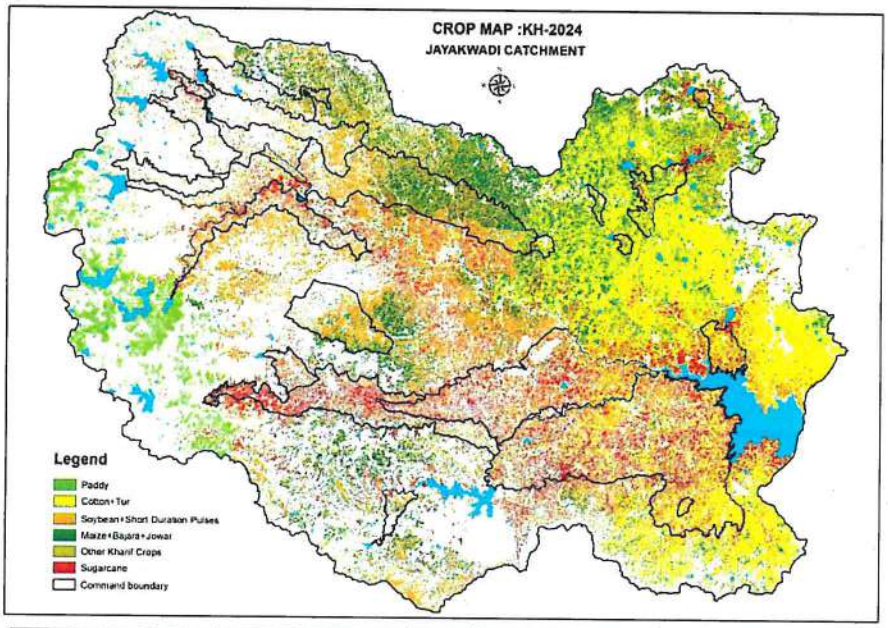
However, as nearly a decade has passed since the submission of the Shri Mendhegiri Committee Report in 2013, there arises a pressing need to revisit its recommendations. This reconsideration is necessitated by various factors such as the utilization of Kharif water, losses due to evaporation and conveyance, alterations in the water usage patterns of the Jayakwadi project, and the challenges encountered in releasing water from upper upstream reservoirs to the Jayakwadi Reservoir, particularly during periods of yield shortfall. Furthermore, recommendation No. 4 of the Guiding Principles outlined by the Shri Mendhegiri Committee emphasizes the importance of reviewing and updating the operating rules, or guiding principles, presented in Table 6. The committee suggests that this review should occur after a lapse of 5 years, or at shorter intervals as determined by the Government. This periodic review is essential to address any difficulties encountered during implementation and to adapt to changes in the water planning scenario of the sub-basin.

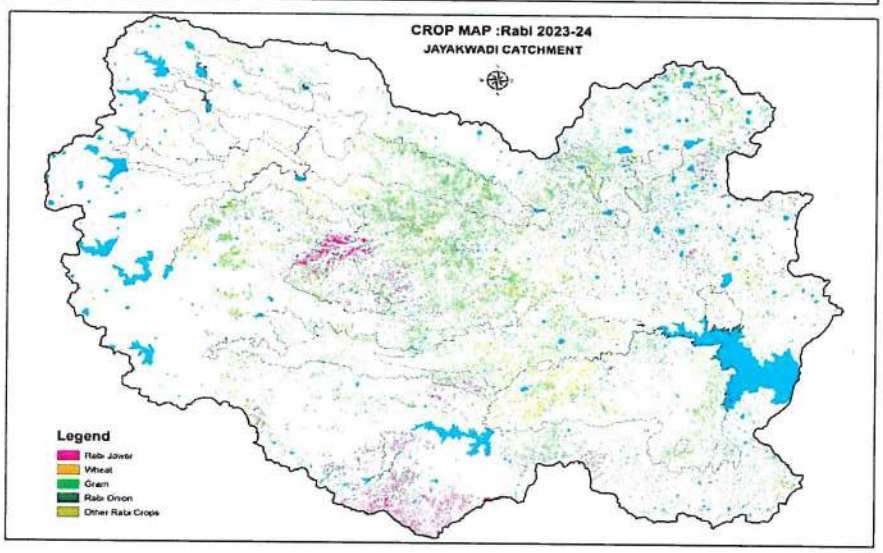
Based on the aforementioned background, the Water Resources Department of the Government of Maharashtra established a Study Group chaired by the Director General of DTHRS (MERI), Nashik. This initiative was formalized through Marathi Resolution No. Misc -2024/ File No 186 / 2024/IM(P) dated 26th July, 2023 and 1st August, 2023. The Study Group was tasked with the following Terms of References:

1. To formulate guidelines for the integrated operation of reservoirs during the filling period in the Upper Godavari sub-basin to prevent potential water scarcity situations in the Jayakwadi dam.
2. To develop mechanisms for the effective implementation of these guiding principles.

3. To recommend reforms pertaining to technical, financial, and management aspects to improve water management practices in the sub-basin.

This initiative underscores the government's commitment to addressing water scarcity challenges and ensuring sustainable water management in the Upper Godavari sub-basin. Through collaborative efforts and comprehensive reforms, it aims to optimize water utilization, mitigate conflicts, and enhance the resilience of water resources for present and future generations. Cropping pattern map of kharif and rabi season 2023-24 is depicted in figure 2 &3 (Source MRSAC, Nagpur).





3.0 Drought Declaration in Maharashtra:

Drought is a complex occurrence primarily caused by significant deviations from normal rainfall patterns or the skewed distribution of rainfall over time and space. In India, drought usually coincides with the monsoon season. The severity and extent of drought are influenced by various factors such as the availability of surface and groundwater resources, agro-climatic conditions, crop choices and patterns, and socio-economic vulnerabilities of local communities. Despite efforts, there is no precise indicator or index to forecast the onset and severity of droughts or predict their impacts. However, the impact of drought tends to worsen with successive occurrences.

To aid in the assessment of drought-prone areas in Maharashtra, the Government has adopted a methodology outlined in the Drought Management Manual of 2016 and 2020, using MahaMADAT geoportal developed by the Maharashtra Remote Sensing Application Centre (MRSAC), Nagpur. MahaMADAT is a web-based Geoportal that integrates data from multiple sources, including rainfall (Quantum and distribution), cropping patterns, soil moisture levels, and remote sensing indices, to provide early warning and agricultural drought assessment at the tehsil level. It consolidates data from multiple sources including rainfall deficiency, spatial and temporal distribution of rainfall, duration of dry spells, and other factors recognized as key triggers for drought. Additionally, the portal considers various impact indicators such as cropping patterns, soil moisture levels, hydrological data, and remote sensing-based indices to assess drought conditions. This comprehensive approach enables the accurate declaration of drought and facilitates timely interventions to mitigate its impacts.

Given the multifaceted nature of drought declaration and water management, the Godavari study group has developed a methodical approach to thoroughly assess and enhance the current procedures.

1. Review the recommendations of the Shri Mendhegiri Study Group Report, considering additional data on water availability, yield, current water usage, climatic and hydrological changes, technological advancements, implementation challenges, and changes in water resource planning.
2. Engage MRSAC, Nagpur in the development of Decision Support System for drought declaration, utilizing five parameters specified in the drought manual published by the Government of India viz., Rainfall-related indices, Remote Sensing-based Vegetation indices, Crop Situation Related indices, Soil moisture-based indices, and Hydrological indices.
3. Enhance the methodology for releasing water from upstream reservoirs by incorporating the aforementioned five parameters in addition to surface water hydrology and kharif

water utilization. MRSAC will provide a software module to facilitate the precise determination of water release amounts from upstream dams to the Jayakwadi dam (Jaykwadi project).

This proposed methodology aims to improve the accuracy and effectiveness of drought assessment and water management strategies by leveraging advanced technology and incorporating a broader range of indicators and data sources. By adopting a comprehensive approach, Maharashtra can enhance its resilience to drought and optimize water resource utilization for sustainable development. Water was previously abundant but due to increase in population & industrial growth, it has now become scarce and now became vital factor in economy.

Government of Maharashtra, Water Resources Department has constituted the Godavari Study Group for formulation of guiding principles on integrated operation of reservoirs in Upper Godavari (up to Jayakwadi dam) sub basin. Keeping all the above considerations in mind, the study group has decided the following procedure to approach the problem:

1. Holding meetings and deliberations
2. Collection of hydrological and water use data from field organization.
3. Analysis of data
4. Present water resources planning scenario study
5. Operating strategy for Reservoir Operation
6. Review of Literature
7. Discussions and Conclusions.
8. Recommendations.

4.0 Meetings and Deliberations

The Study Group Committee (II) has conducted 18 meetings as outlined below:

4.1 First Meeting on 12/08/2023 at MERI Nashik

1. A comprehensive review and discussion of the GSG-I Report (2013) was conducted. It was decided that the committee's draft report should be updated to reflect data upto 2022.
2. MWRRA case no. 01/2014 was presented by Shri Santosh Tirmanwar, E.D. GMIDC.
3. The MWRRA order dated 19/04/2014 and PIL 173/2013, as provided by the Hon. High Court in its judgment, were read. A discussion followed regarding the order and the challenges encountered in its implementation concerning water release based on the dam storage status at that time. The earlier report submitted to MWRRA by E.D.

GMIDC, Chhatrapati Sambhaji Nagar, and the integrated reservoir operation as per the review group's 2018 report were also discussed. It was resolved that the 2018 study should be updated with data up to 2022, and the additional available water for irrigation and non-irrigation use should be included in the proposed report.

4. The committee members were tasked to review the various Hon. High Court cases and PILs arising in this context, along with the decisions given. Members were requested to provide their feedback on the Hon. Court's decisions.
5. Following the review of the GSG Report 2013, the committee discussed Suggestion No. 06 made by the Members of the Legislative Assembly during the Monsoon Session of 2023. It was decided that, if necessary, the suggestion would be incorporated into the report in accordance with prevailing rules and procedures.
6. A presentation was made by MERI Nashik, Department of Engineering Resources, on the Sediment Survey of the Godavari Basin Project.

4.2 Second Meeting on 28/08/2023 at MERI Nashik

1. The details of changes to be made to the original GSG-I Report (2013) (as per revised and latest approvals) are as follows:

    - Changes in drinking water consumption quantities.
    - Changes in industrial water usage quantities.
    - Changes in reservoir capacity due to sedimentation in the dam.
    - Changes due to modifications in irrigation practices.

    Accordingly, SE, CADA, Nashik, and SE, CADA, Chhatrapati Sambhajinagar are required to update and submit this information to the committee.

2. **Discussion on the Committee's Report:**

    - The study area of the Study Group Committee includes the Godavari Basin/sub-basins and its tributaries' basins/sub-basins upstream of the Jayakwadi Dam. The Study Group was formed to establish guidelines for effective integrated operations of all reservoirs to prevent water shortages at the Jayakwadi Reservoir during the monsoon season. It was discussed that the Study Group should develop procedures to operate all reservoirs in an integrated manner and provide suggestions, including technical, financial, and managerial recommendations, for the integrated operation or scheduling of the reservoirs upstream of the Jayakwadi Dam.

- It was noted that two meetings have been held so far, and the final report is to be submitted to the Government by 31/08/2023. However, due to challenges in data collection, a proposal for an extension of the deadline for the GSG will be sent to the Government. The Hon. Chairman instructed that a letter be sent to the Government requesting this extension. Additionally, the difficulties in data collection were discussed, and the Chairman directed both Superintending Engineers to submit complete and accurate information as soon as possible.

4.3 Third Meeting on 12/09/2023 at MERI Nashik

1. After reviewing the work completed, the Hon. Chairman instructed the Superintending Engineer and Administrator, CADA, Chh. Sambhaji Nagar, to update the yield series of the Jayakwadi Dam from 1975 to 2022. The C.E. NMR, Nashik stated that all yield series for the specified period should be taken into account while calculating the yield. Additionally, the Chairman instructed that the yield of the Jayakwadi Dam in the GSG-I Report (2013), shown as 7235 mm^3 in 1976 and now 7283 mm^3, should be rechecked for accuracy.

    - The data for dams below Nandur Madhameshwar up to the Jayakwadi Dam, as listed in Table 5, should be updated. Information regarding their yield should be compiled.
    - The Hon. Executive Director, Godavari Marathwada Irrigation Development Corporation, Chh. Sambhaji Nagar, stated that since the term of the committee ends on September 30, all information regarding the dams in the North Maharashtra region, CADA, Nashik, should be submitted as soon as possible. Information for all dams under CADA, Chh. Sambhaji Nagar should also be provided promptly.
    - It was discussed that the figures mentioned in the GSG-I Report (2013) need correction. The Executive Director, GMIDC, instructed that any corrections should only be made if supporting documents are provided to justify the changes.
    - The information up to 2017 had already been verified by MWRRA in 2018. Therefore, data from 2018 to 2022 should be collected and validated.
    - The Chief Engineer, Hydrology Project, provided a revised table for tank gauge data in relation to the yield series. The Hon. Chairman instructed that information for all dams be included in this table. In response, the

Superintendent Engineer (Dam Circle) noted that the table covers data for the entire year and suggested that it be limited to the monsoon period only.

- The Hon. Chairman requested validation of the aforementioned data. The Chief Engineer, NMR, suggested cross-checking certain data and, if necessary, conducting site visits for verification.

4.4 Fourth Meeting on 12/10/2023 at MERI Nashik

1. Regarding the submission of updated information up to 2022 to the Godavari Study Group-II:

    - As per the instructions given by the Chairman in the previous meeting, the status of the information submission by the Superintending Engineers and Administrators, CADA, Nashik, and CADA, Chhatrapati Sambhajinagar, was discussed. The information from S.E. CADA, Chhatrapati Sambhajinagar, had not yet been received, and data from one division under S.E. CADA, Nashik, was still pending. It is crucial to submit accurate data to the study group without errors to facilitate the preparation of the various annexures for the report as soon as possible.

2. Regarding the information to be submitted to the CE, H. & D.S., Nashik:

    - The Chairman instructed that all information submitted to the CE, H. & D.S. should be certified by the CE, NMR, Nashik, and the CE. & Chief Administrator, CADA, Chhatrapati Sambhajinagar.

3. Inclusion of tanks/dams constructed by the local sector department:

    - The Chairman emphasized that information on tanks and dams constructed by the local sector department should be included. Therefore, updated data should be obtained from the Water Conservation Department.

4.5 Fifth Meeting on 02/11/2023 at MERI Nashik

1. **Compilation and submission of information**:

    - The study group committee reviewed the compilation and submission of information. The Superintending Engineer and Administrator, CADA

Nashik, informed that he is submitting the information today, on 02/11/2024. Accordingly, the information was submitted to the study group. The S.E. and Administrator, CADA, Chhatrapati Sambhajinagar, assured that the information will be submitted on 06/11/2023. Once all the information is received, the study group will be able to analyze the data.

2. **Submission of updated note on Jayakwadi Project:**

   - The Chairman and E.D. GMIDC instructed the S.E., CADA, Chhatrapati Sambhajinagar, to submit an updated note on the Jayakwadi Project.

3. **Committee observations on the GSG-I Report (2013):**

   - All committee members were asked to submit their observations on the GSG-I Report (2013) and check if any points were missing. They should consider the concepts from 2013 and compare them with the current situation in 2023. The C.E. NMR, Nashik, noted that the GSG-I Report (2013) was prepared considering only surface and subsurface water in the hydrological study. However, rainfall moisture content and soil cover of both the upstream and downstream sides of the command area of the Jayakwadi Project should also be considered. Additionally, tanks with a capacity of 5 Mcft located upstream of the Jayakwadi Project should be

4.6 Sixth Meeting on 22/11/2023 at MERI, Nashik

1. Data Review: Ongoing analysis of information from CADA Nashik and CADA Chhatrapati Sambhajinagar.
2. Submission by CE, NMR : Letter submitted to the Study Group as per the Chairman's previous directives.
3. Key Discussions:

   - Inquiry about hydrological yield data for all dams up to the Jayakwadi Project.
   - Update dam storages as per the revised silt survey conducted by MERI, Nashik.
   - Collect hydrological drought parameters and drought declaration information on mandal-wise basis.
   - Review water use efficiency in upstream and downstream projects.

- Address ongoing PILs related to the study.
- Information on rainfall and yield data to be submitted to the Chief Engineer, Hydrology Project.
- Incorporate provisions from the Mendhegiri Report into the study.

4. Extension Granted: Study Group received an extension until 30/11/2024; further extension of 4–6 months requested.

4.7 Seventh Meeting on 29/11/2023 at MERI, Nashik

1. **Presentation on River Linking of Godavari Basin to Western Flowing Rivers:**

    - The Executive Engineers from the Nandur Madhameshwar Project Division and Minor Irrigation Division, Nashik, presented the proposal for linking the Godavari Basin to western flowing rivers.
    - After discussions, the study group agreed to include a separate chapter on this topic in the final report.
    - The Hon. Chairman directed the Chief Engineer of the North Maharashtra Region to submit a project note on river linking to the Godavari Study Group.
    - The Chief Engineer emphasized the project's priority to help alleviate water deficit issues in the Godavari Basin. A review of the collected information from both circles was conducted.

2. **Draft Report Presentation:**

    - The Hon. Chairman presented the draft of the report, highlighting the following chapters:

        - Chapter 1: Introduction from the GSG-I Report (2013) will be updated.
        - Chapter 2: Related to irrigation and non-irrigation information will be updated and finalized.
        - Discussions were held regarding the Government Resolutions (G.R.) published by the Revenue Department in 2018 and 2024 concerning

drought declarations. The Chairman directed the collection of information on revenue circles within the command areas of the projects.

3. **Drought Declaration Criteria:**

- The Chief Engineer of the North Maharashtra Region raised questions about the criteria for declaring droughts and how this is carried out with reference to the Central Government's drought manual.
- The Member Secretary was tasked with contacting the Deputy Secretary of the Revenue, Help & Rehabilitation Department, Government of Maharashtra, to request a presentation for the study group.

4. **Report Structure:**

- A separate chapter will be prepared by the Chairman and presented to the study group before finalization.
- The Chief Engineer informed that the information submitted to the study group by CADA Nashik and CADA Chhatrapati Sambhajinagar (i.e., Annexures 1-7 and Statements 1-10) should be verified by the Superintending Engineer of the Dam Circle, Nashik, and the SE & Administrator of CADA, Chhatrapati Sambhajinagar, for presentation in the next meeting.

5. **Population Growth Data:**

- The study group decided to forecast population growth post-2011 census using data from the 2001, 1991, and 1981 censuses and gather additional information from M.J.P.

6. **Drinking Water Calculations:**

- The group agreed to conduct drinking water calculations as per MWRRA norms for the Mula, Pravara, Godavari, and Jayakwadi basins.

7. **GSG-I Report (2013) Review:**

- An opinion regarding the GSG-I Report (2013), issued by the Government of Maharashtra in a letter dated 09/08/2014, should be included in the study group's report.

This meeting marked significant progress towards finalizing the report and addressing critical water management strategies in the context of drought and river resource management.

4.8 Eighth Meeting on 06/12/2023 at MERi, Nashik

1. **Review of Work Done:**

    - The study group conducted a comprehensive review of the progress made till date.

2. **Drought Declaration Criteria:**

    - Following up on discussions from the previous meeting regarding drought declaration, the Superintending Engineer of CADA and the Administrator of Nashik reported that the Deputy Secretary, Relief and rehabilitation Dept. Government of Maharashtra stated that drought is declared with assistance from MRSAC, Nagpur.
    - Dr. Prashant Rajankar from MRSAC clarified that they have developed software for drought declaration. MRSAC collects the required data from Maharashtra State and subsequently presents it to the Government.
    - It was decided to request MRSAC to present to the Godavari Study Group-II on the drought procedure adopted in Maharashtra using the Maha-Madat software.

3. **Drought Manual Insights:**

    - The Hon. Chairman highlighted key points from the Drought Manual, noting that MRSAC declares drought based on 3 out of 4 indicators outlined in chapter 3.1.21.
    - The study group discussed the implications of a drought situation occurring in the command area of Jaykawadi Dam and upstream dams. MRSAC's data should be integrated with storage levels of Jaykawadi Dam to assess the situation.
    - The definition of a "dry spell" according to the Drought Manual was also addressed. A dry spell is defined as a period of no rain for 21 days or rainfall less than 50%. The impact of such dry spells must be considered before releasing water from upstream dams and reservoirs.

4. **Water Release Requests:**

- In response to demands from various beneficiaries to release water from upstream dams starting September 1st, the Hon. Chairman directed the Chief Engineer of the Hydrology Project to study the monthly rainfall data from June to September over the last 40 years in the catchment and command area of all dams in the Upper Godavari project. This study will also include an analysis of climate change impacts. The rainfall data in the GSG-I Report (2013) is to be updated accordingly.

5. **Tank Gauge Data and Yield Calculation:**

- The Hon. Chairman directed the Chief Engineer of the Hydrology Project to collect tank gauge data and calculate the yield of all dams for submission to the study group.

6. **Water Release Considerations:**

- It was discussed that prior to releasing water from gated dams, it is essential to consider information regarding all ungated dams, canal outlets, river sluices, and escape routes, including their capacities. However, due to minimal impact, this idea was dropped by the study group.

7. **Presentation by CADA Nashik:**

- The Superintending Engineer and Administrator of CADA Nashik presented information regarding Annexures 1-7 and Statements 1-10, discussing the impacts of the updated information. Members suggested that a study on sanctioned non-irrigation schemes and actual water use should also be conducted.

8. **Drinking Water Requirement Calculation:**

- The study group agreed to calculate the water requirements for domestic use based on the current population in the Mula, Pravara, Godavari complexes, and the Jaykawadi project.

This meeting furthered the study group's objectives by delving into critical aspects of drought management, water resource allocation, and addressing the needs of beneficiaries in the region.

4.9 Ninth Meeting on 12/01/2024 at MERI, Nashik

Discussion Points:

1. **Review of MRSAC Presentation:**

    - Members of the GSG-II visited Nagpur on 15/12/2023, where the MRSAC presented their methodology for declaring drought using the MahaMADAT software.
    - This presentation was revisited during the meeting, and the group decided to include the drought declaration method in the GSG-II Report (2024).

2. **Inclusion of New Parameter:**

    - MRSAC uses 3 parameters for drought declaration with the MahaMADAT software. The group discussed the possibility of including a new parameter concerning the storage levels of upstream dams, including Jaykawadi Dam.
    - It was agreed to arrange a meeting with MRSAC officers in the third week of January 2024 to discuss this potential addition.

3. **Review of Yield Calculation Work:**

    - The Hon. Chairman reviewed the yield calculation work assigned to the Chief Engineer of the Hydrology Project, noting that approximately 90% of the work is complete.
    - However, additional data on design water use and upstream water use for all dams is still needed. The Hon. Chairman directed the Superintending Engineer of CADA, Chhatrapati Sambhajinagar, to submit rainfall and yield data to the Chief Engineer of the Hydrology Project.

4. **Layout of Study Group -II Report (2024):**

    - The Hon. Chairman presented a rough layout for the GSG-II Report (2024), which includes:

        - **A) Technical Report:** The chapters to be included were discussed, and the Chairman directed members assigned specific topics to submit their reports promptly.

- **B) Annexure:** This section will include updated information from Annexures 1-7 and Statement 1-10, along with any new information.
- **C) Drawings:** This section will contain relevant drawings.

5. **Revenue Circle (Mandal) Information Submission:**

    - The Hon. Chairman instructed the submission of Revenue Cicle (Mandal) information in the command areas of all projects, as drought declarations are made on a mandal-wise basis by the Government of Maharashtra.

This meeting focused on consolidating the progress made by the study group, reviewing methodologies for drought declaration, and organizing the structure of the forthcoming report. Members were urged to expedite their contributions to ensure timely completion.

4.10 Tenth Meeting on 23/01/2023 at MERI, Nashik

Discussion Points:

1. **Inclusion of New Parameter for Drought Declaration:**

    - Following discussions from the previous meeting on 12/01/2024, the Godavari Study Group invited Dr. Prashant Rajankar, Associate Scientist at MRSAC, Nagpur, to discuss incorporating an additional parameter regarding the storage levels of dams upstream of Jaykawadi and Jayakwadi into the MahaMADAT software used for drought declaration.

2. **Presentation by Executive Director, G.M.I.D.C:**

    - The Hon. Executive Director of G.M.I.D.C, Chhatrapati Sambhajinagar, presented information related to the GSG-I Report (2013). This included discussions on:
    - The background of the GSG-I (2013) Committee's formation
    - Yield of dams and associated water use
    - Challenges faced in utilizing yield from 30% catchment area and 70% free catchment area of upstream dams of Jaykawadi.

3. **GSG-I Report (2013) Updates:**

    - It was decided to include a new indicator regarding the dam storages of upstream Jaykawadi and Jayakwadi in the four parameters used by MRSAC's Maha-MADAT software for drought declaration.

- The Chief Engineer of N.M.R Nashik stated that drought declarations and water releases will rely on modifications to Table No. 6 of the GSG-I Report (2013). Daily updates on dam storage information are available through the "PRAVAH App" and can be submitted to the government.

4. **Drought Declaration Procedures:**

- The Hon. Executive Director noted that the Government of Maharashtra declares drought on a Taluka and Revenue Mandal (mandals) basis. Therefore, information on the command area of canals for upstream dams of Jaykawadi and Jayakwadi must be provided to MRSAC.

5. **Data Requirements Suggested by MRSAC:**

- Dr. Prashant Rajankar suggested that the following data should be provided to enhance the drought declaration process:
  - Maps of all dams, including their latitude and longitude
  - Details of districts, talukas, revenue cicle (mandals), and villages within the command areas of all dams
  - Historical storage data for the last ten years of all dams
  - An MOU to be signed between the Director of MRSAC, Nagpur, and the Executive Director of G.M.I.D.C, Chhatrapati Sambhajinagar.

6. **Status Update on Yield Calculations:**

- During discussions about the yield calculations for the upstream dam complex of Jaykawadi and Jaykawadi, the Chief Engineer of Hydrology Projects (H.P.) reported that 90% of the work by CADA Nashik is complete.
- Urgent submission of rainfall data for Mula Dam before the year 2000 is pending. Additionally, information regarding rainfall, water use, and yield related to CADA Chhatrapati Sambhajinagar also needs to be submitted promptly.

The meeting focused on refining the drought declaration process, enhancing data collection, and ensuring timely submissions from involved agencies. The discussions aimed to facilitate better management of water resources in the Godavari basin.

4.11 Eleventh Meeting on 28.03.2024 at MERI, Nashik

Discussion Points:

1. **Development of Plug-In Software:**

    - The GSG-II (2024) had discussion over the previous meeting with Dr. Prashant Rajankar from MRSAC Nagpur on 23/01/2024. It was decided to develop a plug-in software that will integrate a new indicator, including the dam storage information of upstream Jaykawadi and Jaykawadi, alongside the four parameters currently used in the MahaMADAT software for drought declaration. The MOU between the Director of MRSAC, Nagpur, and the Executive Director of G.M.I.D.C, Chhatrapati Sambhajinagar, is to be signed to formalize this agreement.

2. **Signing of MOU and Cost Finalization:**

    - A virtual meeting was held on 21/03/2024 included the Director of MRSAC, the Hon. Chairman of the GSG-I (2024), the Executive Director of G.M.I.D.C, Chhatrapati Sambhajinagar, and the Member Secretary to finalize the MOU and determine the cost of the plug-in software. Copies of the MOU were distributed to all members, and after discussion, it was approved.

3. **Review of Assigned Information:**
    - The Hon. Chairman reviewed the status of previously assigned information:
        - **Yield Information:** The Chief Engineer of Hydrology Projects (H.P.) Nashik committed to submitting yield information for all dam complexes by 10/04/2024.
        - **Verification of Submitted Information:** It was agreed that the information submitted to the GSG-II (2024) (Annexure 1-7 & Statement 1-10) should be verified by the Superintending Engineer of the Dam Circle, Nashik, and the Superintending Engineer & Administrator of CADA, Chhatrapati Sambhaji Nagar. They will assess if any changes are needed in Tables 5 & 6 of the GSG-I Report (2013) based on current information and submit a report of comparative studies.
        - **Diversion Schemes and River Linking:** The Hon. Chairman suggested that the Chief Engineer of North Maharashtra Region, Nashik,

submit the necessary information regarding all diversion schemes in the Godavari basin and river linking schemes organized into 3-4 tables for the GSG-II (2024).

- **Report Submission Language:** All members agreed that the final report should be submitted in English.

4. **Next Steps:**

    - The MOU with MRSAC Nagpur is to be completed soon, with the Executive Director of G.M.I.D.C, Chhatrapati Sambhajinagar, to sign the agreement. All assigned information is to be submitted by the members within the next 10 days.

The meeting focused on finalizing agreements for the software development and reviewing the progress on assigned tasks, emphasizing timely submissions for effective project advancement.

4.12 Twelveth Meeting on 25/04/2024 at MERI, Nashik

Discussion Points:

A) **Signing of MOU for Plug-In Software Development:**

- On 21/03/2024, a virtual meeting was held between the Hon. President of the GSG-II (2024), the Hon. Director of MRSAC Nagpur, the Hon. Executive Director of the Godavari Marathwada Irrigation Development Corporation (GMIDC) in Chhatrapati Sambhajinagar, and the Member Secretary of the GSG-II (2024).
- The cost for the development of the plug-in software was finalized at Rs. 61.16 Lakhs.
- The final agreement was signed by Dr. Prashant Rajankar, Associate Scientist at MRSAC, and Engr. Mahendra Amale, Member Secretary and Superintending Engineer and Administrator of CADA Nashik, in the presence of all members.

B) Presentation by MRSAC and Required Adjustments:

- Dr. Prashant Rajankar presented the information based on data provided to MRSAC and additional information available with them.
- The GSG-II (2024) discussed the presentation and suggested the following essential inclusions:
    1. Define the command area of each project on a map.
    2. For the command area upstream of Jayakwadi, deduct the area related to lift irrigation adjacent to Jayakwadi from its command area.
    3. Implement coding and labeling for each dam group and dam.
    4. Add a code (LINK) for each dam from the PRAVAH App, classifying dams as gated or ungated.
    5. Create a flowchart of the computer system based on the reports from the GSG-I Report (2013), specifically referencing Tables 5 and 6, ensuring data validation.

C) Review of Information Submission:

- The Hon. Chairman reviewed the topics for which committee members were asked to prepare information:
    1. The Chief Engineer of Hydrology noted the need for information on upstream utilization of each dam to provide yield data for all dam groups.
    2. The Member Secretary confirmed that all information had been forwarded to the Hydrology Office. The Chief Engineer of North Maharashtra stated that both the Chief Engineer of Hydrology and the Superintending Engineers should collaborate to address any doubts.
    3. The Member Secretary reported that all suggestions from the Superintending Engineer of Dam Circle, Nashik, had been implemented, and the corrected information for Annexure 1-7 and Statement 1-10 was submitted to the study group for review. The Hon. Executive Director of GMIDC mentioned that scrutiny is ongoing and will be communicated to the group once completed.
    4. Additionally, schemes sanctioned under the Jaljeevan Mission should be considered in the assessment of domestic water use.

The meeting focused on finalizing the MOU for the software development, reviewing essential data points for the drought declaration system, and ensuring that committee members are on track with their submissions for accurate reporting.

4.13 Thirteenth Meeting on 13/06/2024 at MERI, Nashik

Discussion Points:

1. **Inclusion of Historical Yield Data:**

    - The Hon. Chairman of the GSG-I (2024) emphasized that the yield data from the year 1975 for the Jayakwadi Dam, as recorded in Statement-3 of the GSG-I Report (2013), should be included in the current report.

2. **Application of MWRRA Guidelines:**

    - According to the MWRRA guidelines issued on 22/09/2017, the reduction factor for drinking and industrial water during scarcity must be applied to the years 2015, 2018, and 2024. The percentage for Kharif and Rabi seasons should be derived from the GSG-I Report (2013), with necessary changes made to Annexures 1-7 and Statement 1-10.

3. **Submission of Relevant Correspondence:**

    - The Hon. Chairman directed that copies letters referred in the G.R. dated 12/09/2018 regarding the revised water planning for the Jayakwadi project should be submitted. This includes adjustments made to reduce evaporation in the planning process.

4. **Extension Proposal Discussion:**

    - There was a thorough discussion regarding the extension of the study group, particularly in light of the upcoming Lok Sabha elections and the time needed for the development and testing of the computerized system as per the MOU with MRSAC, Nagpur. It was unanimously decided to submit an urgent proposal to the government for an extension until 31/07/2024.

5. **Software Testing Presentation:**

    - Dr. Prashant Rajankar, Associate Scientist at MRSAC, presented his findings based on the data provided to MRSAC and their internal information. He demonstrated the software test for 2024, which detailed the statistics of available water for release from each reservoir. The Chief Engineer of North

Maharashtra Region pointed out the necessity for data verification prior to water release orders. The Hon. Chairman directed that data for 2015, 2018, and 2024 should be filled in and verified accordingly.

6. **Adaptation of Headings:**

- The headings used in the computerized system by MRSAC must be adjusted to align with the terminology used in the GSG-II Report (2024)

7. **Access to PRAVAH App:**

- The Hon. Executive Director of the Godavari Irrigation Development Corporation instructed the Member Secretary to urgently contact the relevant personnel to ensure access to the PRAVAH App for MRSAC, Nagpur.

8. **Recommendations from GSG-II (2024) Members:**

- Following Dr. Prashant Rajankar's presentation, the GSG-II (2024) recommended the inclusion of the following elements:
  - Area Calculation for Drought Declaration: For talukas where drought is declared via the MahaMADAT system, the area of Revenue Mandals upstream of Jayakwadi and in its command area should be calculated. Water needs for fodder production required for livestock in these areas should be subtracted from the total calculated water strategy for the upper part of Jayakwadi and added to the water available in the command area of Jayakwadi.
  - Contingent Reservations: The contingency reservations made in the years 2015, 2018, and 2024 for all groups in the upper part of Jayakwadi and the Jayakwadi project should be gathered, and a group-wise average should be calculated and integrated into the water release strategy.

The meeting focused on refining the drought management system, ensuring accurate historical data inclusion, and planning for the future, including software testing and data verification to support effective water management decisions.

4.14 Fourteenth Meeting On 24/07/2024 at MERI, Nashik

Discussion Points:

1. **Presentation of Plug in Software System:**

    - Dr. Prashant Rajankar, Associate Scientist at MRSAC, presented the software system he developed. It was tested for the year 2023 with ancillary information for each dam. While the data showed the amount of water available for release from each reservoir, the Member Secretary mentioned that during a virtual meeting concerning the PRAVAH App, it was noted that only data from 2023 is currently available. Therefore, verification is limited to this year. Additionally, discrepancies were found in several groups (Pravara, Darna, Gangapur, Palkhed) concerning the totals for water release. The Hon. President directed that these discrepancies should be addressed on a group-by-group basis.

2. **Reservoir Storage Updates:**

    - The reservoir storages must be taken from the PRAVAH App as per the system developed by Dr. Rajankar. However, the GSG-II report (2024) includes revised storages after sediment surveys. The Hon. President instructed that for reservoirs that have not yet received sanction for revised contents, an interim factor should be applied to the storages in the software, reflecting the difference between PRAVAH App storages and GSG-II (2024) storages. Once the PRAVAH App storages are updated, a factor of 1.0 should be used in the software. Dr. Rajankar agreed to this approach.

3. **Adaptation of Headings in the System:**

    - The names of headings used in the computerized system created by Dr. Rajankar should be aligned with the terminology used in the Godavari Study Group report.

4. **Water Calculation for Fodder Crops:**

    - It was decided that in talukas where drought relief will be implemented through the MahaMADAT computer system, the area of the Revenue circle

(Mandals) in the upper region of Jayakwadi and its command area should be calculated. Water needs for fodder crops for livestock in these areas should be deducted from the total water sourced from the upper part of Jayakwadi and added to the command area of Jayakwadi. The Member Secretary stated that the necessary information regarding required water has been prepared.

5. **Application of MWRRA Guidelines:**

- The MWRRA order dated 22/09/2017 regarding percentage cuts for drinking and industrial water during scarcity will apply to years when water was released for Jayakwadi (2015, 2018, and 2024). For Kharif and Rabi seasons, percentages will follow the GSG-I report (2013). The Member Secretary confirmed that the necessary changes to Annexures 1-7 and Statements 1-10 have been made per previous directives. The Superintending Engineer of the Dam Circle and the Chief Engineer of North Maharashtra Region stated that actual evaporation data from Jayakwadi Dam should be collected from CADA Chhatrapati Sambhajinagar for Tables 6-10, and the Member Secretary was instructed to ensure these corrections are made immediately.

6. **Contingent Reservation Calculations:**

- The Complex / group-wise average of contingent reservations for all dam Complex / groups in the upper area of Jayakwadi and the Jayakwadi project for the years 2015, 2018, and 2023 has been calculated and sent to MRSAC for incorporation into the water calculations as per strategy.

7. **Recommendations from the Chief Engineer:**

- During the report discussion, the Chief Engineer, North Maharashtra region made the following recommendations:

  - For 2023, the amount of water released from Upper Dams to Jayakwadi should match the amount remaining at the end of 30th June. When releasing water for non-irrigation during drought conditions, at least 50% of the required non-irrigation water should come from the dead storage of the reservoir, similar to practices at the Ujani Reservoir for Solapur.

- In years of drought when Jayakwadi storage is between 50-60%, no water should be released from the upstream dams if drought conditions exist in over 50% of the area of the revenue circles.
- If Jayakwadi storage falls below 50%, the water needed for livestock and fodder crops should be prioritized.

8. **Completion of GSG-II's Work:**
   - It was unanimously decided that upon submission of the GSG-II report (2024) to the government, the work of this Study GSG-II would be completed. The Executive Director of the Godavari Marathwada Irrigation Development Corporation, along with the Superintending Engineer and administrator from CADA Nashik, and the Superintending Engineer and administrator from CADA Chhatrapati Sambhajinagar, will be authorized to provide the information required to MRSAC, Nagpur for the Plug-in Software.

     The meeting focused on the verification of data, adjustments to water management strategies, and the final steps for submitting the GSG-II report (2024), ensuring all necessary actions are taken for effective drought management and resource allocation.

4.15 Fifteenth Meeting on 25/09/2024 at MERI, Nashik

Discussion Points:

1. Finalisation of draft GSG-II report (2024) (Version 1.0)

- As per Memorandum of Understanding (MOU) with MRSAC Nagpur the water will be the released as per the storage is available on PRAHAV App.
- In River link chapter, Chief Engineer, NMR, Nashik , should provide the updated note on the Chapter.
- Water received from West flowing river linking should be distributed by signing and MOU according to the submergence area, benefits and whatever water is available between Marathwada region and Nashik region as per State Water Policy.
- The GSG-II (2024) needs to consider the points raised in various PILs with MWRRA and Hon. High Court, Mumbai Bench, Mumbai.
- Chief Engineer, NMR raised the point related to Balance water in Jayakwadi project as on 31st May 2024, for this the data available in PRAVAH App.
- It is noticed from the data provided to GSG-II (2024) by S.E. CADA, Chh. Sambhajinagar, evaporation losses as per 100, 90, 75 & good year dependability of

observed yield of Jayakwadi projects. Seems to be abnormal. So it is necessary to study the evaporation losses by the third party such as C.E., Hydrology and Dam Safety, Nashik. Also, it should be mandatory to install Evaporometer on all Dams in Upper Godavari basin.

- Superintending Engineer, Dam Circle, CDO Nashik suggested that it is necessary to consider the non operative irrigation and non irrigation schemes in scarcity year, and actual water use while deciding how much water is to be released .
- 7 medium projects of upstream of Jayakwadi project shall be named as "Shivna complex" in GSG-II report (2024).
- This report is based on the data and Report of MWRRA 2018.
- The chronology of the chapters was discussed and finalized.

4.16. Sixteenth, Seventeenth & Eighteenth Meetings on 03/10/2024, 10/10/2024 & 14/10/2024 respectively at MERI, Nashik.

Finalisation of draft GSG-II report (2024)

As discussed in the meeting dated 25th Sept. 2024, the draft report was sent to GSG-II (2024) members. Accordingly, the discussion about Conclusion and Recommendations of the GSG-II report (2024) and other points were discussed. The members suggested additions / corrections in the proposed draft and unanimously it was decided to go ahead with the Draft Report. The corrected draft version 2 and 3 of the GSG-II Report was discussed in detail in the meetings held on 3rd October, 10th October and 14th October 2024 at MERI, Nashik, along with conclusions and discussion. Finally, the draft was unanimously agreed by all members and signed on 14th October 2024 for submission to the Government.

5.0 Data Availability:

The Executive Director, Godavari Marathwada Irrigation Development Corporation, Aurangabad has submitted the requisite data and information about completed, ongoing and planned Major, Medium and Minor irrigation projects in prescribed proformae The details of data and information are as under:

1	Information about Major, Medium and Minor Irrigation Projectsin Upper Godavari upto Jayakwadi dam) sub basin (Annexure-1)
2	Information about availability of yield at various locations in Upper Godavari (upto Jayakwadi dam) sub basin (Annexure-2)
3	Information about water requirement (Demand) from various Reservoirs/Dams (Major and Medium Project) in Upper Godavari (upto Jayakwadi dam) sub basin (Annexure-3)
4	Details of non-irrigation demands from Major and Medium projects in Upper Godavari (upto Jayakwadi dam) sub basin (Annexure-4)
5	Information about Kharif utilizations from Major and Medium projects in Upper Godavari (upto Jayakwadi dam) sub basin (Annexure-5)
6	Information about Rabi utilizations from Major and Medium projects in Upper Godavari (up to Jayakwadi dam) sub basin (Annexure-6)
7	Information about Hot Weather Utilizations from Major and Medium projects in Upper Godavari (upto Jayakwadi dam) sub basin (Annexure-7)
8	Information about approved Reservoir Operation Schedule for Gated Dams in Upper Godavari (upto Jayakwadi dam) sub basin
9	Information about Elevation Capacity Table for Gated Dams in Upper Godavari (upto Jayakwadi dam) sub basin
10	Information on salient features, latest approved water planning for Major and Medium Projects.
11	GSG-I, Shri Mendhegiri Committee Report. (2013)
12	MWRRA 2018 Report
13	Other information as Annexed with the Report is also referred.

The hydrological and water use data of completed, ongoing and planned projects as submitted by GMIDC are enclosed in Annexure 1 to 7.

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CHAPTER : 3

SEDIMENTATION

1.0 Introduction :

The sedimentation is an effect of erosion in the catchment area of the reservoir and hence, lesser the rate of erosion, smaller is the sediment load entering into the reservoir. Deposition of sedimentation in reservoir gradually reduces the capacity of reservoir. Dead storage capacity Aswell as live storage capacity gets affected due to sedimentation. Information about reduction in the storage capacity is necessary for the planning and operational purposes and same can be obtained through sediment assessment surveys done at regular interval. Various factors govern the process of erosion, transport, and deposition of sediment in the reservoir. Type of soil, drainage density, vegetation, rainfall intensity and duration, shape of catchment and land use / land cover affect erosion. Sediment transportation depends upon slope of the catchment, channel geometry and nature of river bank and bed. Deposition is a function of bed slope of the reservoir, length of reservoir, flow patterns, inflow-outflow rates, grain size distribution, mode of reservoir operation etc.

Since 1974, MERI has carried out sedimentation assessment studies of various reservoirs in Maharashtra by Hydrographic surveys, DGPS based Bathymetric Surveys, Satellite based Remote Sensing Technique and Ground Based Differential Global Positioning System (DGPS) technique. Resources Engineering Center (REC) of Maharashtra Engineering Research Institute (MERI), Nashik is entrusted with the work of research, investigation, and consultancy in capacity assessment surveys. Information about the reduction in capacity is necessary for all the planning and operational purpose and same can be obtained through sediment assessment surveys done at regular interval.

Various techniques like boat echo sounder etc being replaced by hydrographic data acquisition system (HYDAC) and HITECH method using Differential Global Positioning System (DGPS).The conventional techniques are found to be either time consuming or costly and require considerable manpower. Remote sensing technique to calculate the present capacity of reservoir is found to be very useful due to its synoptic and repetitive coverage. The surveys based on remote sensing data are faster and economical, too.

Recent observations have brought to light the alarming fact that the reservoir sedimentation resulting from degradation of watersheds is much higher compared to the rate that was assumed at the time the projects were designed. Sedimentation adversely affects planning for long term utilisation of reservoir capacity for irrigation, power generation, drinking water supply and flood moderation.

2.0 Sedimentation Planning Practices

Dr. A.N. Khosla, the then Chairman, Central Water Commission, had reviewed the work of reservoir sedimentation in fifties based on data available for 200 reservoirs all over the world including U.S.A. China and Africa and developed enveloping curves for annual sedimentation rate for major and minor catchments above and below 100 sq miles (2600 sq kms) respectively. He concluded that the sediment rate for major catchments varies from 0.357to 0.476 mm /year (3.57 to 4.76 Ha. m/100 sq.km/yr) and for minor catchments from 0.38 to 1.28 mm/year (3.80 to 12.80 Ha. m/100sq.km/yr). Up to 1965, these recommendations were adopted in the design of reservoirs and the sediment was assumed to get deposited at the lowest level and life was taken as the period required for complete sedimentation of the dead storage.

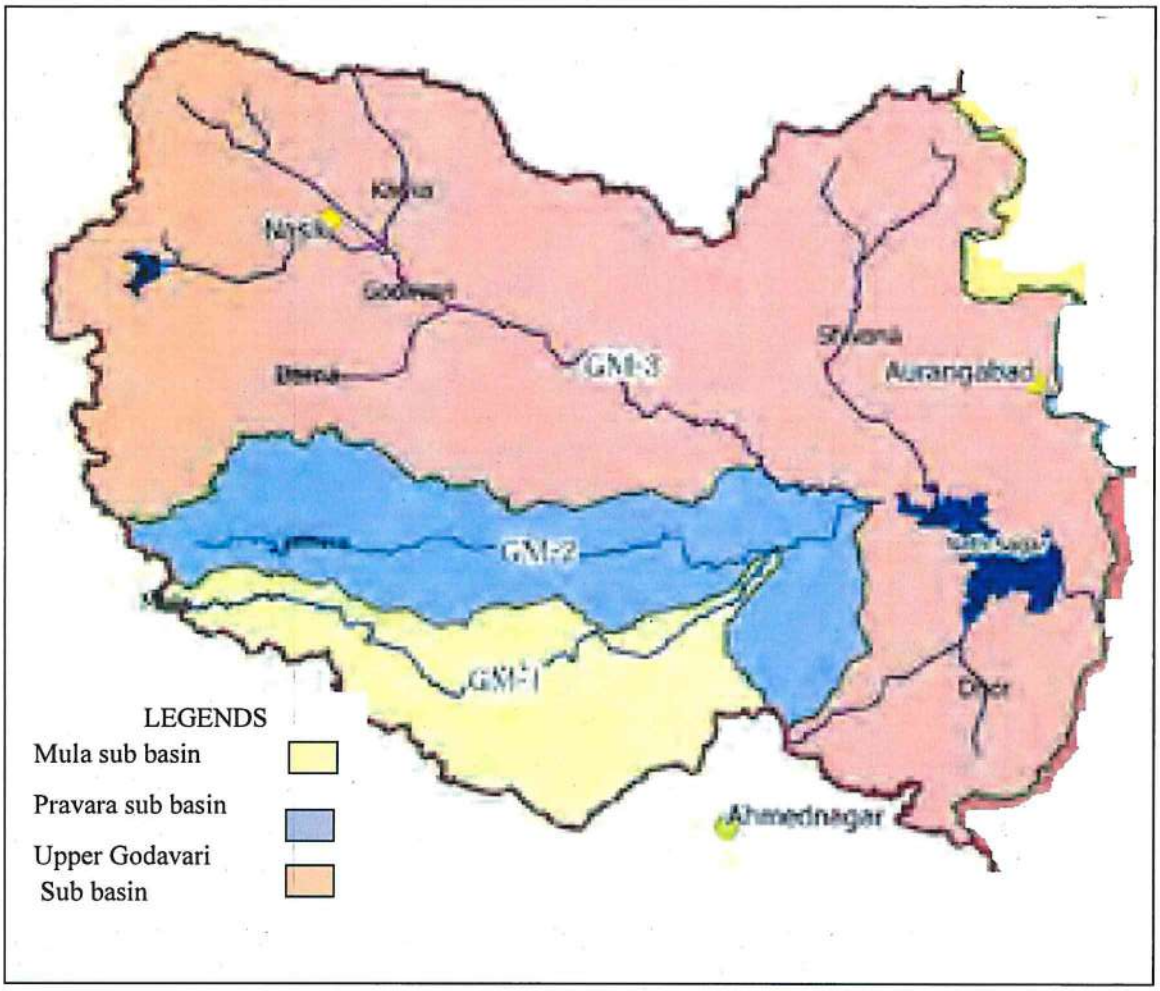
The present practice as incorporated in BIS : 12182(1987) has following main features:

1) The sedimentation rate is to be decided based on observations of river sediment flow and reservoir surveys.
2) The live storage is to be so planned that the benefits do not reduce for a period of 50 years (full-service time) for irrigation or 25 years for hydropower on account of sedimentation. The feasible service time for irrigation projects shall not be less than 100 years after start of operation. For hydropower projects the feasible service time should not be less than 70 years.

3.0 Godavari Basin up to Jayakwadi dam (Jayakwadi dam)

Upper Godavari Sub-basin includes the entire catchment of the Godavari River from its source to Jayakwadi dam including the catchment areas of the Pravara River, Mula river and that of all other tributaries which falls into the Godavari River in this reach.

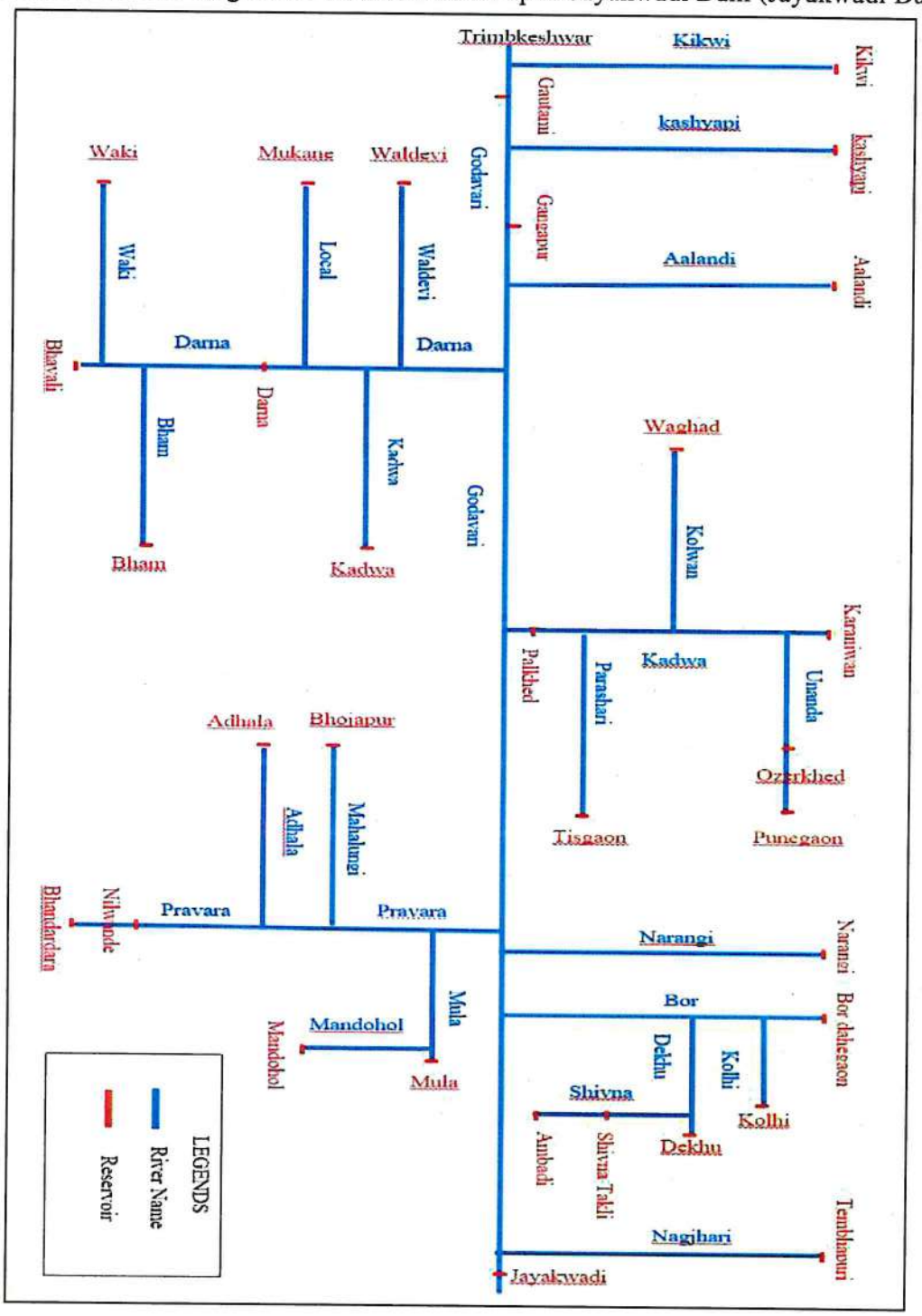
Figure 1: Godavari Basin up to Jayakwadi dam (Jayakwadi dam)



There are three sub basin namely Upper Godavari, Mula and Pravara up to Jayakwadi dam as shown in Figure 1. This three sub basins consist of 32 reservoirs in that 17 Major and 15 medium reservoirs.(Ref: Godavari Study Group Report by Mendhegiri Committee, August 2013 page no.66 to 68)The Figure 2 showing line diagram of reservoirs in the Godavari basin up to Jayakwadi dam.

The Maharashtra Engineering Research Institute carried out the sedimentation survey of 13 Major and 8 Medium reservoirs from the above sub basins. The Table 1 showing year of survey and Table 2 showing the bifurcation of Major and Medium dams in the complex of Upper Godavari, Mula and Pravara sub basin.

FIGURE 2 : Line Diagram of Godavari Basin up to Jayakwadi Dam (Jayakwadi Dam)



Ref:Godavari Study Group- 1 August 2013 page no. 45.

4.0 Reservoir Sedimentation Work Done by MERI for Godavari Basin up to Jayakwadi.

The following are sedimentation surveys done by Maharashtra Engineering Research Institute for Godavari basin up to Jayakwadi till 31/08/2024.

Table No. 1A : Number of Survey Completed (As of 31.08.2024)up to Jayakwadi Dam (Jayakwadi Dam) [Complex-wise]

Sr. No.	Reservoir Name	Year of Survey	Sr. No.	Reservoir Name	Year of Survey
A)	**Mula Complex**				
1	Mula	2015	2	Mandohol	2015
B)	**Pravara Complex**				
3	Bhandardara	2015	4	Adhala	2013
5	Bhojapur	2017			
C)	**Gangapur Complex**				
6	Gautami	2014	7	Kasyapi	2013
8	Gangapur	2016			
D)	**Godavari-Darna Complex**				
9	Kadwa	2016	10	Darna	2015
11	Mukane	2015	12	Alandi	2014
13	Waldevi	2013			
E)	**Palkhed Complex**				
14	Karanjwan	2015	15	Waghad	2014
16	Punegaon	2014	17	Ozarkhed	2014
18	Palkhed	2014	19	Tisgaon	2014
F)	**Remaining up to Jayakwadi dam**				
20	Tembhapuri	2018			
G)	**Jayakwadi dam (Jayakwadi)**				
21	Jayakwadi	2012			

Ref : The Status Report on Capacity Assessment of Reservoirs in Maharashtra, Year 2020
A Publication of MERI, Nashik(MS)

Table No. 1 B: Number of Survey Completed (As of 31.08.2024) up to Jayakwadi Dam (Jayakwadi Dam) [Year wise]

Sr. No.	Year of Survey	Reservoir Name	Complex	Number of Reservoirs
1	2012	Jayakwadi	Jayakwadi dam (Jayakwadi)	1
2	2013	Adhala	Pravara	1
3		Kashyapi	Gangapur	1
4		Waldevi	Godavari-Darna	1
5	2014	Gautami	Gangapur	1
6		Alandi	Godavari-Darna	1
7		Punegaon, Palkhed, Waghad, Ozarkhed, Tisgaon	Palkhed	5
8	2015	Mula, Mandohol	Mula	2
9		Bhandardara	Pravara	1
10		Mukane, Darna	Godavari-Darna	2
11		Karanjwan	Palkhed	1
12	2016	Gangapur	Gangapur	1
13		Kadwa	Godavari-Darna	1
14	2017	Bhojapur	Pravara	1
15	2018	Tembhapuri	Remaining up to Jayakwadi dam	1
Total Reservoir				21

Table No. 2 :As Per Complex Projects in Godavari Basin Studied by MERI

Name of Complex	Major	Medium
A) Mula Complex	Mula	Mandohol
B) Pravara Complex	Bhandardara	Adhala
		Bhojapur
C) Gangapur Complex	Gangapur	Gautami
		Kasyapi
D) Godavari-Darna Complex	Kadwa	Alandi
	Darna	Waldevi
	Mukane	
E) Palkhed Complex	Karanjwan	
	Waghad	
	Punegaon	
	Ozarkhed	
	Palkhed	
	Tisgaon	
F) Remaining up to		Tembhapuri
G) Jayakwadi dam (Jayakwadi	Jayakwadi	

Table 3 :Range of observed rate of siltation in Godavari basin [Complex wise]

Sr. No.	Sub Basin	Range of Observed Rate of Siltation Ha-m/100 sq. km/yr.	Number of Reservoirs	Name of Reservoirs
1	Mula Complex	(5 -10)	2	Mula, Mandohol
2	Pravara Complex	(0 - 5)	1	Bhojapur
		(5 -10)	1	Adhala
3	Gangapur Complex	(>30)	1	Gautami
4	Godavari - Darna Complex	(0 - 5)	2	Darna, Waldevi
		(5 -10)	1	Kadwa
		(15-20)	1	Alandi
		(20-25)	1	Mukane
5	Palkhed Complex	(0 - 5)	2	Palkhed, Karanjwan
		(5 -10)	2	Ozarkhed, Waghad
		(10-15)	2	Punegaon, Tisgaon
6	Jayakwadi Dam	(0 - 5)	1	Jayakwadi

Table 4 :Loss in capacity complex wise in Godavari basin up to Jayakwadi Dam (Jayakwadi Dam)

Sr. No.	Sub-basin	Loss in Capacity Mm^3		
		Gross Storage	Live Storage	Dead Storage
Annexure I (Projects covering 100% Live Storage studied by MERI)				
1)	Godavari – Darna Complex	-----	6.691	-----
2)	Palkhed Complex	-----	7.225	-----
3)	Jayakwadi Dam (Jayakwadi)	-----	178.933	-----
Total (Annexure A)		-----	192.849	-----
Annexure II (Projects covering less than 100% Live Storage studied by MERI)				
1)	Mula Complex	-----	58.503	-----
2)	Pravara Complex	-----	6.01	-----
3)	Gangapur Complex	-----	6.77	-----
4)	Godavari-Darna Complex	-----	20.645	-----
5)	Palkhed Complex	-----	2.876	-----
Total (Annexure B)		-----	94.804	-----
Total loss in capacity up to Jayakwadi dam (Annexure A + Annexure B)		-----	287.653	-----

Ref : *The Status Report on Capacity Assessment of Reservoirs in Maharashtra,* Year 2020, A Publication of MERI, Nashik(MS)

5.0 Conclusion :

Table 5 :Percentage Loss in Studied Live Storage Capacity

Sr. No.	Name of Reservoir	Complex	Studied Live Storage Capacity		Revised Studied Live Storage Capacity		Loss in Live Storage Capacity	
			Mm^3	TMC	Mm^3	TMC	Mm^3	%
1	Mula	Mula	541.073	19.108	486.020	17.164	55.053	10.17
2	Mandohol		8.750	0.309	5.300	0.187	3.45	39.43
3	Adhala	Pravara	26.160	0.924	20.510	0.724	5.65	21.60
4	Bhojapur		10.220	0.361	9.860	0.348	0.36	3.52
5	Bhandardara		273.460	9.657	276.663	9.770	---	---
6	Gautami	Gangapur	51.360	1.814	44.590	1.575	6.77	13.18
7	Kashyapi		52.43	1.851	59.060	2.085	---	---
8	Gangapur		132.362	4.674	137.614	4.860	---	---
9	Kadwa	Godavari-Darna	52.920	1.869	50.589	1.787	2.331	4.40
10	Darna		202.684	7.158	188.659	6.662	14.025	6.92
11	Mukane		151.120	5.337	144.530	5.104	6.59	4.36
12	Alandi		27.460	0.970	23.100	0.816	4.36	15.89
13	Waldevi		31.220	1.103	31.190	1.101	0.030	0.10
14	Karanjwan	Palkhed	144.010	5.086	143.925	5.083	0.085	0.06
15	Waghad		63.423	2.240	63.138	2.230	0.285	0.45
16	Punegaon		17.015	0.601	16.169	0.571	0.846	4.97
17	Ozarkhed		60.320	2.130	56.690	2.002	3.63	6.02
18	Palkhed		21.230	0.750	17.635	0.623	3.595	16.93
19	Tisgaon		12.440	0.439	10.780	0.381	1.660	13.34
20	Tembhapuri	Remaining up to Jayakwadi dam	19.620	0.693	20.090	0.709	---	---
21	Jayakwadi	Jayakwadi dam	2170.920	76.666	1991.987	70.347	178.933	8.24
TOTAL CAPACITY			4070.197	143.74	3798.099	134.129	287.65	7.06

Comparison of GSG - I (2013) & GSG - II (2024)

Statement Showing the difference between the Design Live Storage & Revised live storage (Excluding silt as per survey) in MCum

Sr. No.	Name of dam	Type of overflow section	Design Live storage in MCum	Revised live storage (Excluding silt as per survey) in MCum	Differe-.-nce in storage due to silt	% change
1	2	3	4	5	6	7
1	Mula	Gated	608.81	546.55	62.26	10.23
2	Bhandardara	Gated	304.10	307.61	-3.51	-1.15
3	Nilwande	Gated	228.75	228.75	0.00	0.00
4	Gauatami	Gated	52.90	46.13	6.77	12.80
5	Kashyapi	Gated	51.75	59.06	-7.31	-14.13
6	Gangapur	Gated	203.88	159.42	44.46	21.81
7	Kadwa	Gated	52.90	50.59	2.31	4.37
8	Dama	Gated	219.82	188.66	31.16	14.18
9	Mukane	Gated	204.98	198.39	6.59	3.21
10	Karanjwan	Gated	166.22	152.00	14.22	8.55
11	Punegaon	Gated	17.57	16.64	0.93	5.29
12	Palkhed	Gated	21.24	18.49	2.75	12.95
13	Waki	Gated	70.57	70.57	0.00	0.00
14	Jayakwadi	Gated	2170.94	1991.98	178.96	8.24
15	Mandohol	Ungated	8.78	5.68	3.10	35.31
16	Adhala	Ungated	27.61	21.97	5.64	20.43
17	Bhojapur	Ungated	10.22	9.86	0.36	3.52
18	Alandi	Ungated	27.47	23.1	4.37	15.91
19	Bham	Ungated	69.76	69.76	0.00	0.00
20	Bhavali	Ungated	40.79	40.79	0.00	0.00
21	Waldevi	Ungated	32.09	32.06	0.03	0.09
22	Waghad	Ungated	72.23	64.95	7.28	10.08
23	Ozarkhed	Ungated	60.32	56.69	3.63	6.02
24	Tisgaon	Ungated	12.87	10.78	2.09	16.24
25	Tembhapuri	Ungated	19.61	19.61	0.00	0.00
26	Dheku	Ungated	12.17	12.17	0.00	0.00
27	Kohli	Ungated	3.24	3.24	0.00	0.00

Sr. No.	Name of dam	Type of overflow section	Design Live storage in MCum	Revised live storage (Excluding silt as per survey) in MCum	Difference in storage due to silt	% change
1	2	3	4	5	6	7
28	Narangi	Gated	11.5	11.5	0.00	0.00
29	BorDahegaon	Gated	11.47	11.47	0.00	0.00
30	Ambadi	Ungated	9.42	9.42	0.00	0.00
31	Shivana Takli	Gated	36.45	36.45	0.00	0.00
		Total	4840.43	4474.34	366.09	7.56

Table 6 : Range of Percentage loss in live storage capacity since impounding

Sr. No.	Range of % loss in live storage capacity since impounding	No. of reservoir within the range	Name of reservoir
1	0-5 %	7	Kadwa , Bhojapur, Mukane,Waldevi , Karanjwan, Waghad, Punegaon
2	5-10 %	3	Ozarkhed, Jayakwadi, Darna
3	10-15 %	3	Mula, Gautami, Tisgaon
4	15-20 %	2	Alandi, Palkhed
5	>20 %	2	Mandohol, Adhala

Dams/reservoirs have played significant role in development of the country. Dams are instrumental in generation of electricity, provide water for irrigation, for farmers, supply water to households and industries. However, sedimentation has impacted the storage capacity of the reservoirs, thus affected their performance, and reduced their benefits. De-silting of reservoirs is an expensive task and extracted silt has environmental impacts also. In-depth knowledge of rate of sedimentation, pattern of silt deposition and details of vulnerable areas of catchment is necessary to manage the sedimentation of the reservoirs to ensure that the dams serve intended purpose as long as possible. Correct rate of sedimentation and percentage loss in live storage capacity is essential for assessing useful life of the reservoir as well as optimum

operation schedule. The Godavari Study Group-II has considered the sedimentation analysis based on "The Status Report on Capacity Assessment of Reservoirs in Maharashtra", a publication of MERI, Nashik while considering the live storage capacity of various reservoirs in the Upper Godavari basin during formulation of report.

The study Group proposes to carry out Reservoir sedimentation of all the remaining dams of various Complex in the upper Godavari basin An update the live storage in the Reservoir within next 5 years so that the exact impact of sedimentation can be considered while formulation the Reservoir water release strategy from upstream Reservoir up to Jayakwadi project in report / coming years.

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CHAPTER - 4

STATUS OF RIVER LINK PROJECT

1.0 Introduction :

According to the National Perspective Plan prepared by the Central Government in the year 1980, it is proposed to divert water from water-rich basins to deficit basins. In 1983, the National Water Development Agency (NWDA) was established to study river linking schemes. The state of Maharashtra has six major river basins namely Godavari, Krishna, Tapi, Narmada, Mahanadi and West flowing River (Kokan). Of these, the rivers of Konkan and the Wainganga River, a tributary of the Godavari in the east, have surplus water. To divert the surplus water to deficit basin, the following various river link schemes are proposed. In Maharashtra, Konkan, which is only 10% of the state's geographical area, receives 50% of its rainfall. At present, 75% of that water flows unused westward into the Arabian Sea. The Tapi and Godavari basins are deficit basins and therefore, Inter-basin water diversion is required to meet future water demand.

2.0 River Linking Project from Konkan region to Godawari Basin:

2.1 Damanganga-Ekdare-Godavari River Link Project:

Under this project it is proposed to construct Ekdare dam with capacity of 1.16 TMC (32.95 Mm3) on Damanganga River (Tal. Peth Dist. Nashik). ICA of the project is 12753 there through this Project, out of 3.55 TMC (100.569 Mm3) of water 3.02 TMC (85.484 Mm3) will be lifted by 351.43 meters and diverted to Waghad Dam in Godavari Basin and then released into Jayakwadi Dam. Out of 3.55 TMC of water 3.02 TMC (85.484 Mm3) of water will be diverted and rest 0.53 TMC (15.085 Mm3) will be available for local water use. The cost of the project is Rs.2213.53 crores (price level 2022-23) and the Benefit Cost Ratio of the scheme is 1.67 and the Internal Rate of Return is 14.48%. The proposal has been cleared on 28.08.2024 by State Level Technical Advisory Committee, Nashik in its 214th meeting and the Government of Maharashtra has accorded Administrative Approval to this scheme on 14th October 2024.

2.2 Damanganga-Vaitarna-Godavari River Link Project:

This project envisages diversion of 5.68 TMC of surplus water to Godavari basin by constructing 4 dams in Damanganga and Vaitarana sub-basins. ICA of the project is 33110 hectare total area of 33110 hectares including 17960 hectares in Sinnar Taluka of Nashik

district and 5840 hectares in Jayakwadi project in Marathwada will be irrigated through this scheme. The cost of project is Rs. 13497.24 Crores (Price level 2022-23) with a Benefit Cost ratio of 1.21 and the Internal rate of return of 9.7%.The proposal has been cleared by 29.08.2024 State Level Technical Advisory Committee, Nashik in its 216th meeting and the Government of Maharashtra has accorded Administrative Approval to this scheme on 14th October 2024.

2.3 Par Godavari River Link Project :

Under this project it is proposed to construct 17 Earthen dam with capacity of 2.88 TMC(81.94 Mm3)on Par river and its tributaries. 2.58 TMC(73.39 Mm^3) diverted towards Godavari Basin. Through this Project, 1.31 TMC (37.32 Mm^3) of water will be lifted by 223.49 meters towards Manjarpada dam (Devsane).1.26 TMC (36.07 Mm^3) of water will be lifted by 159.5 meters towards Karanjvan river via Chilarpada-Shivarpada Tunnel. The cost of the project is Rs. 3716.06 crores and the Benefit cost ratio of the scheme is 0.24. This project has been discussed in State Level Technical Advisory Committee (SLTAC) 170th meeting on 20.04.2022. The study regarding water availability certificate is ongoing with Chief Engineer, Hydrology Project and Dam Safety, Nashik.

According to the study conducted by the Chief Engineer, Hydrology and Dam Safety, Nashik, the current situation available water is 45.11 Mm^3 instead of the required 85.41 for the scheme. Chief Engineer of River linking project coordination pursuant to the meeting held on 19.04.2024, suggested that the committee of Superintending Engineers related to this project should jointly study and prepare a preliminary proposal. Accordingly, Superintending Engineer, Hydrology, Nashik, in the meeting was held on 29/04/2024, informed that 45.11 Mm^3 will be available considering RL 500m in Par valley. The cancellation of the Par-Tapi Narmada Link project will result in an additional approx. 305.59 Mm^3 remains available in the Par basin. By canceling the condition to avail water above RL 500, additional 83.97 Mm^3 water from RL 300 to RL 500 will be available for this project just by constructing 3 dam i.e. (1) Chhekda- 13.60 Mm^3 (2) Bhandshet- 38.18 Mm^3 (3) Surgana 32.19 Mm^3.

As per study by Hydrology, Nashik 45.11 Mm^3 available above RL 500 and if considering RL 300 to RL 500 water available 83.97 Mm^3 total 129.08 Mm^3 (4.55 TMC) water will be available for Par Godavari river linking project.

3.0 Details of Completed Water Diversion Scheme

a) **Punegaon Dam:** (Total water Diverted - 17.16 MCM)

i. Manjarpada Diversion Scheme: Under this scheme, 17.16 MCM water is diverted. 90% Project is Completed.

b) **Waghad Dam:** (Total water Diverted - 6.69 MCM)

ii. Zarlipada Diversion Scheme: Under this scheme, 1.06 MCM water is diverted. Project is Completed.

iii. Ambegan Diversion Scheme: Under this scheme, 1.40 MCM water is diverted. Project is Completed.

iv. Pimpraj Diversion Scheme: Under this scheme, 1.26 MCM water is diverted. Project is Completed.

v. Golashi-1 Diversion Scheme: Under this scheme, 2.97 MCM water is diverted. Project is Completed.

c) **Karanjvan Dam:** (Total water Diverted – 3.47 MCM)

vi. Ranpada Diversion Scheme: Under this scheme, 0.35 MCM water is diverted. Project is Completed.

vii. Chaphyachapada Diversion Scheme: Under this scheme, 0.31 MCM water is diverted. Project is Completed.

viii. Hattipada Diversion Scheme: Under this scheme, 0.90 MCM water is diverted. Project is Completed.

ix. Palasvihir Diversion Scheme (Local Sector) : Under this scheme, 0.89 MCM water is diverted. Project is Completed.

x. Chillarpada Diversion Scheme (Local Sector) : Under this scheme, 1.02 MCM water is diverted. Project is Completed.

d) **Gangapur Dam:** (Total water Diverted - 3.20 MCM)

xi. Amboli Bombiltek Diversion Scheme: Under this scheme, 0.92 MCM water is diverted. Project is Completed.

xii. Waghera Diversion Scheme: Under this scheme, 1.19 MCM water is diverted. Project is Completed.

xiii. Pengalwadi Diversion Scheme: Under this scheme, 0.69 MCM water is diverted. Project is Completed.

xiv. Velunge Diversion Scheme (Local Sector): Under this scheme, 0.40 MCM water is diverted.
Project is Completed.

Thus, overall 14 river diversion schemes are completed and 30.52 MM^3 (1.08 TMC) water diverted in Godavari Basin from Konkan region.

4.0 Details of Ongoing Water Diversion Schemes:

i. Dhondalpada Diversion Scheme:
Under this scheme, 1.39 MCM water is diverted. 85% Project is Completed. Supplementary works are in progress.

ii. Golshi Mahaje Diversion Scheme:
Under this scheme, 5.09 water is diverted. 95% Project is Completed. Supplementary works are in progress.

iii. Nanashi Diversion Scheme:
Under this scheme, it is proposed to divert 1.00 MCM water. Dam work completed. Forest clearance process for link cut is in progress.

iv. Payarpada Diversion Scheme:
Under this scheme, it is proposed to divert 1.90 MCM water. Land Acquisition work is in progress.

v. Kalmuste Diversion Scheme:
This scheme is located at Nashik District, Tal. Trambakeshwar near Dongargaon village on local Nalla. Under this scheme, it is proposed to divert 0.69 TMC (19.54 MCM) water from Damanganga Basin to Godavari Basin. The ICA of the project is 1984 hectare. The cost of project is Rs. 494.98 Crores (Price level 2022-23) a Benefit Cost ratio of 1.17. Administrative Approval for the project received on 29/08/2023 by the Government of Maharashtra. Forest Clearance procedure is in progress. Further Estimate Technical Sanction procedure is in progress.

vi. Ambad Diversion Scheme :-
Under this project, it is proposed to divert 0.91 MCM water West flowing rivers to Godavari basin. ICA of the project is 51 hectre. The cost of project is Rs. 10.328 Crores (Price level 2021-22) with a Benefit Cost ratio of 1.52. Further tender procedure is in progress and work order has been given to the work on date-09/09/2024.

vii. Chimanpada Diversion Scheme :-
Under this project, it is proposed to divert 0.82 MCM water West flowing rivers to Godavari basin. ICA of the project is 111 hectare. The cost of project is Rs. 36.40 Crores (Price level 2022-23) with a Benefit Cost ratio of 1.71. Administrative Approval of Rs.36.40 Crores for the project received on 29/08/2023. Further tender procedure is in progress.

viii. Upper Vaitarna - Mukane Diversion Scheme :

Upper Vaitarana Mukane Gravity Diversion Scheme envisages construction of a structure on right side of Upper Valtarana saddie dam Upper Vaitarana saddle dam runs along ridge line of Vaitarana valley and Godavari valley, Valtarana River is west flowing river and Godavari is east flowing river. The reservoirs of Upper Vattarana dam and Mukane Dam are adjacent to each other separated by saddle dam. Mukane dam is located at Mukane, Tal. Igatpuri, Dist. Nashik and is built on Aundha Nala, Audha Nala in the tributary of the river Dama.

In order to reduce the water deficit in the Upper Godavari basin to some extent, this scheme was accorded approval by the Government for diversion of 1.00 TMC water to Godavari basin on 14.03.2012 with certain conditions. Also the Government of Maharashtra, Water Resources Department has agreed to divert 16.50 TMC water from Upper Vaitrana Dam to Godavari basin by marathi letter no. संकिर्ण / 160 / 2020 / जसंअ दि.18/10/2021. In the meeting headed by Secretary, (Projects Coordination), Mantralaya, Mumbai on 07/10/2020, the discharge and crest level of proposed diversion spillway structure was finalized as 700 cumecs and 595.50 m respectively. Considering the above facts, the CDO, Nashik, has proposed 2 radial gates of size 12m x 8m with crest RL as 595.50 m and a river sluice middle pier of size 1.2 m x 1.5m was proposed with crest RL of 592.00 m.

Technical sanction for the scheme has been given by CE, NMR, Nashik on 31.01.2022, and the work order has been issued by letter dated 24/06/2022. The farmers are demanding return of their 623 Hector of excess land acquired during the construction of Upper Vaitarna Dam. The resolution to return this 623 Hector of land within the possession of water resources department is approved in the 79th Governing Council meeting of Konkan Irrigation Development Corporation, Thane and as per the approved proceedings the procedure to return to farmers excess land is in progress through Chief Engineer, Konkan Region, Mumbai.

Despite of strong oppositions from project affected farmers, the work of the scheme has been started in the field after positive discussions in coordination with MPs and local farmers. At present, the work of the scheme has been started and approximately 20% of the work has been completed. Also, it is planned to divert 1.0 TMC of water flowing from the spillway of Upper Vaitrana Dam through the scheme, by June 2025.

Thus, overall 5 river diversion schemes are in progress and 35.293 MM ^{3} (1.22 TMC) water is diverted in Godawari basin from Konkan region.

5.0 Future water diversion scheme :

In addition to above river diversion scheme, 8 new schemes viz. Amboli Velung, Kapwadi, Hivara, Samrada, Tolarkind, Khireshwar, Sadadaghat, Patharaghat river diversion schemes are proposed. However, the project details are yet to be finalized.

5.1 Kapwadi Diversion Scheme:

Under this project, it is proposed to divert west flowing 0.21 TMC(6.00 MCM) water to Godavari basin's upper side of Darana Dam. The cost of project is Rs. 258.48 Crores (Price level 2018-19) with a Benefit Cost ratio of 0.6.The proposal has been cleared on 6.04.2022by State Level Technical Advisory Committee, Nashik in it's1 meeting. The AA proposal is submitted to WRD,Govt of MH on date 13/04/2022 and the compliance of the points raised on the same proposal vide Govt ltr dated 23.11.2023 is in progress at field level.

Conclusion:

The Godavari Study Group II observed that overall 14 river diversion schemes are completed and 30.52 MM^3 (1.08 TMC) water is diverted also, other 8 are in progress and 59.84 MM^3 (2.11 TMC) water is to be diverted, the details is shown in various charts.

The water available through river linking project shall be used to cater the deficit in Jayakwadi project. For releasing the water available from river diversion / river linking Project, to cater the deficit in Jayakwadi project the Government shall establish the mechanism for measurement and distribution after the completion of river diversion / river linking Project.

The quantum of water received in Upper Godavari basin shall be measured and such quantum of water shall be released to Jayakwadi Project. However, a methodology for determination of various losses to be considered for water available from river diversion schemes shall be derived in due course.

In the Public Interest litigation No. 50/2022 at the Hon'ble High Court Bench at Chh. Sambhaji Nagar, Dist: Chh. Sambhaji Nagar, the Petitioner has requested "to take immediate steps to start the inter district, river linking project to transfer the water from Kokan region to Marathwada region without diverting water in any of the dam of Nashik region and to complete the schemes within stipulated period to provide the water to Marathwada region". However, the Study Group Committee, has to state that the water transfer to the Marathwada region through the upstream dams of Jayakwadi reservoir located in Nashik & Ahmednagar Districts as they are adjoining districts between Kokan and Marathwada region.

Marathwada Region (Godavari Basin)

(A) Water Diversion Schemes : (Completed Projects)

Sr No	Diversion Scheme	Water Availability Certificate (Mm^3)	Proposed Water Use (Mm^3)	Local Water Use (Mm^3)	Water Diverted (Mm^3)	Dam use to divert water
1.	Devsane (Manjarpada)	20.00	17.16	0.00	17.16	Punegaon
2.	Zarlipada	1.35	1.35	0.29	1.06	Waghad
3.	Ambegan	1.87	1.87	0.47	1.40	Waghad
4.	Pimparaj	1.68	1.68	0.42	1.26	Waghad
5.	Golashi-1	3.11	3.11	0.14	2.97	Waghad
6.	Ranpada	0.44	0.44	0.08	0.36	Karanjavan
7.	Chaphyachapada	0.37	0.37	0.06	0.31	Karanjavan
8.	Hattipada	1.60	1.57	0.67	0.90	Karanjavan
9.	Palasvihir (Local Sector)	1.17	1.17	0.28	0.89	Karanjavan
10.	Chillarpada (Local Sector)	1.25	1.25	0.23	1.02	Karanjavan
11.	Amboli Bombiltek	0.96	0.96	0.04	0.92	Gangapur
12.	Waghera	1.19	1.19	0.00	1.19	Gangapur
13.	Pengalwadi	0.69	0.69	0.00	0.69	Gangapur
14.	Velunge (Local Sector)	0.68	0.68	0.28	0.40	Gangapur
Total					**30.52 (1.08 TMC)**	

(B) **River Linking Project :**

Sr No	Diversion Scheme	Water Availability Certificate (Mm^3)	Proposed Water Use (Mm^3)	Local Water Use (Mm^3)	Water Diversion (Mm^3)	Dam use to divert water
1.	Damanganga-Ekdare- Godavari	100.569	100.569	15.084	85.484	Ekdare
2.	Damanganga-Vaitarna- Godavari	160.97	172.21	18.10	40.00	Upper Vaitarna
3.	Par-Godavari	43.43 (Proposed)*	43.43	6.11	73.39	(11 Earthen Dam)
Total					**198.874 (7.02 TMC)**	

*water availability certificate yet not received

(C) **Water Diversion Schemes : (Ongoing Projects)**

Sr No	Diversion Scheme	Water Availability Certificate (Mm^3)	Proposed Water Use (Mm^3)	Local Water Use (Mm^3)	Water Diversion (Mm^3)	Dam use to divert water
1.	Dhondalpada	2.05	2.05	0.66	1.39	Karanjavan
2.	Nanashi	1.56	1.56	0.56	1.00	Karanjavan
3.	Payarpada	2.26	1.90	0.00	1.90	Karanjavan
4.	Golashi Mahaje	8.54	5.56	0.47	5.09	Waghad
5.	Kalmuste	23.14	19.54	3.60	19.54	Gangapur
6.	Ambad	1.043	1.043	0.133	0.91	Karanjavan
7.	Chimanpada	1.334	1.334	0.00	0.82	Karanjavan
8.	Upper Vaitarna - Mukane	28.50	28.50	0.00	28.50	Mukane
Total					**59.64 (2.11 TMC)**	

CHAPTER : 5

DECLARATION OF DROUGHT BY MRSAC, NAGPUR

1.0 Drought Overview:

Drought is a complex phenomenon that occurs primarily due to significant deviations in rainfall from the normal and/or uneven spatial or temporal distribution. This deviation can adversely affect crops over a single agricultural season or successive seasons. Defining drought precisely and universally is challenging because of its multifaceted nature and varying characteristics across different agro-climatic regions. Additionally, it is difficult to determine the exact beginning and end of a drought.

In India, drought is generally considered to coincide with the monsoon season. The severity and spread of this calamity depend on several factors, including the status of surface and groundwater resources, agro-climatic conditions, cropping patterns, and the socio-economic vulnerabilities of the local population.

There is no single indicator that can accurately forecast the onset and severity of a drought event or its potential impacts. However, the impact of drought tends to be magnified in the event of successive occurrences.

A deficiency in rainfall leads to the depletion of soil moisture and a decline in surface and groundwater levels. This, in turn, negatively affects agricultural operations due to the insufficient availability of water for crops, particularly during critical stages of plant growth. The relationship between rainfall quantity and drought triggers varies across agro-climatic zones in India. Although deficient rainfall is generally seen as the primary cause of drought, the occurrence, spread, and intensity are influenced by multiple factors, including climate change vulnerabilities, hydrological and soil profiles, soil moisture availability, crop choices, agricultural practices, fodder availability, and socio-economic factors.

Characteristics of Drought: The occurrence of drought is influenced by various factors, such as cropping choices, agronomic practices, soil types, drainage, and groundwater profiles. However, rainfall deficiency, coupled with spatial and temporal distribution, duration, and dry spells, are acknowledged as the most significant triggers for drought.

Over-exploitation of groundwater and suboptimal conservation and storage of surface water reduce the availability of irrigation, particularly in years of rainfall deficiency. A steady decline in per capita water availability for humans and animals, even in non-drought years, exacerbates the situation. Out-migration of cattle and other animals from drought-hit areas also intensifies pressure on resources in surrounding regions.

Poor rainfall over successive years tends to compound the effects of drought by limiting the recharge of surface and groundwater resources, the replenishment of soil moisture, and the financial recovery of farmers, thereby hampering future agricultural investments.

2.0 Monitoring and Early Warning System:

Drought is a complex phenomenon, and careful monitoring along with early warning is crucial for effective management. The objectives of a well-functioning monitoring and early warning system are as follows:

1. Provide accurate and timely information on rainfall, crop-sown areas, soil moisture (wherever possible), streamflow, groundwater levels, and lake and reservoir storage at relevant spatial scale at the state, district, and sub-district levels.
2. Detect drought conditions as early as possible to implement District Agriculture Contingency Plans and Crisis Management Plans. Declare drought based on objective criteria.

The development and success of such a system depend on the coordinated efforts of all stakeholders, including the Government of India, state governments, scientific institutions, and farmers.

3.0 Key Variables for Monitoring Drought:

State governments monitor drought by collecting data on key variables, including:

- Meteorological Data: Rainfall, temperature, wind speed, and relative humidity.
- Weather Forecast: Short, medium, and extended-range forecasts.
- Soil Moisture.
- Sown Area/Crop Health/Stress.
- Satellite-Based Vegetation Index.
- Streamflow: Discharge levels.
- Groundwater Levels.

- Reservoir and Lake Storage/Levels.
- Impacts: Distress sales, migration of cattle and humans, fodder availability, drinking water, animal health, and employment opportunities in the agricultural sector.

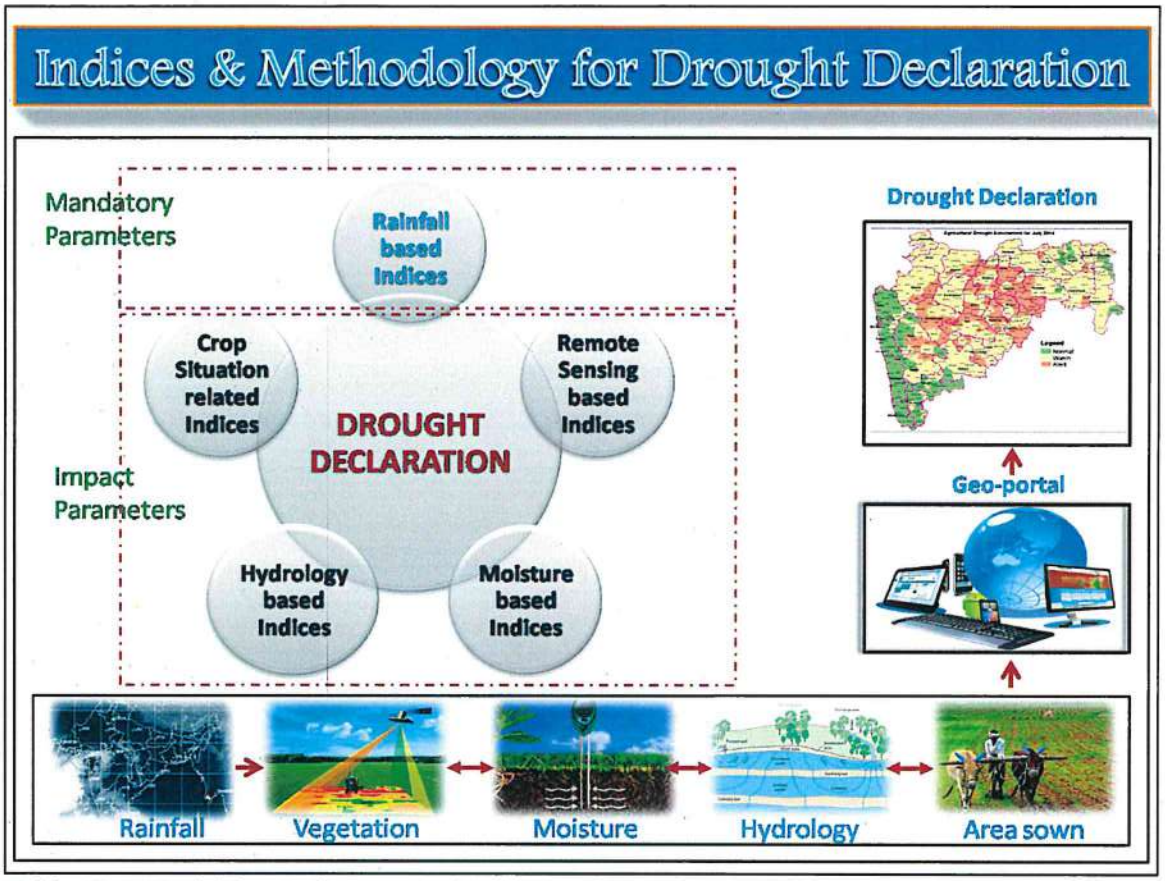
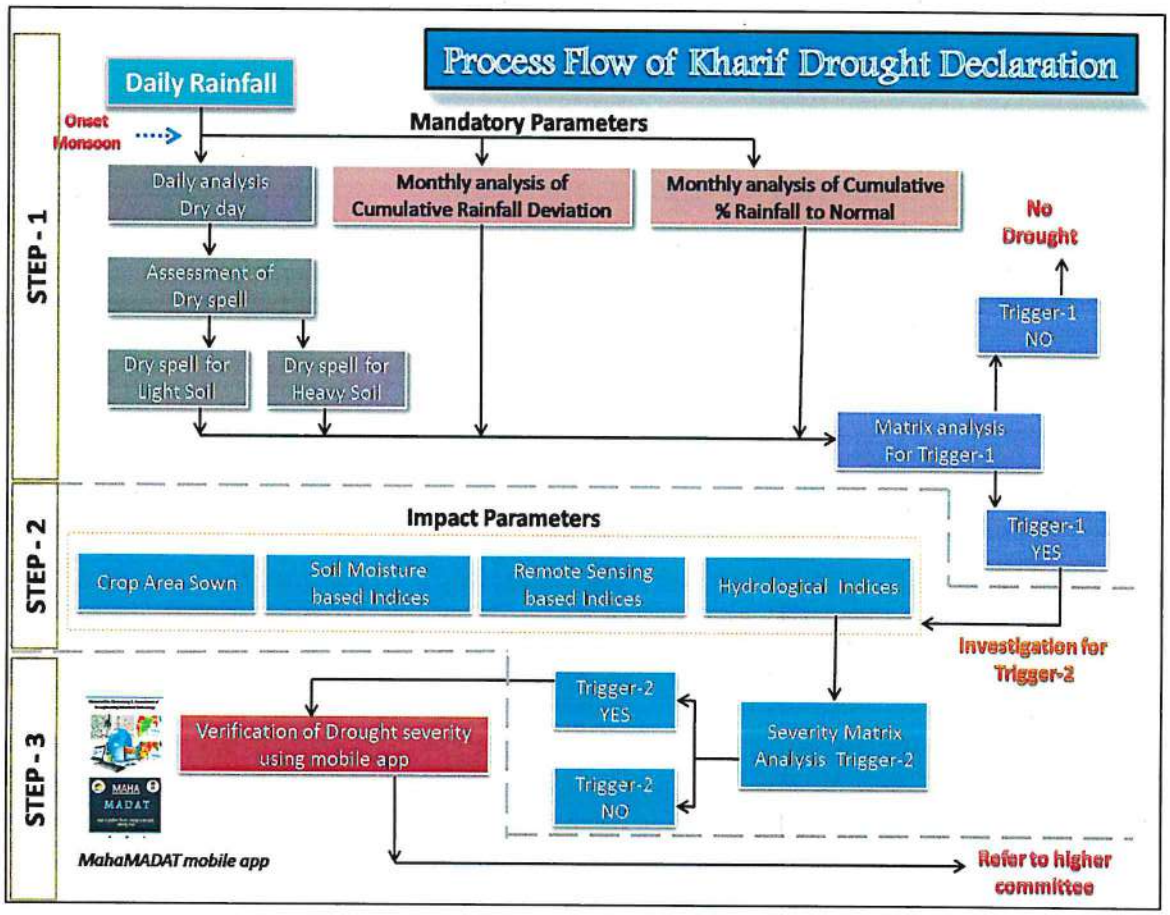


Table: Key Variables, Indicators, and Sources of Data for Drought

Sr. No	Key Variable	Indicator/Index	Sources of Data
1	Rainfall	Rainfall Deviation/SPI	IMD, State Govt.
2	Crop Sown Area	Deviation from Normal	State Govt. (Dept. of Agriculture)
3	Satellite-Based Crop Condition	NDVI, NDWI Deviation from Normal, VCI of NDVI/NDWI	MNCFC, NRSC, ISRO, State Remote Sensing Centres
4	Streamflow	SFDI	CWC / India-WRIS
5	Groundwater Levels	GWDI	CGWB
6	Reservoir Levels	RSI	CWC, Irrigation Dept., Water Resources Dept.

4.0 Process for the Determination of Drought:

The complexity of drought cannot be captured by a single indicator; it requires comprehensive data analysis from several parameters, with rainfall being the most critical. This must be supplemented by field verification. The steps for determining drought are as follows:



Step 1: Mandatory indicators (e.g., rainfall deviation, SPI, or dry spell) will be considered using the matrix provided in the table to assess if the first drought trigger is activated.

Table : Matrix for Rainfall Deviations and Dry Spells (Trigger-1)

Rainfall Deviation/SPI	Dry Spell	Drought Trigger
Deficit or scanty rf / SPI <-1	Yes	Yes
Deficit or scanty rf / SPI <-1	No	Yes, if rainfall is scanty or SPI <-1.5, otherwise No
Normal rf / SPI >-1	Yes	Yes

Step 2: In the event that first drought trigger is set off as per Step-1, impact indicators will be assessed as per the matrix in table below.

Table : Matrix for Impact Indicators (Trigger-2)

Mandatory Indicators	Impact Indicators	Category of Drought
Rainfall Indices	Agriculture	
Remote Sensing	Soil Moisture	Hydrology
Rainfall Deviation (RF Dev) or SPI	Crop Area Sown	VCI or NDVI & NDWI Deviations

The states may consider any three of the four types of impact indicators (one from each category) to assess the drought's severity and make a judgment.

4.3 **Declaration of (Kharip) Drought**: Typically, the declaration of kharif drought should not be made later than October 31st each year. Rainfall deficiency, based on rainfall deviation or SPI, and the dry spell remain mandatory for declaring drought. In cases where seasonal conditions suggest drought-like situations, early drought declarations may be carried out in August. The deficit rainfall in June and July, coupled with prolonged dry spells and significant reductions in crop-sown areas, can trigger an early drought declaration. Among the impact indicators, a reduction in crop-sown area or failed sowing, MAI, groundwater, or reservoir water levels are particularly important. NDVI is less effective when canopy coverage is low, so in such cases, NDWI, a surface wetness indicator, is preferred over NDVI.

5.0 Integration of Water Release & MahaMADAT plug in Software:

Project execution workflow is elaborated below:

- The precise determination of the storage levels within the command areas of dams situated upstream of Jaykwadi (Jayakwadi Dam) and those within the Jaykwadi project area is conducted annually on the 15th of October using the PRAVAH App. This process involves utilizing the PRAVAH App functionalities to calculate the exact quantum of storage available in these dams, ensuring accurate data retrieval and analysis for effective water management strategies.

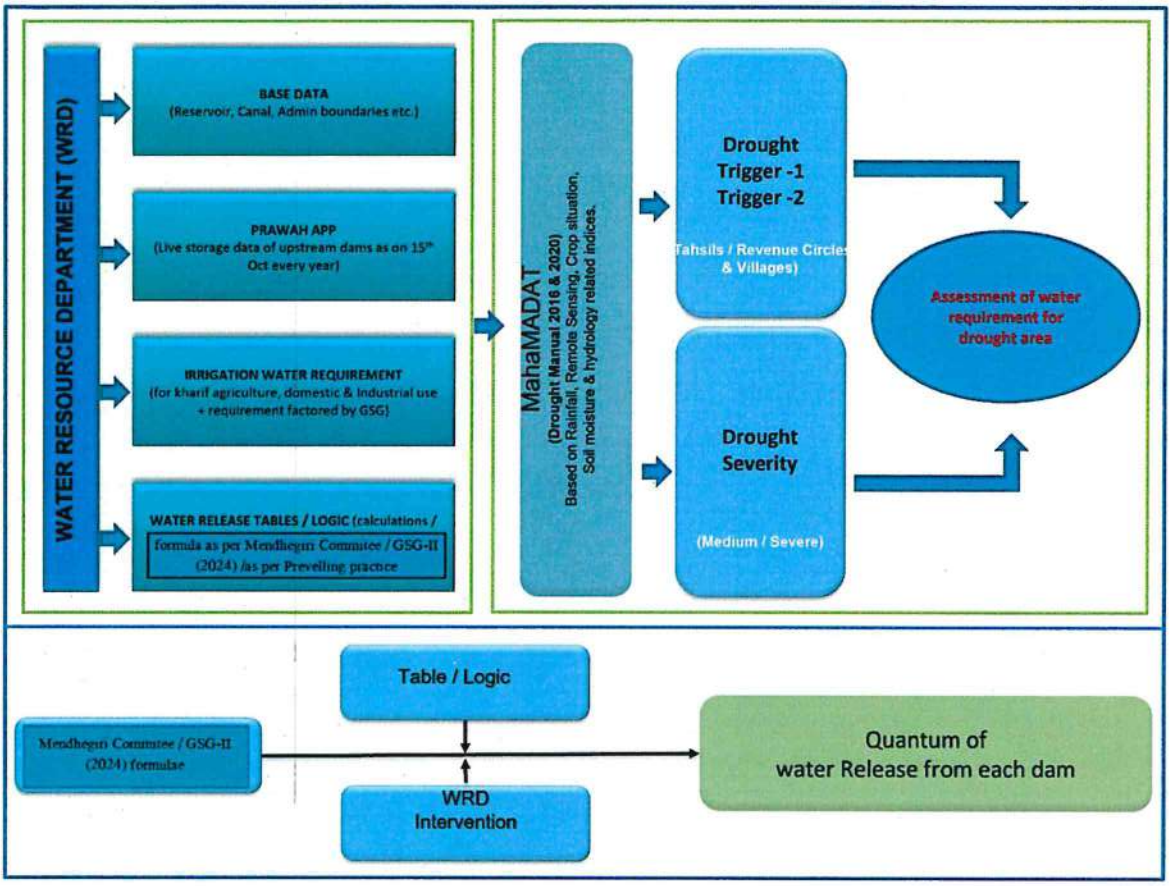
- A Water Resources Department (WRD) officials will be responsible for furnishing the necessary data concerning the kharif utilization of each dam and the requirements for non-

irrigation purposes, including drinking and industrial usage, for dams situated upstream of Jaykwadi (Jayakwadi Dam).

- MRSAC will provide the list of circles under drought with the help of MAHAMADAT software. WRD will provide the water utilization data for fodder growth for each circle, based on which MRSAC will calculate exact amount of water required for growing the fodder for the quantum of livestock in each circle.

- MRSAC will provide precise calculations regarding the amount of water to be released, taking into account various factors such as the prevailing drought conditions, the storages in dams i.e., Jaykwadi and upstream dams levels as of October 15th, the utilization of water during the kharif season, and the requirements for non-irrigation purposes, including drinking and industrial usage. Additionally, the irrigation requirements, as determined by the GSG committee, will also be factored into these calculations. This comprehensive approach ensures effective water management and allocation in accordance with the prevailing conditions and demands. After receipt of all data and considering all practical situation the Executive Director, GMIDC, Ch. Sambhajinagar will take the final decision for release of water through various complex.

- The work will be executed in several phases:
    - Phase I: Collection storage, utilization and drought data
    - Phase II: Preparation of the release water analogy
    - Phase III: Conducting trial runs using historical data from 2015, 2018, and 2024
    - Phase IV: Updating the software module based on the results of the trial runs, if necessary
    - Phase V: Running the software annually and update software as per experiences result & outcome.



- With the help of skilled software developers who will collaborate with MWRD officials to accurately determine the amount of water to be released. This determination will be made after assessing the severity of the drought situation in the command areas of Jaykwadi (Jayakwadi Dam)& Upstream dams of Jaykwadi. MRSAC will develop specialized software that takes into account five key parameters related to drought, as well as the storages of all dams within the study area and the utilization of water for Kharif crops and non-irrigation requirement also irrigation requirement as per prevailing strategy of G.S.G. report.at each dam by October 15th of every year. The software will be designed to operate autonomously, without requiring human intervention, streamlining the process, and ensuring accuracy in water release decisions.

Methodology elaborated above will ensures a systematic approach to water management, leveraging technology and collaboration between MRSAC and WRD to optimize water utilization and mitigate the impacts of drought in the region.

6.0 PRAVAH

PRAVAH is application developed by WRD for capturing water level, rainfall, discharge released and evaporation data of major, medium and minor dams. PRAVAH application is Web and mobile based. Web version is compatible with all browsers in market Mobile version is currently available for Android Users.

The Dam in-charge-officers can update daily lake level, rainfall, discharge, and evaporation data through PRAVAH application. Access rights for data entry are given to Division level. Section offices, sub division offices and Division offices have access rights for data entry by using Division login ID. Dams are mapped in application as per their Jurisdiction. Administrative hierarchy of WRD from IDC level to Division level is mapped in application. PRAVAH application have different reports and dashboards in it. From data captured in application different kind of analysis can be done.

Application is also integrated with Real Time Data Acquisition System(RTDAS) in Krishna and Bhima basin, sensors installed at Major dams under RTDAS system captures lake levels at different intervals and shares that data to PRAVAH application also. The content tables of dams are incorporated in application, Application calculate Dam Storage based on lake level entered in application, and captured it in Daily storage report.

As on date 2997 dams(138 Major, 260 Medium and 2599 Minor)are included in PRAVAH application. Application has facility to add or delete dams in it. Daily storage report generated through PRAVAH consist of summary of Revenue region wise Major, Medium, Minor and state total storage details. It, also, gives Revenue region wise and Districts wise storage details of all major dams. Daily Storage report is available in English as well as Marathi language. it is published Daily on WRD Website.

7.0 Revenue Mandal and Fodder requirement during Drought Management:

1) The Godawari Study Group-II has collected information regarding revenue circle / taluka / district of command area of Mula, Pravara, Gangapur, Palkhed, Darna and Shivana Complexes situated in the upstream of Jayakwadi Project and Jayakwadi Project

comprising of Jayakwadi Left Bank Canal and Right Bank Canal etc. in the Upper Godavari sub-basin.

2) This revenue circle wise data of projects command area is proposed to be considered while release of water from upstream projects. A complex having drought situation will be studied separately again in order to meet the drinking water demand for concern population and livestock in that complex.

3) Also, this revenue circle wise information is key element which will decide whether additional water for drought management is to be released from upper reservoir to Jayakwadi project or not? based on the overall drought area of all the circles taken together and considering the overall drought situation in Upper Godavari Basin.

7.1 Fodder requirement in drought management.:

Most of the people in villages depend on Animal Husbandry for milk and milk products. During drought situation, there is a direct impact on Livestock which in turn affects animals health, their reproductive power and milk production etc. Thus, it is a responsibility of administration to provide domestic water and fodder requirements for these livestock.

The various circulars of Commissionerate of Animal Husbandry were referred to calculate the requirements of fodder of livestock. As per these circulars, fodder requirements of 18 kg per day and 5kg per day is considered for big and small animals respectively. Based on this, further requirements of area to be irrigated is worked for producing this quantity of fodder in command area and in turn the water requirements to produce this quality of fodder requirement in drought situation.

With the help of this information, if there is drought situation in upstream and downstream area Jayakwadi project, the drought area of the revenue circle will be considered for that area, the water required for fodder to the livestock such as cows, buffalos, poultry Farm etc.) is to be calculated on the basis no. of livestock per Sq.km. and their fodder requirement and then water required to produce this fodder requirements during drought situation so that sufficient fodder is available for livestock.

Aaccordingly, GSG II has calculated water required per Sq.km to produce fodder for the districts in the command of Upper Godavari Sub-basin. The details of further requirements for livestock is given in Annexure.

7.2 Water requirement for contingent reservation :

The complex / groupwise average of contingent reservation for all dam Complex / group in the upper area of Jayakwadi and Jayakwadi project for year 2015, 2018 and 2023 has been calculated for software purpose, MRSAC, Nagpur for the inclusion in water release calculation as per strategy. This water required for contingent reservation is to be kept as reserve in the complex / group or Dam before release of water as per strategy. Since the meeting for contingent reservation under the Chairmanship of Hon. Guardian Minister is normally held after 30th October i.e. after the decision of release of water from upstream reservoir complex to Jayakwadi Project, this will ensure that water required for contingent reservation is kept in reservoir as token for drought prone area.

The water needs for fodder crop and contingent reservation (average token provision) for this area (upstream of Jayakwadi) should be adjusted from the total water Source from upper part of Jayakwadi and adjusted to the command area requirement of Jayakwadi.

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CHAPTER- 6

DISCUSSION AND CONCLUSIONS

1.0 Upper Godavari (upto Jayakwadi dam) sub-basin:

The catchment area of Godavari river up to Jayakwadi dam is designated as Upper Godavari (up to Jayakwadi dam) sub-basin. Total geographical area of this sub-basin is 21,774 Sqkm. Mula, Pravara, Kadwa, Darna, Kadava, Dodni, Shivna are main tributaries in this sub-basin upstream of Jayakwadi dam.

The Upper Godavari Sub-basin includes the entire catchment of the Godavari river from its source to Jayakwadi dam including the catchment areas of the Pravara river, Mula river and that of all other tributaries which falls into the Godavari river in this reach. The Jayakwadi dam is located exactly at the border of the sub-basin. Large number of major, medium, minor irrigation projects, K T weirs, local sector schemes are constructed in this sub-basin. The prominent reservoir systems/complex are namely, Mula complex, Pravara complex, Godavari – Darna complex, Gangapur complex, Palkhed complex, Shivna Comlex Remaining up to Jayakwadi dam and Jayakwadi dam. The Satellite imagery of sub-basin is shown in Fig-1.

The system wise (complex) details such as name of major & medium projects, number of M I projects & KT weirs, their storage capacities, irrigation water use, non-irrigation demands, observed yields at various location sect., are presented in Annexure – 1 to 7. The complex wise water planning aspects are described as under:

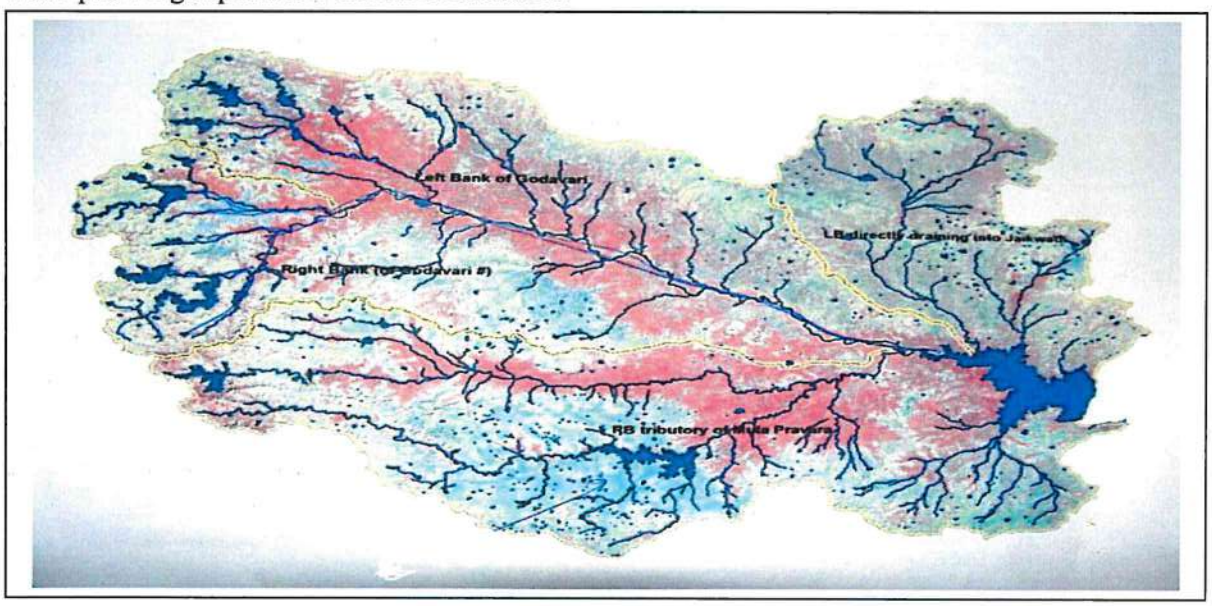


Fig:1 Satellite Imagery of Upper Godavari Sub Basin

2.1 Mula complex:

This complex consists of Mula major project and Mandhol medium project.

Mula Dam: Mula dam is located at Baregaon Nandur, Tal.Rahuri of Ahmednagar district. The dam is constructed across Mula River. Mula Dam is completed in 1971.This project is planned for 70% dependable yield. In planning, the carry over storage of 28.32 MCum is provided.

Mula Dam

The irrigable command area (ICA) is 82920ha.which comprises of:

a)	Mula Right Bank Canal	:	69534ha.
b)	Mula Left Bank Canal	:	10121ha.
c)	Wambori Pipe Chari	:	3015ha.
d)	Bhagda Pipe Chari		250ha.
	Total	:	82920ha.

In the scheme "c & d", water is lifted from reservoir and delivered in percolation tanks and K.T. Weirs through Wambhori and Bhagda Pipe Chari. The cropping pattern of this project is eight monthly having 44% Kharif and 57% Rabi. The design water use from this project is 704.61 MCum. The sanctioned non-irrigation uses are as under:

The provision for non-irrigation use in the project planning is 59.12 MCum.

Sr. No	Particular	GSG-I (2013) Sanctioned scheme	GSG-II (2024) Active scheme	% increase / decrease
a	Domestic use	95.27 MCum	86.07 Mcum	(-)9.65
b	Industrial use	15.09 MCum	7.29 MCum	(-)51.68
	Total	110.36 MCum	93.36 MCum	(-) 15.40

Percentage decrease mainly is due to ,

1) In the year 2013 total sanctioned schemes were considered whereas in 2024 only Active schemes are considered.

2) Reduction in sanctioned Quota of Mula Sugar Factory, Rahuri & Dnyaneshwar Sugar factory, Bhenda Tal – Newasa.

Mandhol dam :Mandhol medium irrigation project is located near village Karjule Hariya,Taluka Parner of Ahmednagar district, across Mandhol nalla , a right bank tributary of Mula river. The live storage is 8.78 MCum. The cropping pattern of the project is 8 monthly. The design water use is 13.15 MCum.

Besides these projects, there are large number of state and local sector minor irrigation schemes and K.T. weirs located in this complex. The live storage capacities and design water utilizations of these projects are given in Statement-5.

The sanctioned non- irrigation uses are as under:

The provision for non-irrigation use in the project planning is 0.00 MCum.

S.N.	Particular	GSG-I (2013) Sanctioned scheme	GSG-II (2024) Active scheme	% increase/decrease
1	Domestic use	1.23 MCum	1.23MCum	0.00
2	Industrial use	0.00 MCum	0.00 MCum	0.00
	Total	1.23 MCum	1.23 MCum	0.00

2.2 Pravara complex :

This complex consists of two major dams, namely Bhandardara, Nilwande and two medium projects namely Adhala and Bhojapur.

Bhandardara dam:

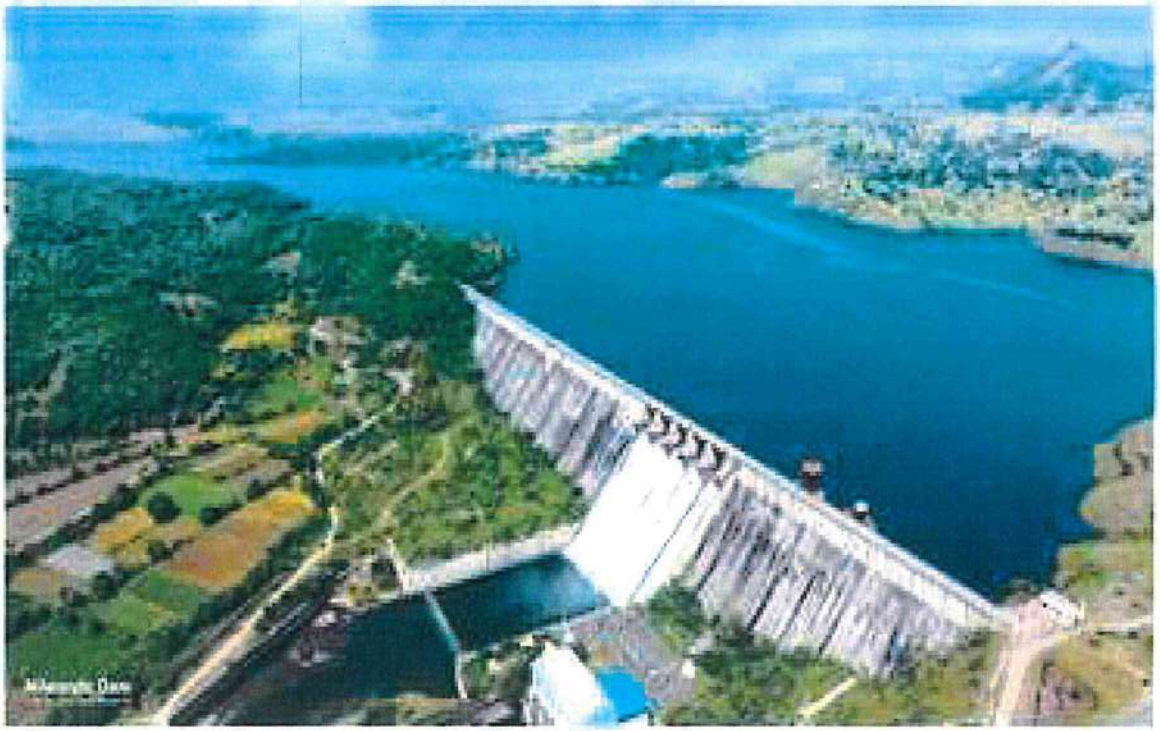
This dam is completed in 1926 on Pravara River. This project is planned for 75% dependable yield. The water is let out from Bhandardara dam
through river to Ozar pickup weir. Ozar pickup weir is constructed in the year 1872.There are two main canals both take off from the pick- up weir namely Pravara Right Bank Canal and Pravara Left Bank Canal.

The annual design water use from Bhandardara Project is 434.67 MCum. The sanctioned non-irrigation uses areas under:

S.N	Particular	GSG-I (2013) Sanctioned scheme	GSG-II (2024) Active scheme	% increase/decrease
1	Domestic use	43.33 MCum	45.19MCum	(+)4.11
2	Industrial use	23.42 MCum	23.12MCum	(-)1.28
	Total	66.75 MCum	68.31 MCum	(+) 2.34

There is no provision for non-irrigation use in project planning of Bhandardara dam.

Nilwande dam



Nilwande dam is situated on Pravara River 20 Km downstream of Bhandardara dam and Upstream of Ozar pick up weir. This dam is located near Village Nilwande of Ahmednagar District. There are two canals having length of 85 Km and 97Km having total irrigable Command area of 64260 Ha. The project is planned for 50% dependable yield. The design water use from the project is 326.06 MCum. The project planning provides for non-irrigation(Domestic) use of 13.15 MCum.

S.N	Particular	GSG-I (2013) Sanctioned scheme	GSG-II (2024) Active scheme	% increase/decrease
1	Domestic use	13.15 MCum	13.15MCum	0.00
2	Industrial use	0.00 MCum	0.00 MCum	0.00
	Total	13.15 MCum	13.15 MCum	0.00

Adhala dam: Adhala is a medium project constructed across river Adhala, tributary of river Pravara, near village Deothan in Akola Taluka of Ahmednagar district. The project was administratively approved in1966.This project is having its independent command area. The annual design water use of the project is 38.73 MCum. The project planning provides for non-irrigation Domestic) use of 0.00 MCum.

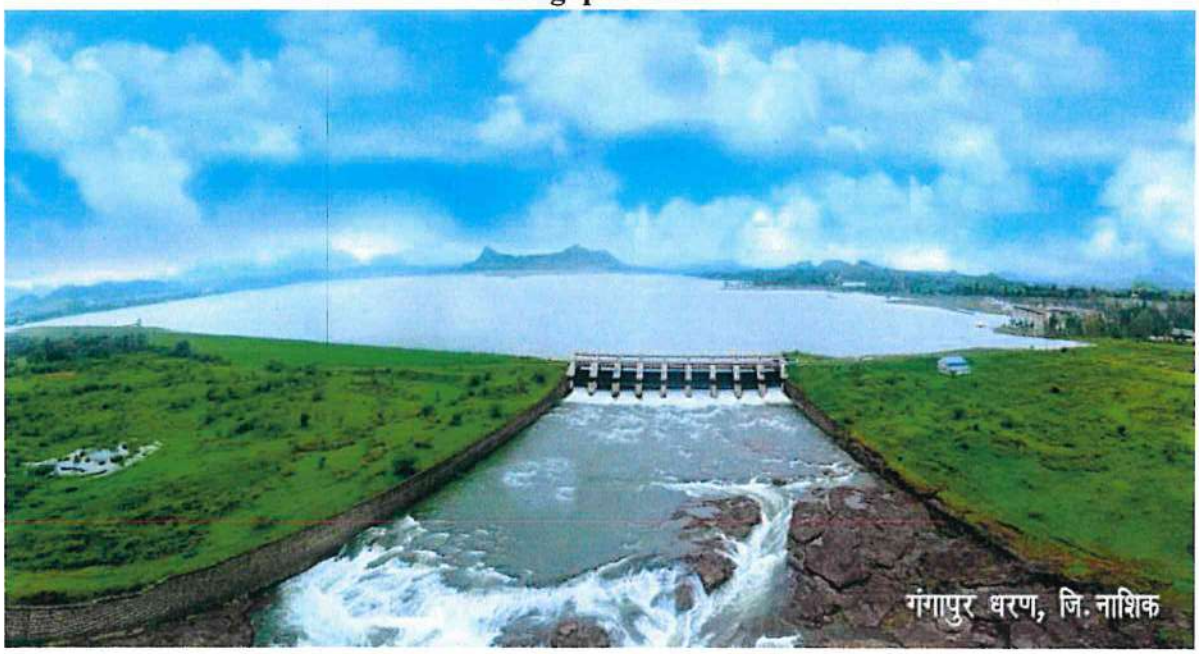
S.N	Particular	GSG-I (2013) Sanctioned scheme	GSG-II (2024) Active scheme	% increase/decrease
1	Domestic use	3.32 MCum	1.82MCum	(-) 45.18
2	Industrial use	0.00 MCum	0.00 MCum	0.00
	Total	3.32 MCum	1.82 MCum	(-) 45.18

Bhojapur dam: Bhojapur is a medium project constructed in 1972-73 on Mahalungi river, tributary of Pravara River near village Sonewadi, Taluka Sinner of Nashik district. The project is planned for 50% dependable yield. The design water utilization is 20.30MCum.Besides these projects, there are large number of state and local sector minor irrigation schemes and K.T. weirs located in this complex. The live storage capacities and design water utilizations of these projects are given in Statement-5.The project planning provides for non-irrigation(Domestic) use of 2.57 MCum.

S.N	Particular	GSG-I (2013) Sanctioned scheme	GSG-II (2024) Active scheme	% increase/decrease
1	Domestic use	2.57 MCum	3.04MCum	(+) 18.28
2	Industrial use	0.00 MCum	0.00 MCum	0.00
	Total	2.57 MCum	3.04 MCum	(+) 18.28

2.3 Gangapur complex: This complex consists of Gangapur major dam and two medium dams, **namely** (i) Kashyapi (ii) Gautami Godavari

Gangapur dam



Gangapur dam: A project for constructing dam across river Godavari near village Gangapur, Taluka and District Nashik was sanctioned by Government of Bombay in1949.The project comprises:

1) Construction of dam on Godavari River to store155.75 MCum (5.5TMC) of water.
2) Construction of Left bank canal to utilize about 104.78 MCum (3.7TMC) of water.
3) Remodeling of existing Godavari canals to utilize 50.97MCum (1.8TMC of water.

In the second stage, the storage was increased from 155.75 MCum (5.5TMC) to 203.8MCum (7.2TMC) by constructing spillway gates and raising height of dam. The carryover storage of

11.64 MCum. is provided. Additional storage is to be utilized by Nashik Left Bank Canal and newly Nashik Right bank Canal.

Kashyapi dam: Non-irrigation use at the time of planning of Gangapur Project was only 2.83 MCum in original project report. Presently, the non-irrigation use is increased to 217 MCum annually. So, to augment Gangapur storage, the Kashyapi dam having live storage capacity of 51.75 MCum, was built to stabilize irrigation requirement. This project was administratively approved by Government in 1985. This dam is constructed across river Kashyapi, a left bank tributary of Godavari, near village Dhandegaon in Taluka Nashik of Nashik district. The annual design water utilization is 55.31MCum.There is no separate canal system for this project. The project is completed in the year 2006.

Gautami Godavari dam: The purpose of construction of this dam is also to augment Gangapur storage as non-irrigation requirement through Gangapur dam is increased from 2.83MCum to 217 MCum. The Gautami-Godavari dam, having live storage capacity of 52.93 MCum was built in the year 2010 to stabilize the irrigation and non-irrigation requirements of Gangapur dam. The dam is constructed on Godavari river near village Andharwadi which is a part of village Beze, Taluka-Trimbakeshwar of Nashik district. The design water utilization is proposed for Gangapur system. There is no separate canal system for this project.

Gangapur complex, the design water uses from above four dams (Gangapur, Kashyapi, Gautami) is 265.80MCum. The sanctioned non-irrigation uses from the Gangapur complex are as under:

Now as Kikwi Project is not constructed yet, it is excluded from Gangapur Complex. Then total Design use is now 265.80 MCum.

S.N	Particular	GSG-I (2013) Sanctioned scheme	GSG-II (2024) Active scheme	% increase/decrease
a	Domestic use	131.21MCum	157.58MCum	(+)20.09
b	Industrial use	55.56 MCum	59.42 MCum	(+) 6.95
	Total	186.77 MCum	217.00 MCum	(+)16.18

Due to Increase in the demands of Domestic & Industrial use ,there is 16.18 % increase as compared to 2013.

The provision for non-irrigation uses in the project planning is 36.81 MCum.

Besides these projects, there are large number of state and local sector minor irrigation schemes and K T weirs located in this complex. The live storage capacities and design water utilizations of these projects are given in Statement-5.

2.4 Godavari-Darna complex:

Initially, a weir with existing canal system had been constructed just at confluence of river Godavari and Kadava, upstream of village Nandur Madhameshwar, Taluka Niphad of Nashik district. In the year 1907 to 1916, Canal system known as "Godavari canals" is functioning since then. The system is fed by storage constructed on river Darna, a right bank tributary of Godavari about76 Km upstream of Nandur Madhameshwar (N.M weir) weir.

Darna Dam

The Darna dam having live storage of 219.82 MCum was constructed during the year 1907 to 1916.The canal system is also partly supplemented by Gangapur storage to the extent of34.27 MCum and Waldevi medium project to the extent of 16.14 MCum. To utilize the additional quantum of water available up to N.M. weir, it was necessary to have additional live storage capacities. Four storages are planned on rive Darna and its tributaries upstream of N.M. Weir. They are:

1)Bham dam across river Bham, a right bank tributary of Darna near village Kaluste,

2) Bhavali dam across river Darna, just down stream of village Bhavali,
3) Waki dam across river Waki, downstream of village Kurnoli,
4) Mukane dam across Aundha Nalla near village Mukane.

All these four dams are situated in Igatpuri Taluka of Nashik district. The water stored in these four storages along with the existing Darna reservoir, partly supplementing from existing Gangapur storage and the runoff from the rivers from uninterested catchment, will be utilized for the irrigation of existing Godavari RBC and LBC as well as a newly constructed LBC off-taking from N.M. Weir, known as Nandur Madhameshwar express canal. Out of above four new storages, only the Bhavali storage is having independent irrigation of about 1053 Ha. The design water utilizations including newly constructed N. M. express canal of this complex are as under:

S.N.	Name of Dam	2013 water use	2024 water use
a	Bham dam	8.78 MCum	10.18 MCum
b	Bhavali dam	18.64MCum	17.06 MCum
c	Waki dam	12.85 MCum	18.16 MCum
d	Darna dam	47.89MCum	56.91 MCum
e	Mukane dam	102.46MCum	105.00 MCum
f	Godavari canals	442.24MCum	362.45MCum
g	N. M. Express Canal	445.05MCum	317.37 MCum
	Total	1077.91MCum	887.139 MCum

Besides above storages/dams, there are three more dams in the catchment upstream of N M Weir, namely Kadwa project, Alandi project and Waldevi project. They are having independent canal system. Waldevi project is having its own canal system and supplementing the water of 16.14 MCum to Godavari canals.

Kadwa dam: A major irrigation project having storage on Kadwa river, a right bank tributary of Darna River near village Pimpalgaon Dukra, Taluka-Igatpuri of Nashik district with a direct Right bank canal to irrigate 10320 Ha. of land from Igatpuri, Nashik, Sinner, and Niphad Taluka. Live storage capacity is 52.90MCum.The dam is completed in the year 1991-92.The design water use of the project is 80.70 MCum. There is a planning to construct a new dam, called Upper Kadwa, located upstream of the existing Kadwa dam, having design live storage of13.69 MCum. However, the works are not yet started.

Waldevi dam: Waldevi is a medium river project constructed across river Waldevi near village Pimplad, Taluka and District Nashik. It is an irrigation cum water supply project to irrigate an area of 1481, Ha. and to supplement water of 16.14 MCum to Godavari canals and some domestic water supply to MIDC Nashik. Live storage capacity is 32.06 MCum. The dam is completed in 2003-2004.

Alandi dam: Alandi project is constructed across Alandi river, a left bank tributary of Godavari River near village Sakotiwadi (Davi) in Dindori Taluka of Nashik district. This is a medium irrigation project to irrigate 6296 Ha. of land in Nashik district. Live storage capacity is 27.47 MCum. The project is administratively approved by Government in 1974.The project is completed in1982.The annual design water utilization is 40.67 MCum.

In Godavari-Darna complex, the design water use1034.26.The sanctioned non-irrigation uses from this complex are as under:

S .N.	Particulars	GSG-I (2013) Sanctioned scheme	GSG-II (2024) Active scheme	% increase / decrease
1	Domestic use	92.10MCum	203.58 MCum	(+)121.30
2	Industrial use	21.96MCum	23.24 MCum	(+) 5.83
	Total	114.06 MCum	226.82 MCum	(+)98.86

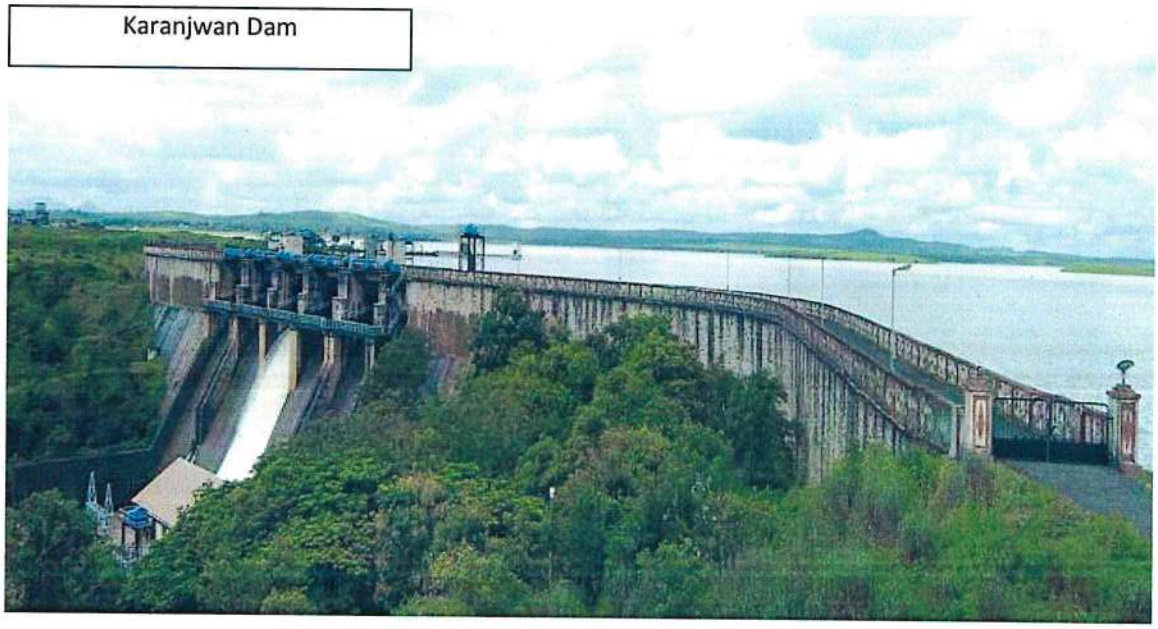
The provision for non-irrigation uses in the project planning is 72.76 MCum, besides these projects, there are large number of state and Local sector minor irrigation schemes and K.T. weirs located in this complex. The live storage capacities and design water utilizations of these projects are given in Statement-5.

2.5 Palkhed complex:

Palkhed complex comprises of six dams namely Karanjwan on Kadava river, 2) Palkhed on Kadava river, 3) Waghad on Kolwan river,4)Punegaon and Ozarkhed on Unanda river, 5) Tisgaon on Parashari river. Kadava river is a major tributary of river Godavari and Kolwan, Unanda and Parashari are the tributaries of Kadava river of which Kolwan and Unanda meets river Kaadava U/s of Palkhed dam. Parashari river meets river Kaadava on the D/s of Palkhed dam. All the 6 dams are located in the Dindori Taluka of Nashik district and their command area is spread in Dindori, Niphad, Yeola, Chandwad, Kopargaon and Vaijapur Taluka. Out of 6 dams, Waghad,

Karanjwan and Palkhed are designed at 75% dependable yield. The project was originally administratively approved in the year 1966. In original project report, Tisgaon and Punegaon were not part of Upper Godavari project. They were added in the 1st revised administrative approval report.

Karanjwan Dam



As per planning, the water for Palkhed canals is taken from Palkhed dam .Karanjawan & Waghad Dams (apart from their respective use) feed water to Palkhed dam for utilization through Palkhed Right & Left Bank Canals. Ozarkhed canal uses water from Ozarkhed dam & Tisgaon dam through Tisgaon R.B.C. (feeder canal).Tisgaon is a feeder dam to Ozarkhed Left Bank Canal through its 420-meter long Tisgaon Right Bank canal (13th Km of O.L.B.C.). The design water utilization from this complex is 468.41 MCum.

The sanctioned non-irrigation uses from this complex area as under:

S.N	Particular	GSG-I (2013) Sanctioned scheme	GSG-II (2024) Active scheme	% increase/decrease
a	Domestic use	27.92MCum	55.37 MCum	(+)98.31
b	Industrial use	6.30 MCum	9.95 MCum	(+) 57.93
	Total	34.22MCum	65.32 MCum	(+) 90.88

The provision for non-irrigation uses in the project planning is 20.65 MCum

Besides these projects, there are large number of state and local sector minor irrigation schemes

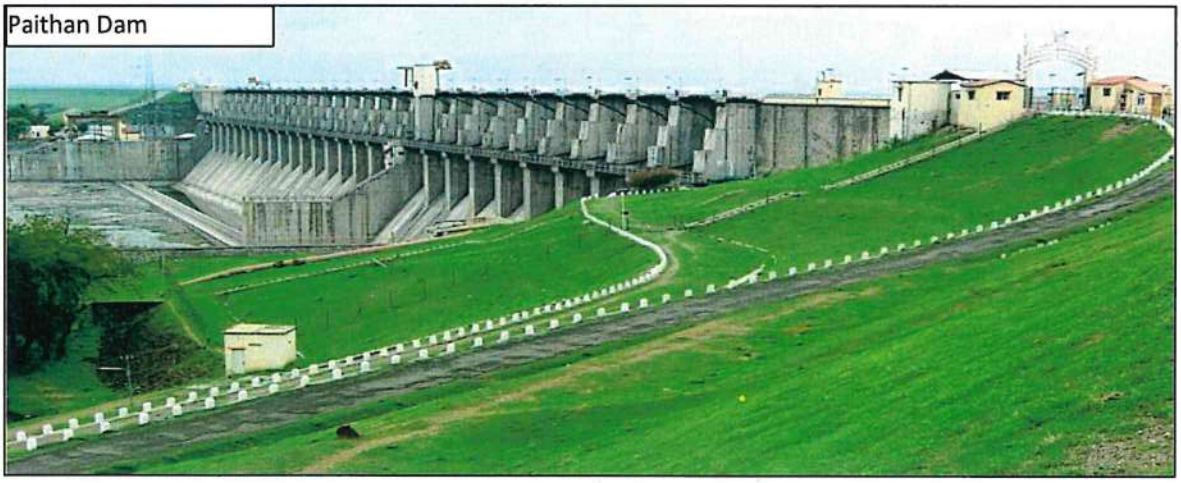
and K.T. weirs located in this complex. The live storage capacities and design water utilizations of these projects are given in Statement-5

2.6 Remaining up to Jayakwadi dam:

The water utilizations of Projects/Schemes located down stream of Mula dam, Zār weir, N.M.weir, and up stream of Jayakwadi dam are considered in this complex. There are 7 Medium irrigation projects located in Marathwada region ;namely Tembhapuri, Dheku, Kolhi, Narangi, Bor-Dahegaon, Ambadi and Shivana Takli. Besides these projects, there are large number of state and local sector minor irrigation schemes and K.T. weirs located in this complex. The live storage capacities and design water utilizations of these projects are given in Statement-5. The Bramhangavan lift irrigation scheme – II is also planned on backwater of Jayakwadi reservoir as against the old defunct lift irrigation schemes. The water utilization of this scheme is 85.00 MCum. The administrative approval is given by Godavari Marathwada Irrigation Development Corporation, Chh. Sambhaji Nagar in the year 2009.The water utilizations of all these schemes are given below:

1. Seven Medium Projects (Shivna Complex)	124.99 MCum
2. Minor Projects (State) (45Nos.)	108.46 MCum
3. Minor Projects (local sector) (93Nos.)	28.25 MCum
Total	261.70 Mcum

2.7 Jayakwadi dam (Jayakwadi):



Jayakwadi dam is located on Godavari River at upstream of Jayakwadi town, Dist. Chh. Sambhaji Nagar. This dam is a part of Jayakwadi Project Stage – I. The reservoir created

behind the dam is named as "Nathsagar" which has submerged 35000 Ha .of land covering 118 villages. These villages have been shifted and rehabilitated at safe places. This has affected the population of 77000 souls. The design water utilization from this dam is 2618.59MCum.The details of Jayakwadi Project are described in para 3.0 below.
Government of Maharashtra, Water Resources Department vide Memorandum No.IPM/ 1574/ 49521/IM-1(1371)dated 21.6.1978, had allocated water from backwater of Jayakwadi reservoir to the extent of 144.42 MCum (5.10 TMC) for the Tajanapur (Shevgaon) and Bramhangavan lift irrigation schemes benefitting the project affected/resettled persons.

The sanctioned active non-irrigation uses from the reservoir are as under :

S.N	Particular	GSG-I (2013) Sanctioned scheme	GSG-II (2024) Active scheme	% increase/decrease
1	Domestic use	283.27 MCum	401.90 MCum	(+)41.88
2	Industrial use	160.74 MCum	117.27MCum	(-)27.04
	Total	444.01MCum	519.17 MCum	(+)16.93

There is no provision for non-irrigation use in the original project planning of Jayakwadi dam. As per revised water planning the provision is 194.10 MCum

2.8 M.I. Schemes (Local Sector):

There are large number of Minor irrigation projects and K.T.weirs planned and constructed by Local Sector Department in this sub-basin. Government has also given the priority for water conservationist present study, the schemes having annual water utilization more than 0.15 MCum (5 Mcft) have been only considered in the respective complex.

3.0 Jayakwadi Project:

Jayakwadi Project on the Godavari River with a catchment area of about 21,774 SqKm. is a multipurpose project of Maharashtra State for irrigating net irrigable area to the tune of 2,77,207 Ha. in Chh. Sambhaji Nagar, Beed, Parbhani & Nanded Districts of Marathwada Region. The Jayakwadi Project Stage-1 was originally administratively approved by Government of Maharashtra vide Resolution No.PIM 3164/103171-IP (Cell), Bombay, dated 13.01.1965.The Project was cleared by Planning Commission, Govt. of India vide letter No.III-2(23)/64 –I & P

dated 03.02.1965. This Project was completed in the year1976.

3.1 The Jayakwadi Project Stage-I :

Jayakwadi Reservoir on the Godavari River above Jayakwadi town with the gross storage capacity 2909.04 MCum (102.73TMC) & live storage capacity 2170.935 MCum (76.66 TMC).

Jayakwadi Left Bank Canal starting from the Jayakwadi Dam 208 Km. in length to cover the gross command and net irrigable area of 204050 Ha. & 141640 Ha. respectively.

Planning Commission, Govt. of India in letter dated 03.02.1965 suggested that the Jayakwadi dam with its Left Bank Canal only be taken up as Jayakwadi Project Stage-I and the remaining components of the project be covered by a separate report as Jayakwadi Project Stage-II.Accordingly, Jayakwadi Project Stage –II originally administratively approved by Govt. of Maharashtra vide Resolution No.PIM 4973/43043 – IPI, Sachiwalaya, Mumbai dated 25.05.1974. The Stage-II was cleared by Planning Commission, Govt. of India vide letter No. II-15 (1)(14)/76-I&CADdated 02.06.1976.

3.2 Jayakwadi Project Stage-II :

a) Majalgaon Reservoir on the Sindaphana river, a tributary of the Godavari River near Majalgaon town with the gross and live storage capacities of 444.65 MCum (15.70TMC) & 311.30 MCum (10.99TMC) respectively and Majalgaon Right Bank Canal 165 Km. long with gross command and net irrigable area of 131520 Ha. &93885 Ha. respectively.

b) Jayakwadi Right Bank Canal starting from the Jayakwadi dam 132 Km. in length to cover the gross command and net irrigable area of 59892 Ha. & 41682 Ha.respectively.

The original project report of Jayakwadi was prepared in the year 1964.The project has been planned for 75% dependable virgin yield. Jayakwadi catchment was almost virgin (with the existence of Gangapur, Bhandardara & Darna dams only). As per revised project report 1985, 75% dependable annual virgin yield was estimated 5566 MCum (196.56TMC) up to Jayakwadi dam in which the upstream utilization was 3270 MCum (115.50 TMC) and 2564.71 MCum (90.57TMC) for Jayakwadi including regeneration of 245.25 MCum (8.66 TMC) from upstream utilizations.

The water utilizations from Jayakwadi dam are planned as under:

Sr. No.	Name of scheme	As Per original project water utilization in Mm3. (1985)	As Per revised water planning water utilization in Mm3. (2018)
1	Jayakwadi Left Bank Canal	1075.54	978.55
2	Jayakwadi Right Bank Canal	318.22	255.73
3	Jayakwadi Dam Evaporation	664.83	323.10
4	Diversion to Majalgaon Dam	560	299.42
5	Domestic Water Use	0.00	117.956
6	Industrial Water Use	0.00	76.145
7	Lift Irrigation Schemes on Backwater of Jayakwadi Dam		
	1 .Brahmgvhan Lift Irrigation Scheme-I (3205 ha)	0.00	27.527
	2 .Brahmgvhan Lift Irrigation Scheme-II (15312 ha)	0.00	90.07
	3. Tajnapur Lift Irrigation Scheme-I (2744 ha)	0.00	. 45.622
	4. Tajnapur Lift Irrigation Scheme-II (6960 ha)	0.00	61.41
	5. .Brahmgvhan Lift Irrigation Scheme-III (10000 ha)	0.00	55.00
	6. Common & Individual Lift		
	a) Ramkrishna Godavari Lift Irrigation Scheme (4400 Ha.)	0.00	25.87
	b) Shri Datta co-uplift Irrigation Scheme.(405 Ha)	0.00	2.38
	c)Sanjivanee Lift Irrigation Scheme (47Ha)	0.00	0.28
	d) Individual Lift Irrigation Scheme	0.00	259.15
	Total	2618.59	2618..21

There is no provision for non-irrigation use in the project planning of Jayakwadi dam. The storage (Live) planning of Jayakwadi dam is done considering utilizations through canals with only 20% Kharif requirement, fair weather lake losses, 560MCum diversion to Majalgaon dam in bad years of Majalgaon is changed to 299.42 MCum. and carry over provision of 381.70 MCum. The Post Monsoon flow (151.77MCum) and regeneration at 7.5% of upstream extractions (243.52 MCum) is accounted while deciding the storage. The design live storage is 2170.935 MCum (76.66 TMC).

3.3 Live Storage Calculations for Jayakwadi Dam:

Sr. No.		Particulars	As per the original A.A. Live storage capacity	As per actual observation in last 20 years
I		Fair Weather utilization	MCum	MCum
	A	Jayakwadi Canals	1124.27	1451.69
	B	Fair weather lake losses	440.78	255.25
	C	20% Kharif requirement	53.88	69.97
	D	Carry over provision As per TAC note 1976	381.70	267.00
		Sub Total	2000.63	2043.91
II		Less		
	A	Post Monsoon Flow	151.77	48.10
	B	Regeneration @ 7.5% of u/s extractions	243.52	0
		Net Requirement	1605.34	1995.81
		Add for Maximum diversion to Majalgaon in bad years	560	227.17
		Live Storage required	2165.34	2223
		Live Storage Provided	2171.00	2171

As per the data submitted by S.E. CADA, Chh. Sambhajinagar, it is seen that observed post monsoon flow is 48.10 MCum and observed regeneration flow is 0.0 MCum. as compared to 151.77 MCum and 243.52 MCum respectively, this shows over estimation of water availability at planning stage. Hence, the water requirement of live storage of Jayakwadi project doesn't fulfill the requirements as per original administrative approval (1965). Hence, the provision of post monsoon flow, regeneration and carry over of 381 MCum needs to be verified & necessary corrective steps shall be taken to review the Jayakwadi Project live storage planning.

4.0 Discussion of Terms of References

The first and main Terms of Reference for Godavari Study Group - II is "To formulate guidelines for integrated operation of reservoirs during filling period in Upper Godavari (up to Jayakwadi dam) sub-basins that likely water scarcity situation in Jayakwadi dam may not be attained." In the Water Availability Studies of year 2004, Central Designs Organizations, Nashik has estimated the 75% dependable annual virgin yield of 4451.50 MCum (157.20 TMC) at Jayakwadi damsite as per the data supplied by GMIDC indicates that the large number of major, medium, and minor irrigation projects are planned and completed in this sub basin(Statement-5) In the Mendhegiri Committee Report the the design water use of these project is about 7174.72 (253.37TMC). and now The Design Water Use of these project is about 6618.76 MCum(233.71TMC).This design water use is from projects having planned at varying depend abilities ranging from 50% to 75% including local sector schemes more than 5 Mcft water use. This change is mainly due to the projects such as Kikvi, Upper Kadava which is not yet started hence their water use is not consider also change in Godavari canal & Nandur Madhameshwar Express canal water use.

The sanctioned an active non-irrigation uses in this sub basin are as under:

S.N.	Particular	GSG-I (2013) Sanctioned scheme	GSG-II (2024) Active scheme	% increase/decrease
a	Domestic use	693.09 MCum	987.95 MCum	(+) 42.54
b	Industrial use	283.07 MCum	240.28 MCum	(-) 15.07
	Total	976.16 MCum	1228.35 MCum	(+) 25.83

The provision for total non-irrigation use in the project planning of dams in this subbasin is 420.09 MCum only. The comparison of NI Provision in project planning showed that the difference in NI Provision is due to Jaykwadi (194.11MCum), Bhojapur (2.57MCum) and

completion of projects Waki (9.12MCum), Waldevi (12.18 MCum) that is (+ 217.98 MCum).

4.1 : Water availability Studies :

The objective of this study is to make water balance scenario considering the different probabilities of inflows and various demands to a maximum possible extent, adopting sub basin as the unit. The concept of operation of reservoir considering it as a single entity has to be given way to the concept of integrated operation of reservoirs to achieve approximate equal distribution of water at subbasin level and to benefit be sout of the system or systems of reservoirs (complex).

4.1.1 Jayakwadi project hydrological and water use status of upstream :

The Jayakwadi project is the terminal major reservoir in the Upper Godavari sub-basin. The catchment area upstream of the project is referred as Upper Godavari Sub-basin as mentioned in Bachhavat Commission. According to the tribunal directives, all the water up to the Jayakwadi project is permissible for use by the state of Maharashtra. The Upper Godavari sub-basin covers considerable part of Nashik and Nagar districts and a large part of Chatrapati Sambhajinagar district.

Original administrative approval for Jayakwadi project is granted on 13.01.1965. The project was completed in 1976. The project consists of two stages viz. Jayakwadi Phase-1 and Phase-2 is inclusive of Majalgaon Project.

The original project was submitted to the Central Water Commission wherein the Commission raised remarks about the yield study. Central Water Commission also commented that the yield is overestimated.

Later on various studies were conducted by the State Government.

The Water Planning Division of the Central Designs Organization (Currently under the Chief Engineer, Hydrology Project, Nashik) has done various studies in this regard and opinioned on previous studies. These studies were conducted in the years 1964, 1985, 1994, 2001 and 2004. The Godavari Study Group (Mendhegiri Committee) has given brief comments in its report regarding the above cited studies.

The Study Group-II has refered following documents.

1. Hydrology Chapter of Jayakwadi Project's Original administrative approval.
2. Yield table as per original planning (1914-1962)
3. Yield table as per actual available yield (1976-2024)

4. Actual water utilization of Projects in upper reach (1980-2017)
5. Other documents related to Hydrological study of Jayakwadi Projects.

Based on above Documents following observations are made by the Study Group-II.

First filling of Jayakwadi project is done in 1976 and it has now completed 48 years. These 48 years are sufficient for hydrological studies. A comparison of the available actual Tank Gauge Data and River Gauging with the original project planning data can help in fact findings.

A hydrological study is based on statistical estimation if actual records are unavailable however the same study is considered as a realistic when actual record is available. The Godavari Study Group did not comment adequately on this type of study.

The original project consists some actual records and some assumptions about yields for the period 1914 to 1962. The yield for Jayakwadi Project is based on records from four zones / terminals.

A	Yield available from spillover of Nandur madhyameshwar weir. (covers the Gangapur, Palkhed & Darna System)
B	Yield available from spillover of Ozar weir (Covers the Pravara System)
C	Yield available from spillover of Baragaon Nandur (Mula Dam) (Covers the Mula System)
D	Yield available from spillover free catchment excluding A, B & C

The yield for Jayakwadi project has been calculated by deducting the planned final water use upto above cited locations which is net yield through the locations and the flow available through Regeneration / Post Monsoon Flow. The estimations are carried out on an average basis.

As per points A, B, C and D above, the average percentage of yield available as per project planning is as follows.

(Table - 1)

A	31.55 TMC	24.27 %
B	10.41 TMC	7.12 %
C	6.32 TMC	3.47 %
D	64.14 TMC	59.55 %

In view of above planning, now as per the actual records available for 47 years (1976 - 2024) a table is prepared and accordingly the average figures are shown in it.

(Table - 2)

A	48.89 TMC
B	7.90 TMC
C	7.40 TMC
D	N. A

When data of table 1 and 2 is compared it is seen that, there is no considerable difference between the water actually available from the locations A, B and C. Apparently, the same or more water is available from the cited locations for the Jayakwadi project than anticipated in Table 1.

There is no adequate data available regarding free catchment (D) hence according to data available about the actual inflow from Jayakwadi project the value in the table is indicated by reverse calculation however the data is insufficient. Therefore, the percentage of yield is not shown in Table 2.

The figures are based on averages as the original project report has calculated the figures based on averages. Even if it is calculated on the basis of hydrological studies (dependability criteria), it seems that there will not be a considerable variation.

In Jayakwadi project the Ghat matha (Sahyadri Hill region) catchment which is represented by A, B and C and free catchment which is represented by D, The quantum of D is almost twice that of A, B, C. (D-70%) as area wise.

Estimation of original yield for Jayakwadi Project is on the basis of "Stranges Table". This estimation is based on Empirical Formula. According to "Stranges Table", the category of catchment area is considered as "Good", which resulted overestimation of yield from free catchment area.

The amount of yield available from the upper reaches has not changed but due to non-availability of the expected yield from the free catchment, it is seen that the anticipated yield is not available in the Jayakwadi project.

The initial hydrological studies tend to show availability of yield on higher side in the project, however after availability of Tank Gauge on the basis of which objective studies were conducted lesser yield availability is observed.

When the quantum of yield is observed short, the study also concluded that water unavailability for the Jayakwadi project is due to excess water storage / water consumption in the upper reach of Jayakwadi. The figures regarding this are given in Godavari Study Group.

Godavari Study Group itself has not mentioned the findings of the study conducted by the Water Planning Division in the case of hydrological study, perhaps because of the perspective of equitable water distribution in Government's Resolution, this context may not have been given importance.

It is necessary to focus on the planned water use in the upper reach of Jayakwadi and the factual figures of water usage available.

As per the project planning of Jayakwadi project, water usage of 115.50 TMC for Major and Medium projects and 4 TMC for Minor projects i.e. in total 119.50 has been admissible in the upper reach of the project.

Hence the water utilization of Jayakwadi project was planned on the basis of balance quantum of water available.

According to the original project report of Jayakwadi project and Government approved water utilization in the upper reach of the Jayakwadi project the water utilizations is tabulated as follows.

The study group has compared the approved water use of Jayakwadi Project as per administrative approval (1965) with the sanctioned water uses of various upstream reservoirs. The details are as below:

Sr. No.	Particulars	Approved water use as per administrative approval (TMC)	Sanctioned water use as per administrative approval (TMC)
A)	Permissible uses above Nandur Madhyameshwar weir		
	1. Gangapur Dam and Canals (Gangapur System)	8.0	10.31
	2. Kadwa Dam and Canals	3.2	38.73
	3. Nandur Madhyameshwar Dam and Darna Dam and Godavari Left & Right Canal (Darna System)	30.0	
	4. Palkhed Project on Kadwa River Karanjavan Palkhed and Canals (Palkhed System)	15.8	18.87
B)	Pravara System		
	Bhandardara, Mhaldevi (Nilwande) and Ozar canals (Pravara System)	26.0	30.31
C)	Mula Project (Baragaon Nandur)	28.5	29.24
D)	Minor projects	4.0	-
	1. Minor projects in free catchment Downstream of the above System (Nashik and Nagar District)	-	7.05
	2. Medium and Minor Projects in free catchment (Marathwada Region)	-	8.49
	Total (TMC)	119.5	143.00

Above figures show that there has been an increase of (143.00 - 119.5) 23.5 TMC in the actual and planned consumption. This is mainly due to increase in Minor projects for which the planned limit of 4 TMC has been considerably increased also as per local requirement, water utilization through K. T. weir has been increased, along with express canal water utilization in Nandur Madhyameshwar (Darna) system for Marathwada. Also, Medium and Minor projects have been constructed in Marathwada region. Considering the above facts, it is necessary to study the variation between planned utilization and actual utilization of the upstream reservoirs of the upper Godavari Basin. So that the necessary steps can be taken in future for equitable distribution. As per available data, it is noticed that the actual water use of upstream side projects is less than 115 TMC.

4.2.0 Upstream Design (Plan) Utilizations:

In the Jayakwadi project report of 1964, the utilizations planned upstream of Jayakwadi dam were shown as 3270 MCum (115.5 TMC). The same figure was also shown in revised project report of 1985. As per Mendhegiri committee report ,the data presented by GMIDC to Study Group indicates that the upstream utilizations are increased to 4556.12 MCum(160.89 TMC). and now as per present status 2024 it is 4000.55 (141.26 TMC) The increase in upstream utilizations at the various stages of development is illustrated in Table-1.

Table-1:Upstream Design (Plan) Utilizations

(Figures in MCum)

Complex	A.A. Provision (1964 &1985) (MCum)	CDO Study (2001) (MCum)	CDO Study (2004) (MCum)	GSG-I (2013) (MCum)	MWRRA report (2018)	GSG-II (2024) (MCum)
(A)Major Projects						
1)Mula	807.03	824.73	824.73	704.63	704.60	704.61
2)Pravara	736.24	753.23	753.23	786.41	782.54	781.93
3)Gangapur	226.54	222.68	222.68	169.61	231.82	231.82
4)Godavari-Darna	940.13	948.93	948.93	1204.49	886.48	967.83
5)Palkhed	447.41	444.58	444.58	456.52	468.41	468.41
Total Major Projects	3157.35	3194.16	3194.16	3321.66	3154.56	3154.60
(B)Medium Projects	0.00	383.70	383.70	421.38	297.58	297.58
(C)Minor Projects	113.27	572.29	496.11	813.08	535.80	548.37
Grand Total (MCum)	3270.62	4150.20	4073.97	4556.12	3987.94	4000.55
Grand Total (TMC)	115.5	146.56	143.87	160.89	140.82	141.26

The same study is also carried out by the Hydrology Project Nashik is calculated as below.(Rainfall Data for 30 Years (Mainly 1990 to 2021)

Study Year	75% dep. virgin yield	Upstream utilization	75% dep. net yield at Jayakwadi
H.P Study 2024	5424.21MCum.	4060.15 (excluding Jaykwadi use 2618.19 MCum,)	1364.06 MCum.
	191.53 TMC	143.37 TMC	48.16 TMC

IS Provisions :--- IS 5477 (Part-I)-1999 the performance of the project is to be decided by success. If the project is planned for 'over the year' storage projects (having carry over) and multipurpose, the performance is to be decided by using minimum 40 years runoff series. Using this minimum 40 years runoff series, As per Clause no 4.2.1 of IS 5477—(Part-I)-1999, the project is feasible if, Irrigation requirement is fulfilled for 75% of its life period. Domestic water requirement is fulfilled for100% of its life period. Hydropower water requirement is fulfilled for 90% of its life period. The simulation study showed that the Jayakwadi system was not capable to cater the demand planned over it. In order to,

1. Decide the exact water availability up to Jayakwadi.
2. Suggest most appropriate alternative to cater to the entire command area as far as possible.

The Government of Maharashtra, Water Resources Department constituted the various committees.

4.2.1 Comparison of various yield studies:

The comparison showing the availability of yield with reference to various studies is given in theTable-2

Table-2 Comparison of yield studies

(Figures in MCum/TMC)

Sr. No.	Study Year	75% dep. virgin yield	Upstream utilizations	75% dep. net yield at Jayakwadi
(1)	Project Report 1964	5558.04 196.30	3270 115.5	2288.04 80.80
(2)	Project Report 1985	5566 196.56	3270 115.5	2565 90.57
(3)	CDO study2001	4830.04 170.58	4150.2 146.56	979.80 34.60
(4)	CDO study2004	4451.5 157.20	4074.02 143.87	671.69 23.72
(5)	GSG-I (2013)	5566 196.56	4556.12 160.89	1009.88 35.67
(6)	GSG-II (2024	5566 196.56	4000.55 141.26	1565.45 55.30
(7)	Hydrology Project Report 2024	5424.21 191.53	4060.15 143.37	1364.06 48.16

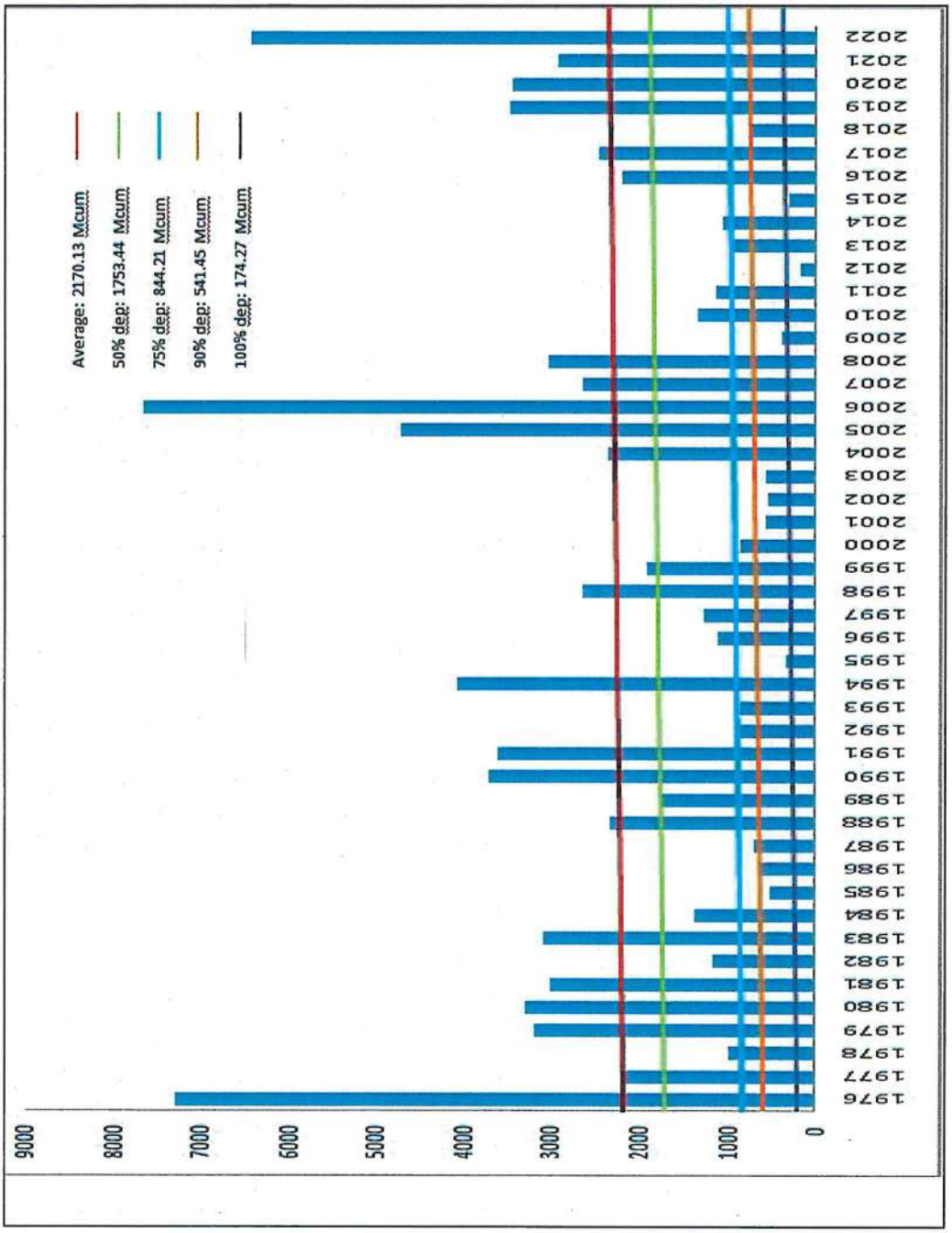
Note: Net yield includes regeneration from upstream utilizations.

4.2.2 **Observed Net Yield at Jayakwadi dam:** The Project Officers have supplied the annual observed net yield series at Jayakwadi dam for the period from1975 to 2022 (Statement – 3).After arranging the yield series in descending order, the dependable yields are worked out as under :

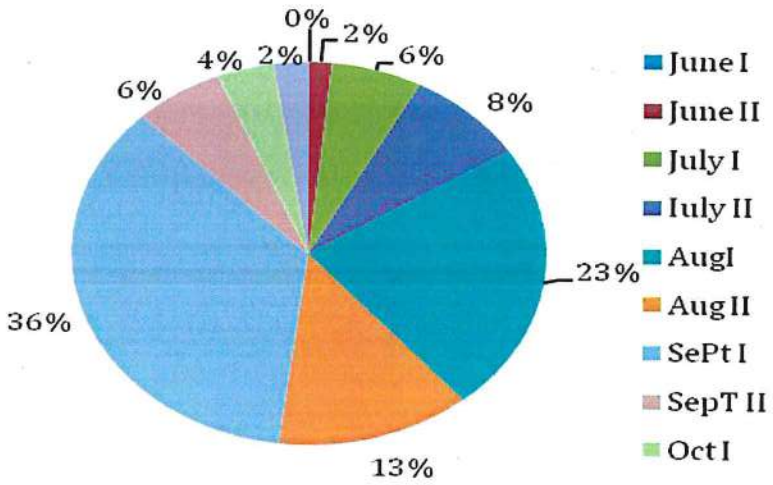
Sr. NO.	Dependability	Yield as per GSG-I (2013) (1975-2012) 38 years	Yield as per GSG-II (2024) (1975-2022) 48 years
1	100 %	122.05	174.27 MCum
2	90 %	528.79	541.45 MCum
3	75 %	816.53	844.21MCum
4	50 %	2067.51	1753.44 MCum
5	Average	2356.34	2214.42MCum

The change in observed net yield is mainly adequate rainfall during 6 years (2016, 2017, 2019, 2020, 2021 &2022) out of 10 years & the dam was having full capacity.33

Annual observed (Net) yield at Jayakwadi dam is presented in the Fig. 2.



Since 1975, Jayakwadi dam has received design yield of 2564.71 MCum (90.57TMC) or more in 18 years only out of 48 years. It is also observed from the yield series that there are consecutive bad years extending up to 2 to 4 years .Fortnightly distribution of 50% dependable net observed monsoon inflows at Jayakwadi dam is presented (worked out by cumulative method) in the Fig.3 (Pie chart.)



Fortnightly distribution of obsurved inflows at Jayakwadi dam site (50% Dep.)

From the above Pie chart, it is seen that about 80% net inflows of Jayakwadi dam are received during the months of August to October period. The inflows in the Jayakwadi dam are received predominantly during the month of August to September from upper reaches after fulfilling the storage requirements of upper dams and September to October from lower reaches (free catchment).

Comparison of Inflow Report at Jayakwadi Dam site (50 %Dep.)

Project	Year of study	June		July		August		September		October	
	Fortnight	I	II	I	II	I	II	I	II	I	II
Jayakwadi dam (Jaykwadi)	GSG-I (2013)	1	4	5	8	15	12	22	12	8	13
	GSG-II (2024)	0	2	6	8	23	13	36	6	4	2

5.0 Inter State Aspects:

The Godavari Water Disputes Tribunal had submitted its report on 27th November1979 (Bachawat Award) to Govt. of India. As per the GWDT award, Maharashtra State can use for their beneficial use all waters up to Jayakwadi dam site on the Godavari River. This is as per the agreement dated 6 October 1975 between the Chief Minister of Maharashtra and Chief Minister of Andhra Pradesh .It is mentioned in the GWDT award that the rule of an equitable apportionment of the benefits of the river, each unit getting a fair share, should be applied in deciding water disputes regarding an interstate river.

6.0 Rainfall Characteristics:

Upper Godavari sub basin receives the major portion of its rainfall during the South-West monsoon period (June to September) than in North-East monsoon .About 85 to 90% of rainfall is received during the South-West monsoon period .The river therefore brings down most of its water between June and September. The monsoon season ends by October but during the next two months there are occasional freshets caused by north-east monsoon over that part of catchment which comes under its influence. Rainfall, however, varies widely in space and time.

The Western Ghats (Sahyadri Ranges) running parallel to the coast form an almost uninterrupted barrier. Heavy monsoon rains are occurred on ghats from South-West monsoon winds striking the barrier. The amount of rainfall on the ghats at any place is governed largely by the orographic features there. This factor introduces considerable spatial variation in the rainfall amount. This is illustrated in Fig.4.

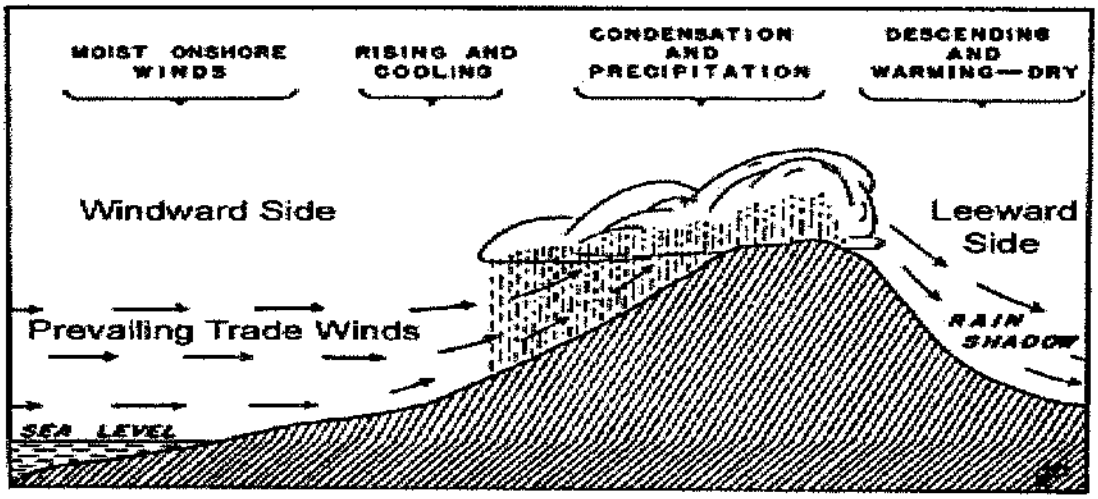
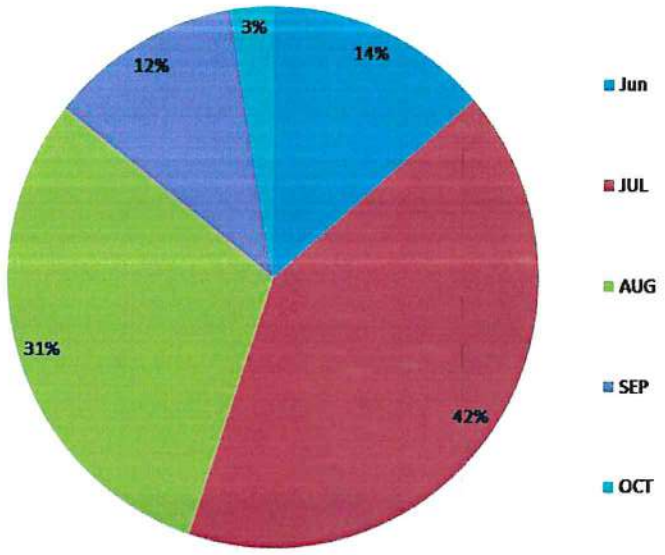


Fig:4 OROGRAPHIC RAINFALL

In crossing the ghats, the monsoon winds lose a large part of the moisture. The sub basin receives high rains in the western ghats of reach about 128 Km which vary from 3000 to 1000 mm in this reach .East of the ghats, the annual rainfall decreases rapidly to about 600 – 500 mm. The rain shadow belt includes portions of Ahmednagar and Chh. Sambhaji Nagar districts. The rain shadow belt/region is also prone to frequent droughts. About 60% catchment of Upper Godavari sub basin falls in low rainfall zone. This part receives some rains in association with the depressions from the Bay of Bengal .The Upper Godavari sub basin map showing Isohyets is enclosed (Drg.2).

The normal date of commencement of the South-West monsoon is about the middle of June. The intensity of rainfall current increases from June to July, remains steady in August and begins to weaken in the month of September. The normal date of withdrawal of South-West monsoon is between the 1st October to 15thOctober.

6.1 Distribution of Average Monsoon Rainfall

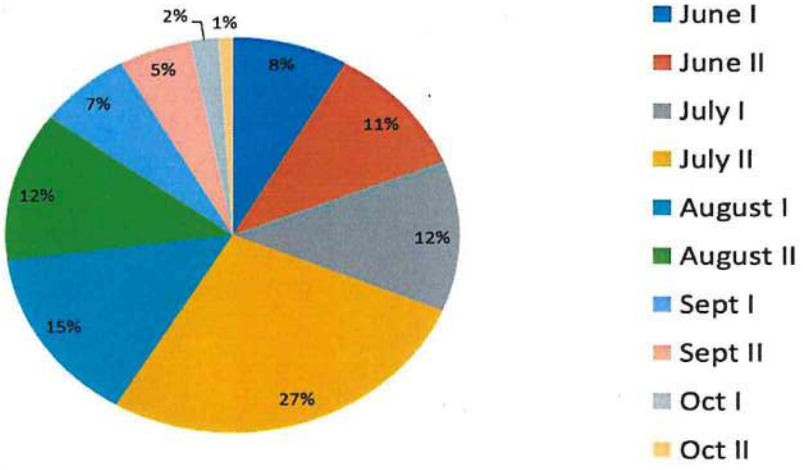


Monthly Distribution (June to October) of Average Monsoon Rainfall of Bhandardara Station (Fig.5)

The rainfall data is collected for the rain gauge station and taluka are a from Water

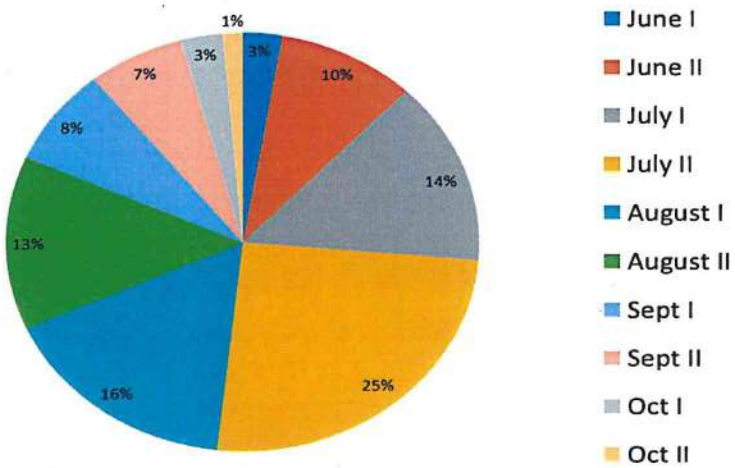
Resources Department and Agriculture Department of Government of Maharashtra.

The Bhandardara rain gauge station located at dam site represents the rainfall characteristics for Upper reaches of Pravara and Mula catchments.



Fortnightly Distribution of Average Monsoon Rainfall for Intercepted (Upper) Catchment – Igatpuri Taluka(Fig.6)

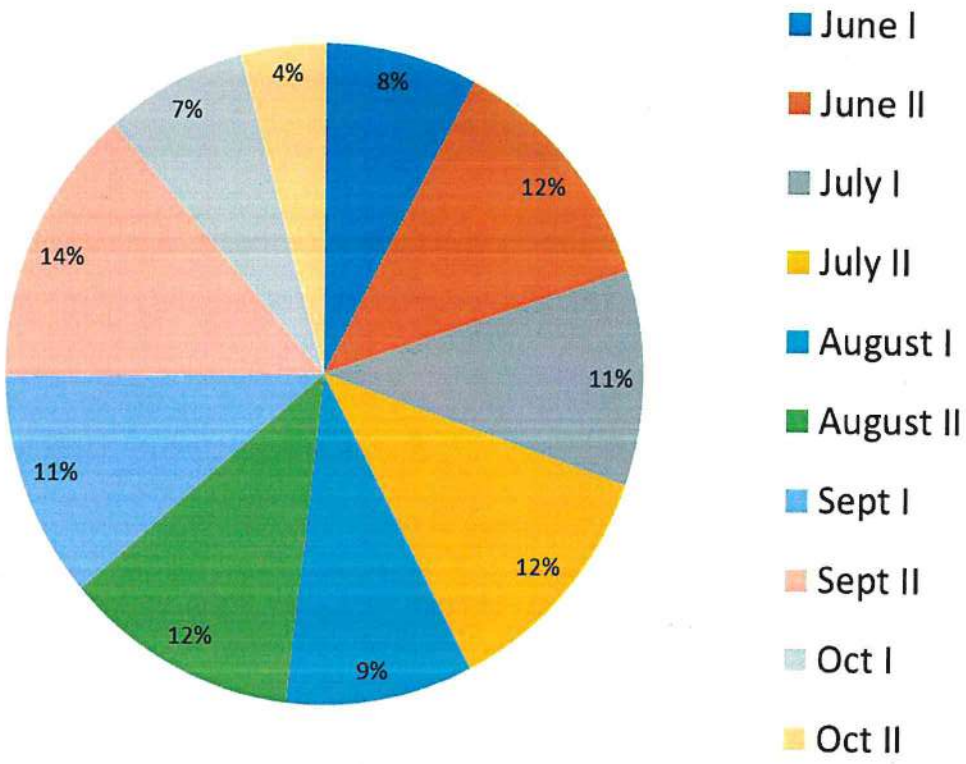
Similarly, the Igatpuri taluka and Trimbakeshwar taluka represents the rainfall characteristics of Darna and Gangapur (Godavari) catchments.
Fortnightly distribution of long period average monsoon rainfall is presented in Fig. 6,7(Pie Chart.)



Fortnightly Distribution of Average Monsoon Rainfall for Intercepted (Upper)

Catchment – Trimbak Taluka (Fig.7)

As may be seen from the three Pie Charts (Fig.5,6,7)that rainfall predominantly occurs during the months from June to August. About 80 to85% of monsoon rain fall is received by the end of August in upper reaches (intercepted catchments).



Fortnightly Distribution of Average Monsoon Rainfall for Intercepted (Upper) Catchment – Lower reach Taluka(Fig-8)

The long period average monsoon rainfall of Niphad, Rahuri, Newasa, Sangamner ,Kopargaon, Chh. Sambhaji Nagar talukas cover the un intercepted (free) catchments (lower reach) are also analysed. Fortnightly distribution of long period average monsoon rainfall of (average of 6 Tahsils)is presented in Fig.8 (Pie chart.)

As may be seen from the Pie chart that the rainfall occurs during the five months from June to October. The lower reach areas are also influenced by Bay of Bengal currents. The rainfall

during the month of September and October is quite predominant.

5.1 Comparison of Rainfall Report at various stations in upstream side of Jaykwadi.

Station	Year of study	June		July		August		September		October	
	Fortnight	I	II	I	II	I	II	I	II	I	
Bhandardara	GSG-I (2013)	4	11	17	24	19	12	6	4	2	
	GSG-II (2024)	14		42		31		12		3	
Igatpuri Taluka	GSG-I (2013)	5	11	17	18	16	12	11	6	3	1
	GSG-II (2024)	8	11	12	27	15	12	7	5	2	1
Trimbakeshwar Taluka	GSG-I (2013)	4	9	18	20	17	12	8	6	4	2
	GSG-II (2024)	3	10	14	25	16	13	8	7	3	1
Free catchment	GSG-I (2013)	10	12	11	10	8	7	10	14	13	5
	GSG-II (2024)	8	12	11	12	9	12	11	14	7	4

6.2 Impact of Climate Change on Rainfall:

The rainfall characteristics of upper and lower reaches (catchments) will have to be considered while deciding the operating strategy for integrated operation of reservoirs in the systems of reservoirs (complex).

The Government of Maharashtra, vide its Govt. Resolution of Environment department dated 25/10/2017 has projected the impact of Climate change on temperature and rainfall. The details are as below:

In order, to study the impact of climate change on temperature and rainfall, the Government of Maharashtra has entrusted study work to UK, Met Office and TERI (The Energy Research Institute). The agency conducted it's studies with help of 2 models namely Regional Climate Modelling System (PRECIS Model) and HadRM3P for the period From 1970 to 2000. Based on the study report, the impact of climate change on rainfall for the year 2030, 2050 and 2070 for the Chh.Sambhajinagar and Nashik region are predicted as bellow :

Table showing Impact of Climate Change on Rainfall in Sambhajinagar and Nashik region:

Sr No.	Revenue Region	IMD Rainfall	Predicted Increase in Rainfall percentage (%)		
			2030	2050	2070
1	Chh. Sambhajinagar	708.8	12.5 to 27.5	15 to 30	20 to 40
2	Nashik	567.5	17.5 to 40	15 to 40	15 to 52.5

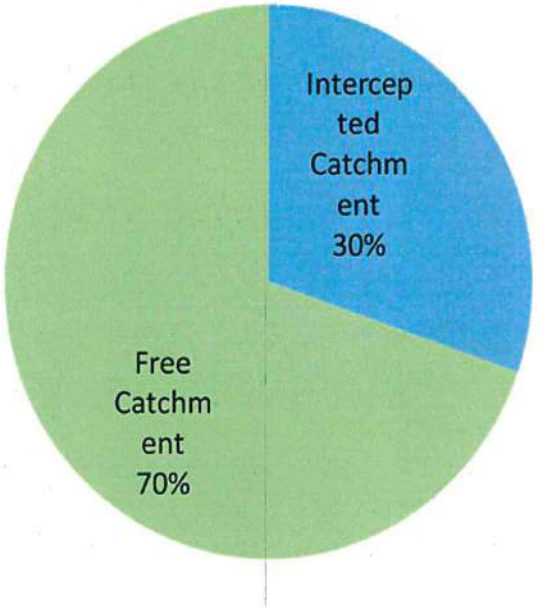
Herein, the Year 2030 means the period from year 2001 to 2040, Year 2050 means period from year 2041 to 2060 and the Year 2070 means from year 2061 to 2080. However, the impact of climate change on rainfall such as intensity, pattern and duration etc. is not studied by the Godavari Study Group-II. GSG-II recommends to establish the study centre or used the data from the various authorities. Godavari Reservoir Regulation Group shall analyze this data and suggest necessary recommendations or give factual information to MRSAC Nagpur as per requirement in near future.

7.0 Un intercepted (Free) Catchment:

Large number of major and medium dams have been constructed in the upper reach catchment for water conservation purposes and utilization of the available water resources,

because of two main reasons viz:(i) technically most ideal dam sites available in ghat areas, and(ii) major source of sub-basin yield in ghat areas.

The distribution of catchment area up to Jayakwadi dam is presented inFig.9 (Pie chart).



Details	Area in Sq .Km.
Total Catchment	21774
Intercepted Catchment	6593
Free Catchment	15181

Fig.9: Catchment Area for Paithan Dam

The un intercepted catchment area is 69.72%. The Upper Godavari sub-basin map showing Isohyets is enclosed (Drg.2).Free catchment area is having low rainfall of about 500 to 600 mm.

8.0 Increasing Water Use Efficiency:

National Water Mission emphasis for action to increase (WUE) of the project by 20%. The promotion of micro irrigation techniques such as drip and sprinkler irrigation for irrigating the crops can improve the existing on farm irrigation efficiency from 50% to 80% and overall efficiency in the range of 50% to 60%.

In order, to verify the water use efficiency in the upper Godavari basin, the study group has studied the data regarding the benchmark indicator of area irrigated per unit of water supplied i.e. hector per 1 Mcum. provided by the Chief Auditor General, Walmi campus, Chhatrapati Sambhajinagar for the last 10 years, from FY 2012 to 2022. The details are attached herewith in the Study Group Report. From the data, it is observed that, in the Upper Godavari basin of various projects indicates that the upper part of the Jayakwadi project namely Mula, Pravara, Gangapur, Darna, Palkhed complex are having their average of last 10 years annual area irrigated per unit of water supply is appx. 187.64 ha/mm^3. where as in Jayakwadi project is having average as 143.76 Ha/mm^3. However, Water Use Efficiency depends on number of factors such as cropping pattern, number of rotation, soil type, evaporation rate and methods of irrigation etc.

Adoption of drip and sprinkler irrigation methods for increasing water use efficiency may be made mandatory within a period of 5 years henceforth, as envisaged in Section 14 Subsection (4) of MWRRA Act. The Government may consider this sub basin as a pilot sub basin for converting the gravity irrigation into micro irrigation system. The WALMI, Chhatrapati Sambhajinagar shall be given lead role to conduct various courses for farmers and water users associations, to increase water use efficiency. The WALMI shall, also, undertake on form training courses.

Area Irrigated per Unit of Water Supplied in Upper Godavari Basin

Complex/Project		Annual Area Irrigated per unit of Water Supply (Ha/Mcum)										State Target	Last 10 Years		
Year		2012-13	2013-14	2014-15	2015-16	2016-17	2017-18	2018-19	2019-20	2020-21	2021-22		Max	Min	Average
1		2	3	4	5	6	7	8	9	10	11	12	13	14	15
A) Pravara Complex															
1	Mula	118	159.29	102.66	286.62	116.96	126.28	210.93	149.9	124.15	121.86	130	286.62	102.66	151.67
B) Pravara Complex															
1	Bhandardara	140.00	106.92	91.06	132.70	74.96	66.85	90.25	75.90	71.45	69.55	130.00	140.00	66.85	91.96
2	Bhojapur	143.47	222.37	182.05	0.00	215.61	184.40	73.37	82.55	67.40	357.14	130.00	357.14	67.40	169.82
C) Gangapur Complex															
1	Gautami	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	130.00	NA	NA	NA
2	Gangapur	251.00	188.22	107.26	315.16	119.69	99.09	127.65	136.67	154.42	133.92	130.00	315.16	99.09	163.31
D) Godavari-Darna Comple															
1	Kadva	296.00	57.34	66.84	69.34	76.65	868.06	90.90	107.90	71.36	70.22	130.00	868.06	57.34	177.46
2	NMC express Mukane	83.00	0.00	174.83	136.54	232.07	173.55	341.18	335.32	117.32	237.19	130.00	341.18	83.00	203.44
3	Waldevi	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	130.00	NA	NA	NA

Complex/Project		Annual Area Irrigated per unit of Water Supply (Ha/Mcum)										State Target	Last 10 Years		
Year		2012-13	2013-14	2014-15	2015-16	2016-17	2017-18	2018-19	2019-20	2020-21	2021-22		Max	Min	Average
1		2	3	4	5	6	7	8	9	10	11	12	13	14	15
E) Palkhed complex															
1	UGC Karanjwan	261.00	NA	NA	NA	NA	NA	NA	NA	NA	NA	130.00	261.00	261.00	261.00
2	UGC Punegaon	234.96	200.08	251.38	411.69	136.71	160.44	232.40	267.38	284.82	190.19	130.00	411.69	136.71	237.01
3	Palkhed	184.00	110.04	97.90	139.80	106.56	140.59	401.61	472.59	529.66	148.35	130.00	529.66	97.90	233.11
F) Remaining upto Paithan Dam															
1	Tembhapuri	0.00	NA	NA	NA	351.74	0.00	0.00	0.00	155.28	50.57	130.00	351.74	50.57	185.86
G) Paithan dam (Jayakwadi)															
1	Jayakwadi	352.00	NA	271.37	0.00	94.78	59.80	72.26	63.32	163.24	73.27	130.00	352.00	59.80	143.76

*Source: Indicator Ia from "Benchmarking of Irrigation Projects in Maharashtra State".

9.0 Equitable Distribution of Water:

MWRRA Act, 2005: Maharashtra has enacted Maharashtra Water Resources Regulatory Authority Act, 2005 (MWRRA Act, 2005) which provides for the establishment of Authority to regulate water resources within the State, facilitate and ensure judicious, equitable and sustainable management, allocation, and utilization of water resources.

In the section 11 of MWRRA Act, the powers, functions, and duties of the Authority have been mentioned In clause (c) and (m) of section 11, the following functions of Authority are mentioned:

(c) to determine the priority of equitable distribution of water available at the water resource project, sub-basin, and river basin levels during periods of scarcity;

(m) in the event of water scarcity, the Authority, in compliance with its policy and rules for allocating such scarcity, shall adjust the quantities of water to be made available to all Entitlements and shall permit the temporary transfer of Water Entitlements between users and Categories of Users in accordance with the approval of the River Basin Agencies.

In general policies of the Authority, as per the provisions of section 12 sub-section (6) of MWRRA Act, the Authority shall fix the quota at project level, sub-basin level, based on some principles. The clauses (a), (b) & (c) of section12 subsection (6) give the principles for sharing of the distress as mentioned below:

(a) for equitable distribution of water in the command area of the project, every land holder in the command area shall be given Quota;

(b) the Quota shall be fixed based on the land in the command area :Provided that, during the water scarcity period each land holder shall, as far as possible ,be given Quota adequate to irrigate at least one acre of land;

(c) to share the distress in the river basin of sub-basin equitably, the water stored in the reservoirs in the basin or sub-basin ,as the case may be, shall be controlled by the end of October every year in such way that ,the percentage of utilizable water ,including kharif use ,shall ,for all reservoirs approximately be the same.

As per Section 14 sub-section (4) of MWRRA Act, Water shall not be made available from the canal for perennial crops in such area and from such date a may be notified by the Authority, unless the cultivator adopts drip irrigation or sprinkler irrigation or such other water

saving technology approved by the Authority. The quantity of water so saved, after satisfying the future increased demand of drinking water, shall be distributed equitably in the command area and the adjoining area.

MWRRA Rules,2013: Maharashtra Water Resources Regulatory Authority (Allocation & Monitoring of Entitlements, Disputes and Appeals and other Matters) Rules, 2013have been published on 30 April,2013.**In sub-Rule 2(1)(c),** the word" water scarcity" or "distress" is defined as under:

"Water scarcity" or **"distress"** in relation to a particular water resources project ,means a situation when actual availability of live storage is less than 33% of design live storage of that project as on the 15thOctober.

Rule 11 is regarding the "Equitable distribution of water during water scarcity" which is reproduced as under:

Equitable distribution of water during water scarcity—

1)The Authority shall, during the period of water scarcity, determine the priority of equitable distribution of water available at the water resources project level and wherever technically and practically feasible, also at sub basin and basin level.

2) During the period of water scarcity, if available live storage in a particular water resources project is not adequate to meet the drinking water needs, release of water from upstream major or medium water resources projects may be considered by the Authority;

Provided that such releases shall be considered only if,-

1) the drinking water needs of such upstream projects are met fully; and

2) such releases are technically and practically feasible.

3) While planning the release of water under sub-rule (2), evaporation losses and transit losses shall be accounted for. The concerned River Basin Agency shall specify the operating procedure for release of water from upstream projects.

4) During the period of water scarcity after satisfying the drinking water requirements from the water resources projects, the apportionment of remaining water shall be decided by the River Basin Agency.

9.1 Analysis of Section 12 (6) (c) of MWRRA Act, 2005.

As per PIL 173/2013 & MWRRA Case No 1 / 2014, the analysis of Section 12 (6) (c) of the MWRRA Act, 2005 states that, the delineation of the Command Areas of an Irrigation Project and delineation of the Command Area of the Water Users' Association at Minor Level has significance for the system of supply of a water from a water resources project. When the Command Area thereunder is delineated, the same involves

(1) substantial repairs, construction and rehabilitation of canals and field channels in the entire Command Area;

(2) fixation of water measuring devices at various water distribution heads so that the quantum of water at the point of supply could be scientifically ascertained;

(3) the supply of water through and by way of mandatory constitution of Water Users' Association to be binding on all holders and occupants of such lands.

There are 236 projects which have been delineated under the MMISF Act, 2005. Out of these 236 projects, MWRRA has fixed the Applicable Water Entitlement (Water Quota) for 222 projects till the year 2011-12 for 792 Water Users Association. The work of fixing the Applicable Water Entitlement (Water Quota) for the balance 14 projects is under way as the measuring devices are in the process of being installed by the State Government. It is significant to note that Quotas cannot be given until all the water measuring devices are installed in the delineated command area of a project because Quotas are volumetric expressions of the quantity of water to be given for which water measuring devices are a must.

As and when the State Government issues a Notification delineating the command area covered by the Jayakwadi Project's Reservoir and after the formation of the Water Users' Associations, the MWRRA will, according to its practice take steps to fix Water Quota, i.e. Applicable Water Entitlement for the Water Users' Associations in the Command Area as per the procedure laid down in the Technical Manual prepared by MWRRA in terms of Rules 29(a) and (b) of the MMISF Rules, 2006."

`The position, as regards the delineation having not been made by the State Government, remains the same. It is also important to point out that the parties seeking equitable distribution of water under clause (c) of sub-section (6) of Section 12 of the MWRRA Act, 2005 do not realize that the principle in clause (c) of sub-section (6) of Section 12 is to be applied when the Quota is fixed at basin-level, sub-basin level or project level. The principle in clause (c) of sub-section (6) of Section 12 does not by itself become a stand alone provision to be applied independent of the function of Quota fixation at basin-level, sub-basin level or project level.

9.2 MWRRA order Date: 22 nd September 2017

" The Criteria For Distribution of Surface Water Entitlements by River Basin Agencies for Domestic & Industrial Uses" (page no. 12 to 13) published by MWRRA on 22 nd September has following criteria.

9.2.1 Sharing Water Deficit

As er the State Water Policy, the domestic water uses for drinking, cooking. and hygiene sanitation including livestock has priority. However, natural water availability is extremely diverse across the various river basins and sub-basins of the state. Annual variations are approximately within the range of 30%. The annual fluctuations in rainfall and consequent water deficit in the reservoirs need to be addressed. During the deficit years, the DBWUs (Domestic Bulk Water Users) will also have to share some deficit. However, while doing so, the basic needs for health & hygiene should not be lost sight of. Considering this aspect, allocation for DBWUs from the reservoir in the deficit year shall be governed by following formula;

AD (in percentage) = 70+ [(U x 30)/100)

$$\text{Where } U = \frac{\text{(Reservoir Storage on 15th October + Kharif Utilization) X 100}}{\text{Design Annual Utilization from the Reservoir}}$$

Applicable cut in % = 100-AD

Note in case the live storage in the reservoir on 15th October is less than or equal to total domestic water entitlements from the reservoir for the balance year, all available water shall be kept reserved for domestic Sector.

Illustration:- If the live storage as on 15th October plus the Kharif utilization already done is 90% i.e. deficit in water availability is 10%, the deficit to be shared by domestic sector shall be calculated as under;

AD = 70+[(90 x 30)/100]-97%

Applicable cut 100-97-3%

So Bulk Water User in Sr. No. 4 in Table No 1 will get at 135 x 97% =131 Lpcd (Liter per capita per day)

Allocation for IBWU (Industrial Bulk Water Utilization) from the reservoir in the deficit year shall be governed by the following formula;

AI (in percentage) = 60+ [(U x 40)/100]

where U= $\frac{\text{(Reservoir Storage on 15th October + Kharif Utilization) X 100}}{\text{Design Annual Utilization from the Reservoir}}$

Applicable cut in % = 100 - AI

is adopted for fixing the applicable cut by this study group. and the detailed calculations is appended in annex Q.

GSG-II has considered MWRRA's criteria (2017) for various applicable cut for domestic & industrial water use.

As per these formulae / methodology the calculations calculations the proposed cut for various operating conditions is as follows.

S .N.	Particular	% Cut	Factor % considered
1	Domestic	12.81	87.19
2	Industrial	17.08	82.92
3	Irrigation kharif	20.00	80.00

Therefore, the percentage(%) considered for various dependability is as below.

S.N.	Jayakwadi observed net	% Demands As per G.S.G-I (2013)					% Demands As per G.S.G-II (2024)				
		D-NI	I-NI	K-I	R-I	HW-I	D-NI	I-NI	K-I	R-I	HW-I
1	100% dep. Year	80	80	80	0	0	87.19	82.92	80	0	0
2	90% dep. Year	80	80	80	32	0	87.19	82.92	80	32	0
3	75% dep. Year	80	80	80	52	0	87.19	82.92	100	52	0
4	Average yield	80	80	80	80	0	87.19	82.92	100	80	0
5	Good Year	100	100	100	100	100	100	100	100	100	100

However, for Irrigation purpose the applicable cut is considered as per GSG-I (2013 & MWRRA 2018 Report.)

10.0 **Evaporation from Reservoir Jaykwadi (Jayakwadi Dam)** The planning of Jayakwadi Dam was done considering the annual lake evaporation losses of 664.83 MCum. However as per Govt. Resolution dated 12/09/2018, the evaporation losses work to be 323.10 MCum. as per detailed discussions the 90% & 75% dependable year information of evaporation losses provided by SE, CADA, Chhatrapati Sambhajinagar are214.26 MCum. & 288.65MCum. respectively.The evaporation losses are as below.

S.N.	Jayakwadi observed net	Years	Available yield	Evaporation Losses
1	100% dep. Year	2012-13	174.27	206.71
2	90% dep. Year	2002-03	541.45	214.26
3	75% dep. Year	1993-94	844.21	288.65
4	Average yield	1977-78	2198.86	323.10
5	Good Year	2017-18	2465.23	323.10

11.0 Physical Constraints

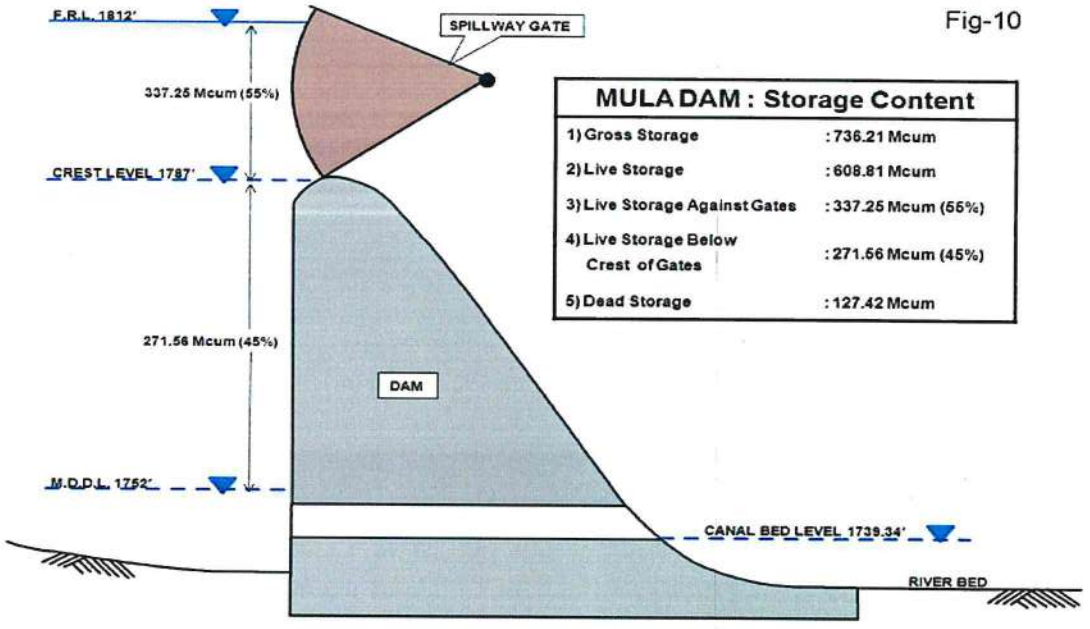


Fig-10

Fig. 10 shows the typical cross section of Mula dam

Water Resources projects are classified into three categories ,namely major, medium, and minor irrigation projects. The minor projects are having cultural command area less than 2000 Ha. and are having small size storage. They are designed with 50% dependable yield. Generally, they are also having no spillway gates for release of surplus water. In case of ungated dams, the release of water from live storage is possible only through canal outlet and river sluice ,if provided .As the discharge capacity of such outlet/sluice is small and inadequate to release water through river from feeding downstream projects .If releases are made in smaller/lesser quantities, there will be huge transit and evaporation losses in the carrier (river) system. It is most likely that released water will not reach the downstream reservoir. The releases are technically and practically feasible from gated spillways of medium and major projects.

There are 16 major and 7 medium projects (Total = 23 dams) located in the upper reaches and which are considered for study. Out of these 23 dams, 13 dams are having spillway gates. Live storage below and above the crest of spillways of these 13 dams are worked out. It is found that on an average 53% of design live storage of all these dams is below crest. (Statement-1) So the 53% of design live storage is assumed as mandatory storage which would not be released for downstream.

11.1 Release of water from upstream reservoir to Jayakwadi Dam :

After formulation of Guiding Principle by the GSG-1, the implementation agency Executive Director, Godavari Marathwada Irrigation Development Corporation, Chh. Sambhajinagar has released water in scarcity / drought period during 2015, 2018 and 2023 the details are given in the table.

Water Releases from Upper Dams in Year 2015, 2018 & 2023

Water to be released from the various Project complex / group up stream of the Jaykwadi project.

	Name of the Dam Group	2015				2018				2023			
		Water Availability in Kharif till 15th October (Mm^3)	% of projected usable water storage	Orders to release Water from the group		Water Availability in Kharif till 15th October (Mm^3)	% of projected usable water storage	Orders to release Water from the group		Water Availability in Kharif till 15th October (Mm^3)	% of projected usable water storage	Orders to release Water from the group	
				Mm3	TMC			Mm3	TMC			Mm3	TMC
1	2	3	4	5	6	7	8	9	10	11	12	13	14
1	Mula (Mandohol, Mula)	352.36	57.02	49.38	1.74	605.14	97.98	54.00	1.90	684.45	110.82	55.51	1.96
2	Pravara (Bhandardara, Nilwande, Adada, Bhojapur)	504.00	88.31	184.00	6.50	609.76	106.85	109.0	3.85	715.28	125.34	88.92	3.14
3	Gangapur (Gangapur, Kashyapi, Gautami Godavari)	225.38	84.99	38.38	1.36			00	00	339.55	128.04	9.91	0.35
4	Godavari Darna (Alandi, Kadwa, Bham, Bhavali, Waki, Darna, Mukane, Waldevi)	552.87	99.52	91.87	3.24	793.99	114.10	91.50	3.24	847.83	121.84	67.68	2.39

	Name of the Dam Group	2015				2018				2023			
		Water Availability in Kharif till 15th October (Mm^3)	% of projected usable water storage	Orders to release Water from the group		Water Availability in Kharif till 15th October (Mm^3)	% of projected usable water storage	Orders to release Water from the group		Water Availability in Kharif till 15th October (Mm^3)	% of projected usable water storage	Orders to release Water from the group	
				Mm3	TMC			Mm3	TMC			Mm3	TMC
1	2	3	4	5	6	7	8	9	10	11	12	13	14
5	Palkhed (karnjvan, waghad, Punegaon, Ozarkhed, Palkhed, Tisgaon	203.68	60.83	00	00	404.37	120.77	00	00	357.24	106.70	0	0
	Total	1836.31	78.43	363.63	12.84	2731.85	109.97	254	8.99	2944.36	118.548	222.02	7.84

12.0 Water Distress:

Drought is an extended period of months or years when a region face a deficiency in its water supply whether surface water or ground water. Generally, it occurs when a region receives consistently below average rainfall. Hydrological drought relates to water availability .MWRRA Rules, 2013 defines the word water scarcity" or "distress" .

These two words have been correlated with the actual availability of live storage of the project as on 15th October. The basis for this definition is Govt. of Maharashtra, Water Resources Department's Marathi Resolution No. Misc10.0/(19/2000)/IM(P) dated 7 March, 2001,in which guidelines for planning of water utilization from water storage are included .In this resolution, it is mentioned that during the expected deficit rainfall year, no sanction for Kharif crop be given until live storage reaches up to 33%.

"Water stress index" is the international level commonly used measures of water scarcity. This method defines water scarcity in terms of the total water resources that are available to the population of a region; measuring scarcity as the amount of s renewable fresh water that is available for each person each year. The water availability per capita per year in a region is below 1700 Cum, it is said to be experiencing water stress; below 1000 Cum it is said to be experiencing water scarcity, and below 500Cum, absolute water scarcity.

13.0 Operating Strategy for Reservoir Operation :

13.1 Study Approach:

The water stress situation is most likely to occur more frequently in future as the water resources available in the sub-basin are not sufficient to meet the demands. The water stress scenario will have to be managed with the well strategy of deficit sharing in respect of a whole sub-basin. Accordingly, the strategy and/or options and their quantitative effects on overall water planning is analyzed in this study by using the approximate equitable concept at sub-basin level to have rational and effective utilization of the water resources.

The river basin simulation approach is generally used to provide an effective tool for better planning and management of water resources in the basin or sub-basin. Lot of computer software packages are available for analyzing the behavior of the basin under different hydrological conditions.

The GSG-I (2013) study was done conventionally by adopting general simulation

principles without the help of computer software packages.

13.2 Study Scope:

The operating strategy for integrated operation of reservoirs is to be formulated for whole sub-basin area. The large number of major, medium & minor irrigation projects are planned and completed in this sub-basin. The details regarding their design live storage and water utilizations are given in Statement – 5.The design water use of these projects is about 7174.72MCum.This design water use is from projects having planned at varying dependabilities ranging from 50% to 75% including local sector schemes more than 5 Mcft water use. The sanctioned non-irrigation uses in this sub-basin are as below :

S. N	Particular	GSG-I (2013) Sanctioned scheme	GSG-II (2024) Active scheme	% increase/decrease
1	Domestic use	693.09MCums	971.61 MCum.	(+)40.18
2	Industrial use	283.07MCum	240.28 MCum.	(-)15.11
	Total	976.16MCum	1211.90 MCum.	(+) 24.15

The increase in domestic water use is due to increase in demand and as GSG-II (2024) study group has considered active schemes only, there is decrease in industrial use. The details of non-irrigation use from major & medium projects are given in Statement - 2.

There are large number of minor irrigation dams having small size storage and dams unless they are full to their capacities. They are also widely spread in the whole catchment and in large numbers. The operating strategy for integrated operation of reservoirs cannot be applied to them, considering the physical and practical constraints Hence, the water utilizations from these minor projects are not considered for the study. The observed yield data at various Nodes (terminal location) of complex is net after excluding the water used by these minor projects .The study scope is limited to the major & medium projects in the sub-basin. Table: 4 shows the comparison of total complex wise design live storage & water use along with present study scope.

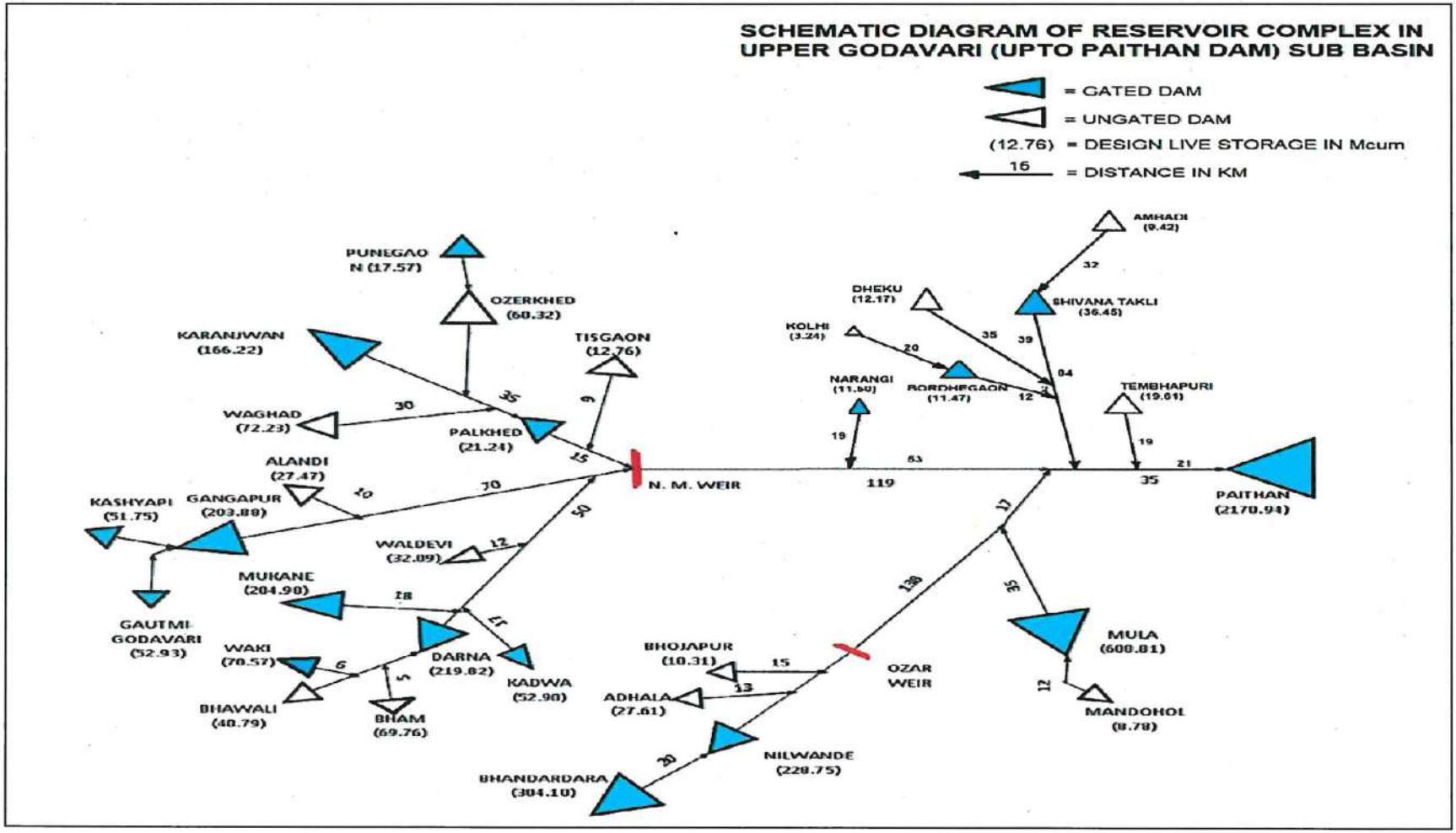
Table: 4 Complex wise present study scope

(Figures in MCum)

Complex	As per (G.S.G-I)						As per (G.S.G-II)					
	Design Live Storage			Design Water Use			Design Live Storage			Design Water Use		
	Complex	Study scope		Complex	Study scope		Complex	Study scope		Complex	Study scope	
1	2	3	4	5	6	7	8	9	10	11	12	13
Mula	708.61	617.59	87.16	829.52	717.78	86.53	725.98	617.23	85.02	835.34	717.76	85.92
Pravara	625.83	570.77	91.20	959.91	835.84	87.07	594.73	570.68	95.95	864.70	840.96	97.25
Gangapur	419.78	308.56	73.51	405.53	324.81	80.10	335.47	308.53	91.97	293.81	265.80	90.46
Godavari - Darna	823.32	718.38	87.25	1390.16	1220.04	87.76	737.08	718.38	97.46	1054.28	1034.26	98.10
Palkhed	379.24	350.34	92.38	505.87	456.52	90.24	387.12	350.45	90.52	505.08	468.41	92.74
Remaining up to Jayakwadi dam	350.01	0.00	0.00	465.13	0.00	0.00	411.57	103.86	25.23	447.34	124.99	27.94
Total	3306.79	2565.64	77.59	4556.12	3554.99	78.03	3191.95	2669.13	83.62	4000.55	3452.18	86.29
Jayakwadi dam	2170.94	2170.94	100.00	2618.59	2618.59	100.00	2170.94	2170.94	100.00	2618.59	2618.59	100.00
Total for Sub basin	5477.73	4736.58	86.47	7174.71	6173.58	86.05	5362.89	4840.07	90.25	6619.14	6070.77	91.71

The study scope covers the reservoirs having 91.71% of sub-basin design water use. Seven (7) medium projects located in Remaining up to Jayakwadi dam" complex are also considered for study.

Fig.: 11 shows the schematic diagram of reservoir complex which are considered in the present study of Upper Godavari (up to Jayakwadi dam)sub basin. Fig.11).



The study covers 17 Major and 7 Medium Projects including Jayakwadi Dam which are distributed amongst seven (7) complex/ systems of reservoirs. These reservoirs/dams have been suitably grouped together in the seven complexes based on the physiography of the river system/systems, water resources developments and hydrologic data availability at Nodes (terminal location).

13.3 Study Scenario: The operating strategy for reservoir operation, will decide the specification of how much water to be stored and released each period, depending on the state of the water availability and water demands in the complex in that period, to best attain a specified goal i.e. approximate equitable distribution of water. So, it is decided to consider following 5 scenarios covering different conditions of probabilities of inflows in Jayakwadi dam including the bad year and good year.

1. 100% dependable year of Jayakwadi dam.
2. 90% dependable year of Jayakwadi dam.
3. 75% dependable year of Jayakwadi dam.
4. Average yield.
5. Good year.

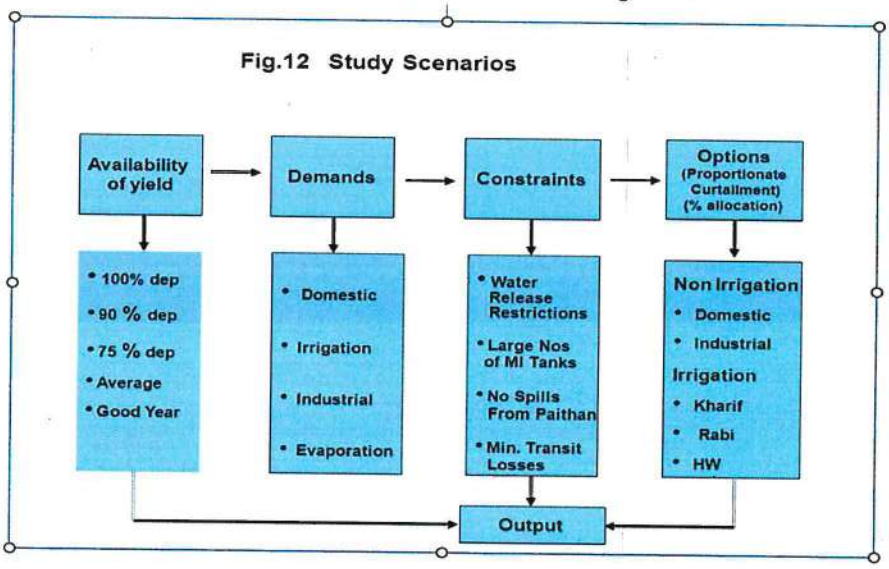
Above mentioned probability criterion is based on the performance requirements of the multipurpose projects as prescribed in IS-5477- (Part-I) — 1999 i.e. the project is successful if,

(1) Domestic requirement is fulfilled for 100% of its life period.

(2) Industrial requirement is fulfilled for 90% of its life period.

(3) Irrigation requirement is fulfilled for75% of its life period.

Fig.12 Study Scenarios



As the sub-basin is in water stress situation, the scenario for ,average yield and good year is also decided to be studied. The computation of these scenarios is done to evaluate how the complex would perform if operated in a particular manner under a given set of predetermined conditions, permitting evaluation of the complex under a parameters and variables. The computations are done with the following components:

(1) Water Availability/ Yield. (2) Water demands.(3) Reservoir Evaporation
(4) Physical constraints (5) Options (6) Operating rules (7) Outputs.

The computation and its components are explained in the Fig.: 12

The dependable year of Jayakwadi dam is considered as study year for the whole sub basin, so that the performance of all the complex can be evaluated in realistic approach. The statement – 4 shows the observed yield and corresponding spills at different locations of complex. This data is supplied by the field officers during the study. However, the evaporation and transit losses from the carrier (river) system are not accounted considering the limitations of the study group. The operating strategy for reservoir operation is proposed to be implemented for releasing of water from Upper dams immediately after the monsoon months (in the 1st week of November), so that the losses from the carrier system will be minimal.

The water demands are considered as variable parameter. Considering the priorities of water usage as per state water policy, the demands are curtailed and water balance analysis for study year is carried out till the complex perform successfully to meet the available demands .The statement showing the final output of five study scenarios are presented in statement 6 to 10. The output of 5 scenarios is described briefly below:

(1) **Operating Strategy-I** (100% dependable year of Jayakwadi Project):In this scenario 100% dependable year (2012) of Jayakwadi Project is considered, hence less water is available to meet the various demands. All the demands of all the purposes will not be met in this scenario. Hence, as per MWRRA criteria for sharing water deficit 12.81% &17.08% reduction in sanctioned active scheme demands of (1)domestic use (2) Industrial use respectivly and 20% reduction in sanctioned /design 3) Kharif seasonal crop is contemplated. It will not be possible to provide water for rabi and HW crops in this scenario. (Statement:6).

(2) **Operating Strategy-II**(90% dependable year of Jayakwadi Project) :In this scenario 90% dependable year (2002) of Jayakwadi Project is considered, hence less water is available to meet the various demands. All the demands of all the purposes will not be met in this scenario. Hence, as per MWRRA criteria for sharing water deficit 12.81% &17.08% reduction in sanctioned active scheme demands of (1)domestic use (2) Industrial use respectively and 20% reduction in sanctioned /design demands of (3) Kharif seasonal crop is contemplated. However, it will be possible to provide 32% of rabi demands for protective irrigation. It will not be possible to provide water for HW crops in this scenario (Statement— 7).

In the year when, it is decided to use this strategy, then if the available balance water for Jayakwadi Project is more than balance yield after total use of Jayakwadi, then the strategy will be applicable otherwise quantity of release of water to Jayakwadi project shall be restricted to balance water available for Jayakwadi Project.

(3) **Operating Strategy-III** (75% dependable year of Jayakwadi Project):In this scenario 75% dependable year (1993) of Jayakwadi Project is considered. It is expected that all the design demands should be satisfied in this scenario as projects are designed for 75% dependable yield. However, study indicates that water is not adequate to meet all the design demands , Hence, as per MWRRA criteria for sharing water deficit 12.81% &17.08% reduction in sanctioned active scheme demands of (1)domestic use (2) Industrial use respectivly and no reduction in sanctioned/design demands of (3) Kharif seasonal crop is contemplated. However, it is planned to provide 52% rabi demands for protective irrigation. It will not be possible to provide water for HW crops in this scenario also (Statement— 8).

In the year when, it is decided to use this strategy, then if the available balance water for Jayakwadi Project is more than balance yield after total use of Jayakwadi, then the strategy will be applicable otherwise quantity of release of water to Jayakwadi project shall be restricted to balance water available for Jayakwadi Project.

(4) **Operating Strategy-IV**(Average yield): In this scenario average yields in all complex are considered. It is expected that all the design demands should be satisfied in this scenario as projects are designed for 75% dependable yield. However, study indicates that water is not adequate to meet all the design demands. Hence, as per MWRRA criteria for sharing water deficit 12.81% &17.08% reduction in sanctioned

active scheme demands of (1)domestic use (2) Industrial use respectivly and 20% reduction in, (3) Kharif use and (4)Rabi use is contemplated .However, it will not be to provide water for HW crops in this scenario also(Statement: 09).

(5) **Operating Strategy – V** (Good Year) :In this scenario good year (2017) of Jaykwadi Project is considered (IS 7323: 1994 – Good year is a year during which the precipitation or stream flow is more than that in the normal year. Normal year, is a year during which the precipitation or stream flow are within Plus (+) 20 percent of the long period average value).The study indicates that water is adequate to meet all the design demands100% (Statement– 10).

From all above five scenarios, it is seen that the whole sub basin (all the complex) except Good Year scenario fails to satisfy the sanctioned/design water uses .The scenarios support that the sub basin area is experiencing water stress and water scarcity situation is likely to occur more frequently in future. The main reasons for such alarming state can be summarized as under.

(1) Over estimation of water availability at planning stage.
(2) Increase in upstream design (plan) utilizations.
(3) Increase in non-irrigation uses.

The factors like rapid urbanization, high increase in population, change in lifestyle of people and, faster industrial development have compelled to divert more and more water to non-irrigation use irrespective of provisions in project planning. Such a change in allocation at later stage, necessitates the revision of water planning of the projects. The revision of water planning of the projects by way of reviewing the sectoral allocation and thereby reducing for Agriculture use (Irrigation)will create competition and conflict among the water users. Adoption of drip and sprinkler irrigation methods can be made mandatory within a period of 5 years hence forth, as envisaged in Section 14 subsection (4) of MWRRA Act. Government may consider this sub basin as a pilot sub basin for converting the gravity irrigation into micro irrigation system.

13.4 Distribution of Utilizable Water:

The five study scenarios are analysed on the principles of the approximate equitable and judicious distribution of available water within the sub basin, so that the benefits of the water are equally distributed among the different category of uses and among the upper and lower reach users. With this approach, & methodology ,the deficits in the sub-basin are shared equitably in proportion with the demands in holistic way. This concept is in line with the rule of equitable apportionment of water mentioned in GWDT award.

The output of the study scenarios gives the distribution of utilizable water available in the sub basin among the various complex/systems of reservoirs under different conditions of probabilities of inflows in Jayakwadi dam. Table: 5 shows the output. The water uses in the kharif/monsoon period for irrigation or any other purposes including lake evaporation is accountable in utilizable water for that complex.

13.5 **Guiding Principles** :The output of the five study scenario gives the distribution of utilizable water among the various complex under different inflow conditions. Given the utilizable water for each complex in the sub-basin for the known or predicted availability of inflows, it is possible to specify the set of guiding principles (operating rules) i.e. to specify the riders for synchronization of storages in upper reservoirs with the state of Jayakwadi dam step by step with different end target storages.

Mula, Gangapur and Jayakwadi dam are having carry over storage of 28.32MCum, 11.64 MCum and 381.70 MCum respectively. The storage left over unused in the reservoir at the end of the depletion period of a year, is available for use in the later years. The requirement of utilizable water for that dam/complex will be less to that extent; if last year carry over is unused because of normal or good year .With this concept, the guiding principles(operating rules)are presented in theTable:6.Table:6 gives the step-by-step synchronization of storages in upper reservoirs with the state of Jayakwadi dam for different operating strategies during filling (monsoon)period.

These guiding principles will limit the reservoir storages/levels in the different systems of reservoirs / complex to be synchronized with the Jayakwadi dam storage during monsoon period. These guiding principles (operating rules) will help for the approximate equitable & judicious distribution of water available among the different category of uses and among the upper & lower reach users. The water deficit will get shared equitably in proportion with the demands .These guiding principles will help for the integrated operation of reservoirs for conservation uses during filling (monsoon) period to achieve the objectives. This operating strategy of integrated operation of reservoirs will mitigate this verity of water stress/ scarcity situation.

Table : 5 (As per GSG-I)

Distribution of Utilizable Water Available in the Upper Godavari (upto Paithan dam) Sub-basin among the various complex/systems of Reservoirs under different conditions of Probabilities of Inflows in Paithan dam

Strategy No.	Scenario						Utilizable Water including Kharif/Monsoon Use (Mcum)					
	Complex →						Mula	Pravara	Gangapur	Godavari - Darna	Palkhed	Paithan
	Dams/Systems in complex →						Manchol, Mula	Bhandardara, Nilwande, Adhala, Bhojapur	Gangapur, Kashyapi, Gautami	Alandi, Kadwa, Bham, Bhawali, Waki, Darna, Mukane, Waldevi	Karanjwan, Waghad, Punegaon, Ojharkhed, Palkhed, Tisgaon	Paithan
	Design Live storage (Mcum) →						617.59	570.77	308.56	718.38	350.34	2170.94
	Carry over (Mcum) →						25.32	0.00	11.64	0.00	0.00	381.70
	Design Water Use (Mcum) →						717.78	835.84	324.81	1220.04	456.52	2618.59
1	2						3	4	5	6	7	8
	Paithan observed Net Inflow at	% Demands										
		D-NI	I-NI	K-I	R-I	HW-I						
1	100% dep. Year	80	80	80	0	0	331.45	320.33	198.50	460.69	253.98	1178.67
2	90% dep. Year	80	80	80	32	0	430.04	425.38	235.76	604.00	253.98	1554.62
3	75% dep. Year	80	80	80	52	0	517.25	500.44	263.61	736.26	287.41	1780.43
4	50% dep. Year	80	80	80	72	0	604.56	674.96	288.43	870.25	345.36	2027.12
5	Average yeld	80	80	80	80	0	638.39	605.16	298.15	917.52	368.54	2113.94
6	Good year	100	100	100	100	100	717.78	835.84	324.81	1220.04	456.52	2618.59

Table 5 (As per GSG-II)

Distribution of Utilizable Water Available in the Upper Godavari (up to Jayakwadi Dam) Sub basin among the various complex/systems of Reservoirs under different conditions of probabilities of Inflows in Jayakwadi dam.

Strategy No.	Scenario						Utilizable Water including Kharif/.Monsoon Use (MCum) (seven Medium projects)						
	Complex						Mula	Pravara	Gangapur	Godavari-Darna	Palkhed	Jayakwadi	Shivna Complex
	Dams/System in Complex						Mand ohol, Mula	Bhandardara, Nilwande, Adhala, Bhojapur	Gangapur, Kashyapi. Gautami	Alandi, kadwa, Bham. Bhawali, Waki, Darna, Mukane, Waldevi	Karanjwan, Waghad, Punegaon, Ozarkhed, Palkhed, Tisgaon	Jayakwadi	Tembhapuri, Dheku, Narangi, Bor Dahegaon, Ambadi, Shivna takli
	Design Live Storage (MCum)						725.98	594.73	335.47	737.08	387.12	2170.94	231.80
	Carry over (MCum)						28.32	0.00	11.64	0.00	0.00	381.70	0.00
	Design Water Use (MCum)						835.34	864.70	293.81	1054.28	505.08	2618.21	261.70
1	2						3	4	5	6	7	8	9
	Jayakwadi observed Net	% Demand											
		D-NI	I-NI	K-I	R-I	HW-I							
1	100% dep. Year	87.19	82.92	80	0	0	263.63	385.98	207.53	426.05	218.39	938.23	48.14
2	90% dep. Year	87.19	82.92	80	32	0	371.84	409.75	214.04	529.49	256.30	1286.40	56.31
3	75% dep. Year	87.19	82.92	100	52	0	517.40	519.98	219.08	674.72	330.28	1644.63	71.49
4	Average Yield	87.19	82.92	100	80	0	606.05	608.59	223.86	757.16	401.60	2210.17	80.91
5	Good year	100	100	100	100	100	705.39	836.93	264.02	971.42	458.32	2618.20	101.85

Table : 6 (As per GSG-I)

Table : 6

Upper Reservoirs' Storages to be synchronized with the state of Paithan dam storage for different Operating Strategies during filling (Monsoon) period

Operating Strategy	Utilizable Water including Kharif/Monsoon Use excluding carry over (Mcum) (% of Design Live Storage)					
Complex →	Paithan	Mula	Pravara	Gangapur	Godavari Darna	Palkhed
Dams/Systems in complex →	Paithan	Mandhol, Mula	Bhandardara, Nilwande, Adhala, Bhojapur	Gangapur, Kashyapi, Gautami	Alandi, Kadwa, Bham, Bhawali, Waki, Darna, Mukane, Waldevi	Karanjwan, Waghad, Punegaon, Ojharkhed, Palkhed, Tisgaon
1	2	3	4	5	6	7
Strategy -I	797 (37%)	303 (49%)	320 (56%)	187 (61%)	461 (64%)	254 (73%)
Strategy - II	1173 (54%)	402 (65%)	425 (74%)	227 (74%)	604 (84%)	254 (73%)
Strategy - III	1409 (65%)	489 (79%)	500 (88%)	252 (82%)	736 (102%)	287 (82%)
Strategy -IV	1645 (76%)	576 (93%)	575 (101%)	277 (90%)	870 (121%)	345 (99%)
Strategy - V	1738 (80%)	611 (99%)	605 (106%)	287 (93%)	918 (128%)	369 (105%)
Strategy -VI	2237 (103%)	689 (112%)	836 (146%)	313 (101%)	1220 (170%)	457 (130%)

Table: 6 (As per GSG-II)

Upper Reservoirs' Storages to be synchronized with the state of Jayakwadi dam storage for different Operating Strategies during filling (Monsoon) period .

All figures are in MCum.

operating Strategy	Utilizable Water including Kharif/.Monsoon Use (MCum) (% of design live storage)													
Complex	Jayakwadi		Mula		Pravara		Gangapur		Godavari-Darna		Palkhed		Shivna Complex	
Dams/System in Complex	Jayakwadi		Mandohol, Mula		Bhandardara, Nilwande, Adhala, Bhojapur		Gangapur Kashyapi Gautami		Alandi, kadwa, Bham, Bhawali, Waki, Darna, Mukane, Waldevi		Karanjwan, Waghad, Punegaon, Ozarkhed, Palkhed, Tisgaon		Tembhapuri, Dheku, Narangi, Bor Dahegaon, Ambadi, Shivna takli	
Design Live Storage	2170.94		725.98		594.73		335.47		737.08		387.12		231.80	
Carry over	381.70		28.32		0.00		11.64		0.00		0.00		0.00	
Design Water Use	2618.21		835.34		864.70		293.81		1054.28		505.08		261.70	
Strategy -I	557	26	235	32	386	65	196	58	426	58	218	56	48	21
Strategy – II	905	42	344	47	410	69	202	60	529	72	257	67	56	24
Strategy - III	1262	58	489	67	520	87	207	62	675	92	331	86	71	31
Strategy -IV	1808	83	578	80	609	102	212	63	757	103	402	104	81	35
Strategy - V	2237	103	677	93	837	141	252	75	971	132	458	118	102	44

Equitable Allocations

1) In 90% / 75% dependable year. the available water scenario indicates that there is no adequate water to satisfy all design demands. Thus. following allocations are proposed;
Domestic : 87.19% of Sanctioned Use
Industry : 82.92% of Sanctioned Use (It is expected that minimum 10% demand shall be satisfied by recycling the domestic waste water).
Kharif : 80% / 100% of Planned Kharif Water Use. Rabi :32% / 52% of Planned Rabi Water Use. H.W. : NIL.

2) All complexes except Palkhed, satisfy above mentioned allocations. Carryover will have to be used in Jayakwadi.

3) In year when it is decided to use this Strategy, if the balance water available for Jayakwadi Project (i. e. column no 16) is more than balance yield after total use of Jayakwadi .(i.e. column no 15), Then the strategy will be applicable, Otherwise quantity of release of water to Jayakwadi shall be restricted to balance water available for Jayakwadi Project.

Above mentioned guiding principles are formulated based on the data supplied by the GMIDC authorities. The review and updating of these principles may be done after lapse of 5 years or shorter period as decided by the Government, taking into account;

(i) Additional data regarding water availability

(ii) Climatic or hydrological changes might have occurred subsequently.

(iii) Technologies for water resources development & management may have changed significantly.

(iv) Difficulties faced in the implementation of the proposed guiding principles.

(v) Changes in water resources planning scenario of sub-basin.

13.6 Key Operating Specifications: The guiding principles of integrated reservoir operation shall give emphasis on following two issues.

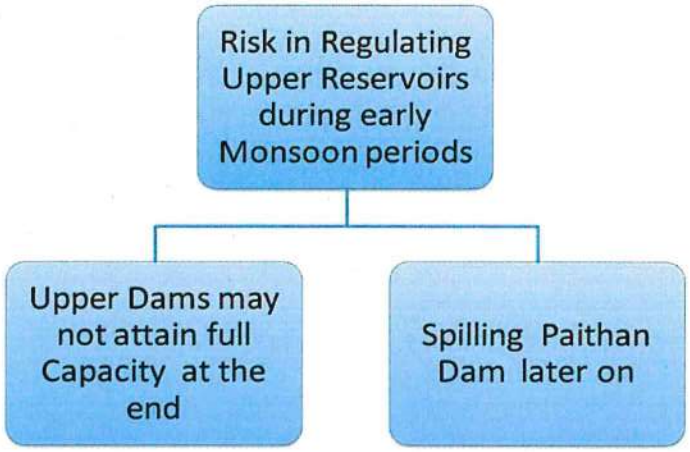
(i) Quantity: How much water to be stored and released at upper dams.

(ii) Period: When water to be stored and released at upper dams.

As per the discussion of Godawari Study Group-II it is seen that

(1).The rainfall characteristics of the upper and lower reaches of the sub-basin shows that about 80 to 85% of monsoon rainfall is received by the end of August in upper reaches and whereas in the lower reach areas, the rainfall during the month of September and October is quite predominant. (2)The analysis of observed net yield at Jayakwadi dam has revealed that inflows in Jayakwadi dam are received predominantly during the month of August to September from upper reach catchments after fulfilling the storage requirements of upper dams and September to October from lower reaches (free catchment).

If the upper reservoirs' storages are regulated / synchronized with the state of Jayakwadi Project storage since beginning of monsoon as per the guiding principles of reservoir operation, it will



create paradoxical situation. This situation is explained in Fig. 13

If the water is released from upper reservoirs in the month of July or August for

synchronizing the storage in Jayakwadi dam, and if, Jayakwadi dam becomes full to its capacity and surplus later due to rains in free catchment in the month of September and October; replenishment of upper storages is not possible. Upper reservoirs may not attain full storage capacity at the end of monsoon The water cannot be transferred from lower to upper reservoirs due to the principles of gravity. GWDT award allows the Maharashtra to use all waters up to Jayakwadi dam on the Godavari River .The spilling of water from Jayakwadi dam without attaining full storage capacity in upper reservoirs, is a loss to the State. Hence, it is logical to regulate the upper reservoirs as per the guiding principles starting from the end of mansoon (1st week of November every year) based on assessment of utilizable water available and availability of actual live storage in the individual reservoirs and systems of reservoirs (complex) at the end of October .The release of water for synchronizing the storages in various complex shall be affected in the month of November, and latest by 15th Nov. every year. If the releases are made in this period, there will be minimal transit losses in the carrier system.

13.7 Real Time Integrated Operation of Reservoirs:

Water which was once considered as abundant and has now become a scarce and economic resource. There is a water stress situation in Upper Godavari (up to Jayakwadi dam) sub-basin. The water resources management is challenging task because of the ever-increasing demands. There is an urgent need for conservation of available water resources and its judicious, equitable distribution among the different category of uses and among the stakeholders, using scientific approach.

At present, the water resources projects are mostly operated and managed considering them as a single entity, instead of attempting integrated operation for deriving optimum and equitable benefits. The operation of reservoirs based on semi-rigid operation rules, which are developed taking into account the various demands and historic / synthetic time series inflow data, often poses difficulties in making appropriate reservoir release decisions due to uncertainty in the probability of occurrence of inflows. Integrated operation of reservoirs in systems of reservoirs become an operation in real time in which water control decisions must be taken at each instant of time.

The current water demands for various purposes, the available storage in individual reservoirs and the distribution of utilizable water available among the reservoirs and among the various complex will have to be considered to develop a coordinated plan to produce the optimum benefits and minimize water losses due to evaporation and transmission. In the reservoir complex, since a greater number of reservoirs are involved, the regulation schedules for reservoirs operated as part of the complex should be prepared separately for each reservoir, based on the integrated plan of operation of reservoirs. Then, the

independent schedules/ estimates should be simulated with a hypothetical operation of the complex, to ensure that complex targets are satisfied, project objectives are maximized and an equitable distribution of water within the complex/systems of reservoirs is maintained.

In Upper Godavari (up to Jayakwadi dam) sub-basin, the reservoir operation will involve a large number of stakeholders with different category of uses such as domestic, irrigation, industry, hydropower, and flood control. Thus, optimization of reservoir operation will be complex, multi-purpose optimization problem where equitable solutions between the often-conflicting category of uses are required. Real time operation will help in avoiding the situation of spilling from Jayakwadi dam at the state when the upper reservoirs are not full to their capacities.

In order to avoid such situation it is necessary to develop the computer-based techniques and applications of system engineering techniques for real time integrated operation of reservoirs with the real time data acquisition system (RTDAS) and flood forecasting model in the Upper Godavari (up to dam) sub-basin immediately.

13.8 Status of Real Time Data Acquisition System:

Information about various Real Time Data Acquisition System centers installed in Upper and Lower catchment area of Jayakwadi Dam in Godavari River basin through Chief Engineer, Hydrology and Dam Safety, Nashik under National Hydrology Project is as below :

Godavari River, one of the major rivers in Maharashtra, has the largest catchment area, accounting for 49.5% of the total river basins. It originates at Trimbakeshwar in the Nashik District and stretches for a total length of 1,465 km, ultimately flowing into the Bay of Bengal near Rajamahendri in Andhra Pradesh. The Godavari River's catchment area spans approximately 313,389 square kilometers across the states of Maharashtra, Telangana, Odisha, and Andhra Pradesh. Within Maharashtra, the river covers length of approximately 668 km and an area of 152,588 square kilometers. The river flows primarily through the districts of Nashik, Ahmednagar, Chhatrapati Sambhaji Nagar, Jalna, Beed, Parbhani, Nanded, and Gadchiroli in Maharashtra before entering the state of Telangana.

The Work of supplying, installing, testing, commissioning, and maintaining of Real Time Data Acquisition Systems in the Godavari River Basin is been carried out by the Hydrology Project Division, Chhatrapati Sambhaji Nagar under the Nodal officer, National Hydrology Project & Chief Engineer, Hydrology and Dam Safety in Nashik. The installation of these Real Time Data Acquisition Systems was carried out between 2021 and 2024.

Currently, the installation of various Automatic Rain Gauge Stations (ARG), Automatic Weather Stations (AWS), Automatic E-PAN Stations, Automatic Water Level Recorder (AWLR) Stations, and Gate Sensors for real-time data collection is completed under the

Real Time Data Acquisition System. These systems are being installed under the guidance and supervision of SPMU (SW), Maharashtra, in the catchment areas of the Godavari River basin and at various dam sites. This system works for the automatic measurement of hydrological parameters at automated stations, with the real-time collection and dissemination of this data on digital platforms. The data collected serves as a quick decision support system for flood control to Command Area Development Authorities (CADA) in Maharashtra. This system is a valuable tool for planning new or proposed projects and allows for rapid analysis of information, especially useful in flood situations, through the RTDAS system.

Currently, various tender works of Supply, Installation, Testing, Commissioning, and Maintenance of the Real Time Data Acquisition System have been executed under Hydrology Project Division in Chhatrapati Sambhaji Nagar, Nagpur, and Amravati. The following Real Time Data Acquisition System (RTDAS) Stations have been installed.

Real Time Data Acquisition System, sensor details:-

Sr. No.	Basin	ARG / ARS	AWS	AWLR River	AWLR Dam	E-Pan	Spillway Gate Sensor / Dam	Total Data Logger Wise
1	Upper Godavari (Upstream Jayakwadi Dam)	139	7	23	30	22	215	244
2	Lower Godavari (Downstream Jayakwadi Dam up to state border)	81	21	10	20	23	237	128

14.0 Mechanism for Effective Implementation:

Terms of Reference (2) for the study group is to develop mechanism for the effective implementation of the guiding principles. The concept of operation of reservoirs considering it as a single entity must be give way to the concept of integrated reservoir operations in the sub-basin. In the Upper Godavari (up to Jayakwadi dam) sub-basin, there are seven(7) complex/systems of reservoirs. In the reservoir complex, since more number of reservoirs / dams are involved, the decision regarding operation of reservoirs would be taken at higher level than authority

competent for operation of individual reservoir system. Generally, the authority of the entire catchment will be authority responsible for the integrated operation of reservoirs in the sub-basin. In this sub-basin, the Executive Director, Godavari Marathwada Irrigation Development Corporation (Godavari Marathwada RBA) will be the authority who would be responsible for operation of all complex and Decision Support System so developed by MRSAC, Nagpur shall be placed under him.

1. The Memorandum of Understanding (MOU) between ED, GMIDC, Chhatrapati Sambhajinagar and MRSAC, Nagpur "for development of Plug-in-Software module along-with five parameters (viz. Rainfall related indices, Remote sensing based vegetation related indices, crop situation related indices, soil moisture based indices and hydrological indices as per Drought Manual of Government of India) used in MahaMADAT Geo-portal to decide exact amount of water to release from upstream dams to Jayakwadi Dam" is signed on 25th April, 2024.

   This is done along with the PRAVAH App of WRD. MRSAC will develop specialized software that takes into account five key parameters related to drought, as well as the storages of all dams within the study area and the utilization of water for Kharif crops and non-irrigation requirement also irrigation requirement as per prevailing strategy of G.S.G.-II report at each dam by October 15th of every year. The software will be designed to operate autonomously, without requiring human intervention, streamlining the process, and ensuring accuracy in water release decisions.

2. A Godavari Reservoirs Regulation Group shall be established permanently headed by the Executive Director, GMIDC (RBA), Chh. Sambhajinagar The concerned Superintending Engineers and CADA administrators will be the members of the Group. This Group shall be responsible for the operation of reservoirs in the entire sub-basin. The Group is expected to contact MRSAC, Nagpur to make necessary changes in the Plug-in software every year or as per requirements & changes in various Government policies experiences received during water releases in scarcity period and rules in this regard. Also, in order to make changes, validation of data and other related information specific access shall be given to concern Engineers working in this Group.

15.0 Conclusions :

The overall conclusions of the Godavari Study Group-II are as follows:-

15.1 The study group has observed following major changes, additions and alterations in the Upper Godavari Basin.

15.1.1 Domestic and Industrial water use and comparison with actual use (2022-23)

S.N	Particular	GSG-I (2013) (Sanctioned scheme)	GSG-II (2024) (active scheme)	% increase / decrease	Actual use (2022-23)	% of Actual use with active scheme
Upstream of Jayakwadi						
a	Domestic use	409.82 MCum	586.05 MCum	(+) 43.00	659.92	112.60
b	Industrial use	122.33 MCum	123.13 MCum	(+) 0.006	51.17	41.55
	Total	532.15 MCum	709.18 MCum	(+) 33.26	711.09	100.26
Jayakwadi project						
a	Domestic use	283.27 MCum	401.90 MCum	(+) 41.88	75.03	18.66
b	Industrial use	160.74 MCum	117.27 MCum	(-) 27.04	41.82	35.66
	Total	444.01 MCum	519.17 MCum	(+) 16.93	116.85	22.50

This is mainly due to increase in domestic and industrial water use in upstream of Jayakwadi project and consideration of only active non-irrigation schemes. It is observed that, for non irrigation purpose, actual water use is less as compared to sanction water use of active schemes of Jayakwadi project.

15.1.2 Upstream Design (Plan) utilizations:

Complex	A.A. Provision (1964 &1985) (MCum)	CDO Study (2001) (MCum)	CDO Study (2004) (MCum)	GSG-I (2013) (MCum)	MWRRA report (2018)	GSG-II (2024) (MCum)
(A)Major Projects						
1)Mula	807.03	824.73	824.73	704.63	704.60	704.61
2)Pravara	736.24	753.23	753.23	786.41	782.54	781.93
3)Gangapur	226.54	222.68	222.68	169.61	231.82	231.82
4)Godavari-Darna	940.13	948.93	948.93	1204.49	886.48	967.83
5)Palkhed	447.41	444.58	444.58	456.52	468.41	468.41
Total Major Projects	3157.35	3194.16	3194.16	3321.66	3154.56	3154.60

Complex	A.A. Provision (1964 &1985) (MCum)	CDO Study (2001) (MCum)	CDO Study (2004) (MCum)	GSG-I (2013) (MCum)	MWRRA report (2018)	GSG-II (2024) (MCum)
(B)Medium Projects	0.00	383.70	383.70	421.38	297.58	297.58
(C)Minor Projects	113.27	572.29	496.11	813.08	535.80	548.37
Grand Total (MCum)	3270.62	4150.20	4073.97	4556.12	3987.94	4000.55
Grand Total (TMC)	115.5	146.56	143.87	160.89	140.82	141.26

The major difference in GSG-I and GSG-II figures, is mainly due to the projects such as Kikvi, Upper kadava projects which is not yet started hence their water use is not considered and the change in Godavari canal & Nandur Madhameshwar express canal water use. The same has been corrected by MWRRA during its Report in 2018.

15.1.3 **The rainfall pattern:**

Observations in the Upper Godavari basin at various dam sites seems to follow the almost similar pattern as that GSG-I (Ref. para Chapter no.6, point No 5, Comparison Table 5.1 for details).

However, the impact of climate change on rainfall such as intensity, pattern and duration etc. is not studied by the Godavari Study Group-II. GSG-II recommends to establish the study centre or used the data from the various authorities. Godavari Reservoir Regulation Group shall analyze this data and suggest necessary recommendations or give factual information to MRSAC Nagpur as per requirement, in near future.

15.1.4 **Observed net yield at Jayakwadi Dam :**

SR. NO.	Dependability	Yield as per GSG-I (2013) (1975-2012) 38 years		Yield as per GSG-II (2024 (1975-2022) 48 years	
		MCum	TMC	MCum	TMC
1	100 %	122.05	4.31	174.27	6.15
2	90 %	528.79	18.67	541.45	19.11
3	75 %	816.53	28.83	844.21	29.80
4	50 %	2067.51	73.00	1753.44	61.91
5	Average	2356.34	83.20	2214.42	78.19

15.2 Sharing water deficit:

The "Sharing water deficit" is considered as per the Criteria for distribution of surface water entitlements by River Basin Agencies for Domestic and Industrial Use" as published by MWRRA on 22nd September, 2017, is as below:

S. N.	Jayakwadi observed net	% Demands As per GSG-I (2013)					% Demands As GSG-II (2024)				
		D-NI	I-NI	K-I	R-I	HW-I	D-NI	I-NI	K-I	R-I	HW-I
1	100% dep. Year	80	80	80	0	0	87.19	82.92	80	0	0
2	90% dep. Year	80	80	80	32	0	87.19	82.92	80	32	0
3	75% dep. Year	80	80	80	52	0	87.19	82.92	100	52	0
4	Average yield	80	80	80	80	0	87.19	82.92	100	80	0
5	Good Year	100	100	100	100	100	100	100	100	100	100

(The detail analysis is given in Chapter 6, para 8.1.1)

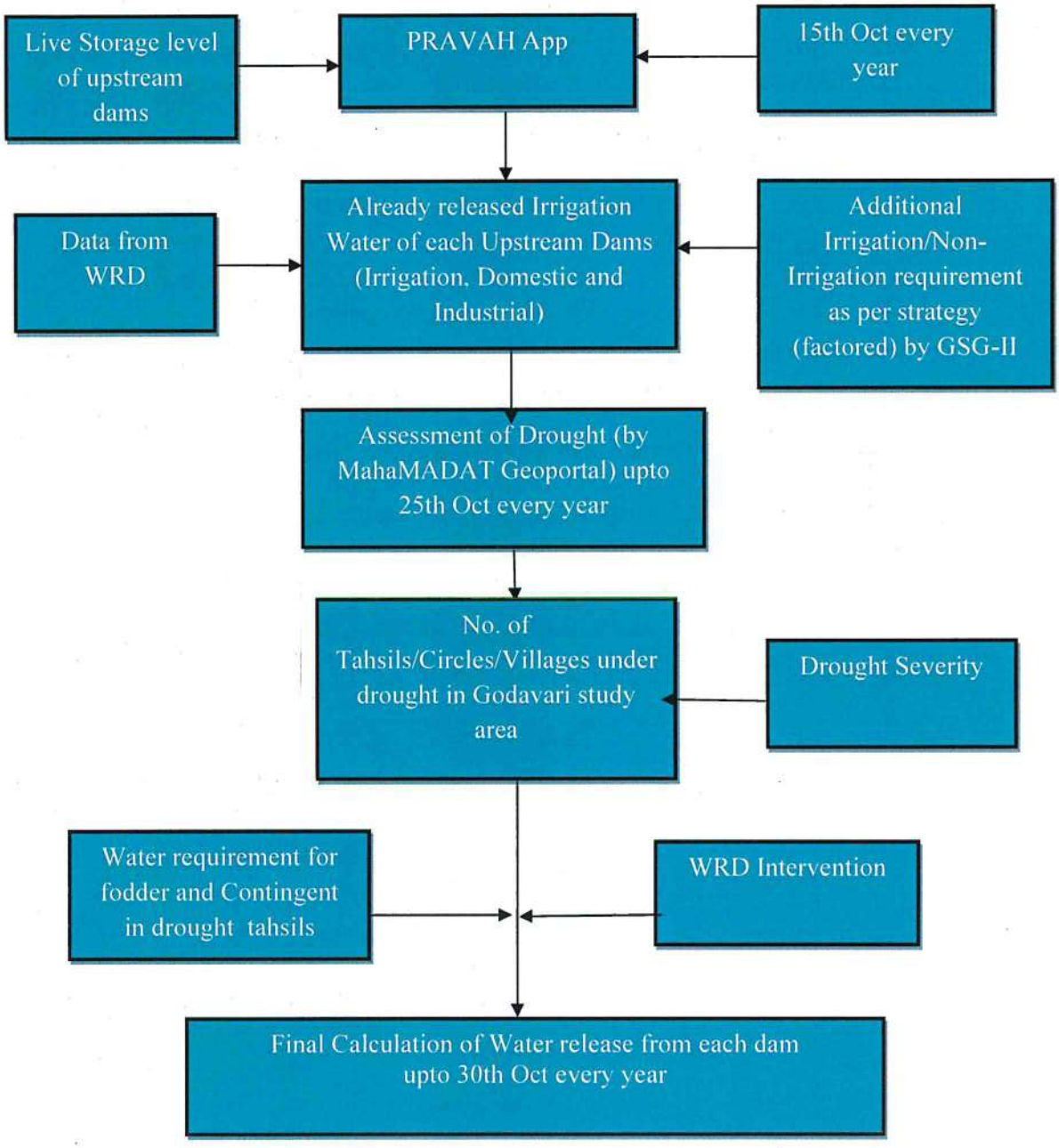
15.3 MahaMADAT software by MRSAC Nagpur

The Memorandum of Understanding (MOU) between ED, GMIDC, Chhatrapati Sambhajinagar and MRSAC, Nagpur "for development of Plug-in-Software module along-with five parameters (viz. Rainfall related indices, Remote sensing based vegetation related indices, crop situation related indices, soil moisture based indices and hydrological indices as per Drought Manual of Government of India) used in MahaMADAT Geo-portal to decide exact amount of water to release from upstream dams to Jayakwadi Dam" is signed on 25th April, 2024.

This is done along with the PRAVAH App of WRD. MRSAC will develop specialized software that takes into account five key parameters related to drought, as well as the storages of all dams within the study area and the utilization of water for Kharif crops and non-irrigation requirement also irrigation requirement as per prevailing strategy of G.S.G.-II report at each dam by October 15th of every year. The software will be designed to operate autonomously, without requiring human intervention, streamlining the process, and ensuring accuracy in water release decisions.

The flowchart is as below:

Flow Chart



15.4 The study group has observed that some of the directions given by MWRRA for effective implementation regarding release of water is yet to be implemented by the River Basin Agency,

These are as below:

(i) To establish two river gauging stations one at Kamalapur to measure the quantity of water actually reached for Jayakwadi dam out of the releases from Darna, Gangapur & Palkhed Complexes and another at Madhameshwar to measure the quantity of water actually reached for Jayakwadi dam out of the releases from Mula & Pravara.

(ii) To estimate realistic river losses considering the dryness / wetness of the river, depressions in the riverbed, and quantity that can be obstructed against the sill of the K. T. Weirs etc.

(iii) The Chief Engineer, Hydrology and Dam Safety, Nashik has to maintain the river gauging stations at Kamalapur and Madhameshwar, measures the water received at these gauging sites and reports it to ED, GMIDC, Chhatrapati Sambhajinagar and MWRRA.

15.5 Evaporation from Reservoir Jaykwadi (Jayakwadi Dam) :

The planning of Jayakwadi Dam was done considering the annual lake evaporation losses of 664.83 MCum in 1965. However, as per Govt. Resolution dated 12/09/2018, the evaporation losses is worked out to be 323.10 MCum. The evaporation losses are as below:

Sr. No.	Dependability %	Year	Available yield (MCum)	Evaporation losses (MCum)
1	100%	2012-13	174.27	206.71
2	90%	2022-23	541.45	214.26
3	75%	1993-94	844.21	288.65
4	Average	1977-78	2198.86	323.10
5	Good year	2017-18	2465.23	323.10

Thus, it is necessary to study the evaporation losses of all the upstream major and medium storage reservoirs including Jayakwadi Projects.

15.6 Jayakwadi Project hydrological and water use status:

The study group has compared the approved water use of Jayakwadi Project as per administrative approval (1965) with the sanctioned water uses of various upstream reservoirs. It is seen that there is shortfall in approved planned water use. This is mainly due to increase in Minor projects for which the planned limit of 4 TMC has been considerably increased also as per local requirement, water utilization through K. T. weir has been increased, along with express canal water utilization in Nandur Madhyameshwar (Darna) system for Marathwada. Also, Medium and Minor projects have been constructed in Marathwada region. Considering the above facts, it is necessary to study the variation between planned utilization and actual utilization of the upstream reservoirs of the upper Godavari Basin. So that the necessary steps can be taken in future for equitable distribution. Also, as per the data available from year 1980-81 to 2017-18, it is seen that the actual water use of upstream side projects is less than, 115 TMC i.e. the approved water use.

15.7 Water use efficiency:

Adoption of drip and sprinkler irrigation methods for increasing water use efficiency may be made mandatory within a period of 5 years henceforth, as envisaged in Section 14 subsection (4) of MWRRA Act. The Government may consider this sub basin as a pilot sub basin for converting the gravity irrigation into micro irrigation system. The WALMI, Chhatrapati Sambhajinagar shall be given lead role to conduct various courses for farmers and water users associations, to increase water use efficiency. The WALMI shall, also, undertake on form training courses.

15.8 Pipeline network from upstream reservoir to Jayakwadi project :

The study group has discussed use of pipeline network from upstream reservoir to Jayakwadi project for release of water, so as to reduce conveyance losses during transit. However, considering the distance and cost involved, this possibility is ruled out by the study group.

15.9 Lift Irrigation Scheme on upstreme reservoirs and Jayakwadi Project :

There are number of private / Government LIS schemes in the backwater of irrigation projects including Jayakwadi project. This affects the measurements of water inflow in Jayakwadi during release of water from upstream reservoir. A detailed study regarding number of LIS schemes , area irrigated, HP sanctioned, water use etc. needs to be done in the coming years so that the water use of this LIS can be accounted for and necessary precautions may be taken during release of water from upstream reservoirs. In nutshell all the LIS schemes including Government and Private, needs to be mapped.

Also, the water user Association (WUA's) shall be formed based on MMISF Act 2005. And water meters as water measuring devices shall be made compulsory / mandatory to all these water user Association and individual water users as the case may be.

15.10 Sedimentation Survey :

The Godavari Study Group-II has considered the sedimentation analysis based on "The Status Report on Capacity Assessment of Reservoirs in Maharashtra", a publication of MERI, Nashik while considering the live storage capacity of various reservoirs in the Upper Godavari basin during formulation of report. The review of sedimentation analysis shows that, the Godavari Study Group -II proposes to carry out the reservoir sedimentation of all remaining dams of various complex in the Upper Godavari basin and update the live storages in the reservoirs within next five years, so that the exact impact of sedimentation can be considered while formulation the reservoir water release strategy from upstream reservoirs to Jayakwadi Project, in further report/coming years.

15.11 Water diversion schemes/river linking projects :

Water diversion schemes/river linking projects are proposed to divert water from surplus basin of Kokan region to deficit Godavari basin. A detailed study shows that the short fall can be met with these river diversion schemes. The government shall take necessary steps to compensate the shortfall of water by constructing water diversion scheme/river linking projects at earliest and proper distribution of surplus water available from this river linking projects.

The water available through river linking projects shall be used to cater the deficit in Jayakwadi Project. Some of river linking projects are completed and others will be completed in near future.

The quantum of water received in Upper Godavari basin shall be measured and such quantum of water shall be released to Jayakwadi Project. However, for determination of various losses to be considered for water available from river divergent schemes, a methodology of the same shall be derived in due course, so that there shall not be any disputes between stake holders of upstream and down stream side.

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CHAPTER : 7

RECOMMENDATIONS

Based on the discussions and various field details/conclusions the recommendations made by Godavari Study Group-II Committee are as below.

1.0 Recommendations :

1. Regulate the upper reservoirs considering parameters & plug in MRSAC software MahaMADAT along with PRAVAH app. based on the strategy for integrated operation of reservoirs with coordinated approach at Upper Godavari (up to Jayakwadi dam) sub-basin level in such away that likely water scarcity situation may not be attained in Jayakwadi project.

2. The GSG-I (2013) has recommended as "the upper reservoirs shall be regulated starting from the beginning of September on the basis of assessment of utilizable water available, rainfall forecast and availability of actual live storage in the individual reservoir sand systems of reservoirs (complex) at the end of August. The release of water from the various complex shall be effected in the month of September and latest by 15th October so that the Jayakwadi reservoir reaches at the level with actual live storage equals to or more than 33% of design lives Storage as on the 15thOctober", as short terms measures.

However, Godvari Study Group -II is of the opinion that, considering the Reservoir operations schedules (ROS) of various reservoirs, operation of Gates is possible only if, the necessary water content is available in that fortnight as per ROS, otherwise there is a possibility of shortfall in the live storage of reservoirs in upstream of Jayakwadi Project. Moreover, dams in the upper reaches are monsoon fed from June to September end. However, majority of inflow in the Jayakwadi comes from returning monsoon rain from 15th Sept to October end every year. Then in that case, if there is early release water from upstream dams, it may prove to be dangerous and these dams may not fill and due to returning monsoon. Jayakwadi project may get more inflow which may have to be released from reservoir.

3. The guiding principles (operating rules) for operating strategy-I presented in Table: 6 shall be followed for releasing water from the various complex. The MWRRA vide it's order dated 19th September, 2014 in Case no. 01/2014, stated in point 10 (e)" that, if the natural storage of Jayakwadi Dam in the first fortnight of October is above or equal to 65% of the live storage (strategy-III), then the question of releasing water from the upstream storages does not arise".

The Godavari Study Group-II (2024) recommends that this percentage shall be brought down to 58% based on the additional data of last 10 years from 2013 to 2022 considered by study group. This is mainly due to increasing domestic and industrial water use in upstream reservoir of Jayakwadi project and consideration of only active non-irrigation schemes. Also, most of the schemes considered in Jayakwadi Project are either not completed or not in use (inoperative) due to various local problems, and the Irrigation / Non irrigation schemes which are not fully development not in fully operation shall be considered and exact requirement shall be assessed and due correction shall be made (by Executive Director, GMIDC, Chh.Sambhajinagar) at the time of release of water from upstream reservoirs.

Also, in the deficit year when the upstream reservoirs do not fulfill it's own non irrigation requirement a possibility to fulfill the non irrigation requirements through dead storage of the Jayakwadi dam shall be made as it has major dead storage.

4. Kharif irrigation requirement to the extent of crop water requirement worked out scientifically taking into consideration the conjunctive groundwater use, shall be met with from utilizable water from the respective systems of reservoirs/complex.

5. Diversion of monsoon flows through canals, flood canals and rivers/streams for kharif use out of project command area, feeding tanks, farm ponds etc. shall be allowed only after Jayakwadi Project reservoir level reaches to its full capacity.

6. Henceforth, the New Irrigation projects, surface storages/ water bodies should not be sanctioned in Upper Godavari Basin.

7. The study group has observed that some of the directions given by MWRRA for effective implementation regarding release of water from upstream reservoirs to Jayakwadi projects is yet to be implemented, by the River Basin Agency, these are as below:

(i) To establish two river gauging stations one at Kamalapur to measure the quantity of water actually reached for Jayakwadi dam out of the releases from Darna, Gangapur & Palkhed Complexes and another at Madhameshwar to measure the quantity of water actually reached for Jayakwadi Project, out of the releases from Mula & Pravara complex.

(ii) To estimate realistic river losses considering the dryness / wetness of the river, depressions in the riverbed, and quantity that can be obstructed against the sill of the K. T. Weirs etc.

(iii) The Chief Engineer, Hydrology and Dam Safety, Nashik has to maintain the river gauging stations at Kamalapur and Madhameshwar, measures the water received at these gauging sites and reports it to ED, GMIDC, Chhatrapati Sambhajinagar, and MWRRA.

8. The water stress situation/scenario in Upper Godavari (upto Jayakwadi dam) sub-basin is required to be managed with a well plan strategy of deficit sharing to ensure the approximate equitable and judicious distribution of available water resources as contempleted in MWRRA Act,2005 and State Water Policy, adopting sub-basin as a unit. A concept "Sharing Water Deficit" as defined and a procedure given by MWRRA in its order dated 22nd September, 2017" criteria for distribution of surface water entitlements by River Basin Agencies for Domestic and Uses" is considered by the Godavari Study Group-II for various cuts adopted for Domestic and Industrial uses rto share water deficit in Upper Godavari sub-basin..

9. The GSG-I Report (2013) has recommended, "to develop computer based techniques and applications of system engineering techniques with the technical assistance of national/international Institutes or Consultants for real time integrated operation of reservoirs with the real time data acquisition system (RTDAS) and flood forecasting model in the Upper Godavari (upto dam) sub-basin as a long term measure for release of water from upstream reservoirs to Jayakwadi Projects" .

As per recommendation of GSG-II, Executive Director, GMIDC, Ch. Sambhajinagar, executed 3 years MOU with MRSAC, Nagpur to develop Plug in software which is the Decision Support System, a computer based programme preparted by MRSAC, Nagpur by plugging of water reservoir storage data through WRD PRAVAH App along with drought declaration software MahaMADAT which is developed by MRSAC, Nagpur and operative since 2018 so the strategy for integrated operation of all the major and medium project reservoirs shall be adopted GSG-II to recommends to involve MRSAC, Nagpur in future also.

10. The Godavari Study Group-II has considered the sedimentation analysis based on "The Status Report on Capacity Assessment of Reservoirs in Maharashtra", a publication of MERI, Nashik while considering the live storage capacity of various reservoirs in the Upper Godavari basin during formulation of report. The review of sedimentation analysis shows that, the Godavari Study Group -II proposes to carry out the reservoir sedimentation of all remaining dams of

various complex in the Upper Godavari basin and update the live storages in the reservoirs within next five years, so that the exact impact of sedimentation can be considered while formulation the reservoir water release strategy from upstream reservoirs to Jayakwadi Project, in further report/coming years.

11. **Evaporation from Reservoir Jaykwadi (Jayakwadi Dam)** The planning of Jayakwadi Dam was done considering the annual lake evaporation losses of 664.83 MCum. However, as per Govt. Resolution dated 12/09/2018, the evaporation losses work to be 323.10 MCum. As per detailed discussions, the 90% & 75% dependable year information of evaporation losses provided by SE, CADA, Chhatrapati Sambhajinagar is 214.26 MCum. & 288.65 MCum. respectively.

It is necessary to study the evaporation losses of Jayakwadi reservoir in the coming years to get exact evaporation losses. Chief Engineer, Hydrology and Dam Safety, Nashik shall monitor and assess this measurement as a third party.

12.0 While construction of new dams, it is suggested to provide a river sluice in the body of dam especially Kikwi and Upper Kadawa project to regulate reservoir operations during monsoon period in systems of reservoirs / complex.

13. A Godavari Reservoirs Regulation Group shall be established permanently headed by the Executive Director, GMIDC (RBA), Chh. Sambhajinagar The concerned Superintending Engineers and CADA administrators will be the members of the Group. This Group shall be responsible for the operation of reservoirs in the entire sub-basin. The Group is expected to contact MRSAC, Nagpur to make necessary changes in the Plug-in software every year or as per requirements & changes in various Government policies experiences received during water releases in scarcity period and rules in this regard. Also, in order to make changes, validation of data and other related information specific access shall be given to concern Engineers working in this Group.

14. Review and updating of operating rules (guiding principles) as presented in Table: 7 may be done after lapse of 5 years or at shorter period as decided by the Government, taking into account the difficulties faced in the implementation and changes in water planning scenario of sub-basin.

A Godawari Reservoir Regulation Group headed by the Executive Director, GMIDC(RBA), Chh.Sambhajinagar. This Group shall be responsible for the operation of reservoirs in the entire sub-basin. The Group is expected to consult and/or meet fortnightly or more frequently in monsoon period for assessment of water availability and review, and take decisions for the integrated operation of reservoirs in the sub-basin on the basis of principles given in this report with more coordinated approach with help of Plug in software developed by MRSAC.

15.0 The carry over storage is a additional storage capacity provided within the live storage to meet shortages during the bad years. Such storage shall not be used during good years and normal years.

16.0 During the period of floods, the normal reservoir capacity regulation shall be switched over to the flood moderation regulation.

17. Water use efficiency:

Adoption of drip and sprinkler irrigation methods for increasing water use efficiency may be made mandatory within a period of 5 years henceforth, as envisaged in Section 14 subsection (4) of MWRRA Act. Government may consider this sub basin as a pilot sub basin for converting the gravity irrigation into micro irrigation system.WALMI Ch.Sambhajinagar shall be give role to conduct various courses for farmers , Water User Associations to increase water use efficiency. WALMI shall also undertake onfarm training courses.

18. For Lift Irrigation Schemes on upstream reservoirs and Jayakwadi Project

i) The number of private/government LIS schemes shall be mapped permanently which are lifting water from submergence of projects, Project Authority shall give them some permanent authorized identification in form of QR code fixed to their pump or lifting stations which shall provide information area sanctioned, H.P sanctioned. Water Users Association shall be formed for the group of farmers. Measuring devices i.e water meters shall be made compulsory for individual and Water Users Associations so as to assess exact water use.

ii) The government shall revised the terriff for LIS Water Users Associations so as to encourage them for forming Water Users Associations for LIS.

19. Sedimentation Study of Upstream projects and Jayakwadi Project.

The review of sedimentation analysis shows that, GSG-II proposes to carry out the Reservoir sedimentation of all the remaining dams of various Complex in the upper Godavari basin and update the live storages in the reservoirs within next 5 years so that, exact impact of sedimentation can be considered while formulation of the reservoir water release strategy from upstream reservoirs to Jayakwadi project in future analysis which is to be done by MRSAC, Nagpur.

20. Water Diversion scheme / river linking project

The water available through river linking project shall be used to cater the deficit in Jayakwadi project. For releasing the water available from river diversion / river linking Project, to cater the deficit in Jayakwadi project the Government shall establish the mechanism for measurement and distribution after the completion of river diversion / river linking Project. The quantum of water received in Upper Godavari basin shall be measured and such quantum of water shall be released to Jayakwadi Project. However, a methodology for determination of various losses to be considered for water available from river diversion schemes shall be derived in due course.

Table: 7 (As per GSG-II)

Upper Reservoirs' Storages to be synchronized with the state of Jayakwadi dam storage for different Operating Strategies during filling (Monsoon) period .

All figures are in MCum.

operating Strategy	Utilizable Water including Kharif/,Monsoon Use (MCum) (% of design live storage)													
Complex	Jayakwadi		Mula		Pravara		Gangapur		Godavari-Darna		Palkhed		Shivna Complex	
Dams/System in Complex	Jayakwadi		Mandohol, Mula		Bhandardara, Nilwande, Adhala, Bhojapur		Gangapur Kashyapi Gautami		Alandi, kadwa, Bham, Bhawali, Waki, Darna, Mukane, Waldevi		Karanjwan, Waghad, Punegaon, Ozarkhed, Palkhed, Tisgaon		u/s Jaykawadi (Seven Medium Projects)	
Strategy -I	557	26	235	32	386	65	196	58	426	58	218	56	48	21
Strategy – II	905	42	344	47	410	69	202	60	529	72	257	67	56	24
Strategy - III	1262	58	489	67	520	87	207	62	675	92	331	86	71	31
Strategy -IV	1808	83	578	80	609	102	212	63	757	103	402	104	81	35
Strategy - V	2237	103	677	93	837	141	252	75	971	132	458	118	102	44

Equitable Allocations

1) In 90% / 75% dependable year, the available water scenario indicates that there is no adequate water to satisfy all design demands. Thus, following allocations are proposed;
   Domestic : 87.19% of Sanctioned Use
   Industry : 82.92% of Sanctioned Use (It is expected that minimum 10% demand shall be satisfied by recycling the domestic waste water).
   Kharif : 80% / 100% of Planned Kharif Water Use. Rabi :32% / 52% of Planned Rabi Water Use. H.W. : NIL.
2) All complexes except Palkhed, satisfy above mentioned allocations. Carryover will have to be used in Jayakwadi.
3) In year when it is decided to use this Strategy, if the balance water available for Jayakwadi Project (i. e. column no 16) is more than balance yield after total use of Jayakwadi .(i.e. column no 15), Then the strategy will be applicable, Otherwise quantity of release of water to Jayakwadi shall be restricted to balance water available for Jayakwadi Project.

Table : 7

Upper Reservoirs' Storages to be synchronized with the state of Paithan dam storage for different Operating Strategies during filling (Monsoon) period (one up-step)

Operating Strategy (one up-step)	Utilizable Water including Kharif/Monsoon Use excluding carry over (Mcum) (% of Design Live Storage)					
Complex →	Paithan	Mula	Pravara	Gangapur	Godavari - Darna	Palkhed
Dams/Systems in complex →	Paithan	Mandhol, Mula	Bhandardara, Nilwande, Adhala, Bhojapur	Gangapur, Kashyapi, Gautami	Alandi, Kadwa, Bham, Bhawali, Waki, Darna, Mukane, Waldevi	Karanjwan, Waghad, Punegaon, Ojharkhed, Palkhed, Tisgaon
1	2	3	4	5	6	7
Strategy - I	797 (37%)	402 (65%)	425 (74%)	227 (74%)	604 (84%)	254 (73%)
Strategy - II	1173 (54%)	489 (79%)	500 (88%)	252 (82%)	736 (102%)	287 (82%)
Strategy -III	1409 (65%)	576 (93%)	575 (101%)	277 (90%)	870 (121%)	345 (99%)
Strategy - IV	1645 (76%)	611 (99%)	605 (106%)	287 (93%)	918 (128%)	369 (105%)
Strategy -V	1738 (80%)	689 (112%)	836 (146%)	313 (101%)	1220 (170%)	457 (130%)

This Report is brought out unanimously by the Godavari Study Group-II (2024).

(M. S. Amale)
Superintending Engineer &
Administrator, CADA, Nashik,
(Member Secretary upto 31/07/2024)

(B. K. Shete)
Superintending Engineer &
Administrator, CADA, Nashik,
(Member Secretary from 01-08-2024)

(R. M. More)
Superintending Engineer
Dam Circle, Central Design Organization,
Nashik,
(Special Invitee Member)

(S. K. Sabbinwar)
Superintending Engineer &
Administrator CADA,
Chh. Sambhajinagar
(Special Invitee Member)

(S. B. Misal)
Chief Engineer, NMR,
WRD, Nashik
(Member)

(J. G. Gavali)
Chief Engineer & Chief Administrator,
CAD, WRD, Chh. Sambhajinagar
(Member)

(S. S. Pagar)
Chief Engineer, Hydrology &
Dam safety, Nashik
(Member)

(Dr. H. T. Dhumal)
Chief Engineer (SP), WRD, Pune
(Member)

(S. R. Tirmanwar)
Executive Director,
Godavari Marathwada Irrigation Development
Corporation, Chh. Sambhajinagar
(Member)

(P. G. Mandade)
Director General,
Design, Training, Hydrology, Research
& Safety, (MERI) Nashik
(Chairman)

Literature review :

In general, the following documents & literature are referred.

1. *Godavari Study Group-I Report, Shri H T Mendhegiri committee Report (2013).*
2. *.Detailed Project Reports of various Major and Medium Irrigation Projects planned and constructed in Upper Godavari (uptoJayakwadi dam) sub-basin.*
3. *IS-7323-1994 on Operation of Reservoirs-Guidelines.*
4. *IS-5477 (Part-1)-1999 on methods for fixing the capacities of Reservoirs*
5. *CDO Report on Jayakwadi-Majalgaon Simulation Studies (Nov.2001).*
6. *CDO Note on Water Availability Studies for Jayakwadi Project (May. 2004).*
7. *Maharashtra State Water Policy (July, 2003 & 2019)*
8. *.Maharashtra Water Resources Regulatory Authority Act, 2005*
9. *Maharashtra Water Resources Regulatory Authority (Allocation & Monitoring of Entitlements, Disputes and Appeals and other Matters), Rules, 2013.*
10. *The Report of the Godavari Water Disputes Tribunal with the Decision (Year 1979)*
11. *Study on "DSS for IWRM of Upper Godavari River Basin (uptoJayakwadi dam)" by Hydrology Project, Nashik (Year 2003).*
12. *Maharashtra Water Resources Regulatory Authority (Criteria For Distribution Of Surface Water Entitlements by River Basin Agencies for Domestic & Industrial Uses) September 2017.*
13. *Drought Ma nual 2020 & 2016.*
14. *Earlier report of MWRRA of GSG review -2018*
15. *IS-12182 -1987 Guidelines for determination of effect of sedimentation in planning & performance of Reservoirs*
16. *Compendium on Sedimentation of Reservoirs in India.-2020.*
17. *The Status Report on Capacity Assessment of Reservoirs in Maharashtra,* Year 2020, A Publication of MERI, Nashik (MS)
18. *G.R. of Revenue & Forest Department Marathi no. scy-2018/pra.kra.-89/M-7/ Dated 6th Nov. 2018 & 10th Nov.2024*
19. *G.R. of Environment Department Marathi no. Meeting-2013/pra.kra.-63/Tech. No. -1/ Dated 25th Oct. 2017 on Policy of Impact of Climate Change in Maharashtra.194 rder*

20. *web site of Animal Husbandry Dept. Govt. of Maharashtra for District wise animal husbandry data & area.*
21. *Animal Husbandry Dept. Dy. Director circular for fodder requirement dated 08/04/2024*
22. *District water conservation officer Nashik, Ahmednagar & Chhatrapati Sambhaji nagar. Data of percolation tank/village tank/ k.t. weir etc.*
23. *website of revenue dept. for revenue circle information.*
24. *PRAVAH App. of W.R.D.*
25. *MOU of MRSAC.*

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Statements

Statement - 1

Statement Showing Live Storage Below & Above Crest of Spillway in Various Gated Upstream Dams of Upper Godavari (up to Paithan dam) Sub Basin

Sr. No.	Name of dam	Type of overflow section	Design Live storage in Mcum	Revised live storage (Excluding silt as per survey) in Mcum	Live storage below crest of spillway (Excluding silt as per survey) in Mcum	Live storage above crest of spillway (Excluding silt as per survey) in Mcum	% of live storage below crest level of spillawy (Excluding silt as per survey) in Mcum	Mandatory live storage	
								Percentage	Storage in Mcum
1	2	3	4	5	6	7	8	9	10
1	Mula	Gated	608.81	546.91	243.24	303.67	45	54	295.33
2	Bhandardara	Gated	304.10	307.61	184.69	122.92	60	54	166.11
3	Nilwande	Gated	228.75	228.75	178.01	50.74	78	54	123.53
4	Gautami	Gated	52.90	46.13	36.83	9.30	80	54	24.91
5	Kashyapi	Gated	51.75	59.06	43.18	15.88	73	54	31.89
6	Gangapur	Gated	203.88	159.42	78.54	80.88	49	54	86.09
7	Kadwa	Gated	52.90	50.59	15.82	34.77	31	54	27.32
8	Darna	Gated	219.82	188.66	91.69	96.97	49	54	101.88
9	Mukane	Gated	204.98	198.39	105.97	92.42	53	54	107.13
10	Karanjwan	Gated	166.22	152.00	79.13	72.87	52	54	82.08
11	Punegaon	Gated	17.57	16.64	4.10	12.54	25	54	8.99
12	Palkhed	Gated	21.24	18.49	2.74	15.75	15	54	9.98
13	Waki	Gated	70.57	70.57	46.86	23.71	66	54	38.11
		Total	2203.49	2043.22	1110.80	932.42	54	54	1103.34
	Jayakwadi	Gated	2171.94	1991.98	60.64	1931.34	3	NA	NA

(Er. Manendra Amale)
S. E. & Administrator
C.A.D.A ,Nashik &
Member Secretary

(Er. Samadhan Sabbinwar)
S.E.& Administrtor,
CADA ,Ch. Sambhaji Nagar.
Special Invitee Member.

(Er.Pramod Mandade)
Chairman Godavari Study Group-II
& Director General, D.T.H.R.S (MERI)
Nashik

Statement - 2

Statement Showing Non Irrigation Use from Major & Medium Projects in Upper Godavari (up to Paithan dam) sub-basin

(All Figures in Mm^3)

Sr. No.	Name of Dam	NI Provision in Project Report	Domestic Use		Industrial Use		Total	
			Sanctioned (Active)	Actual 2022-23	Sanctioned (Active)	Actual 2022-23	Sanctioned (Active)	Actual 2022-23
1	2	3	4	5	7	8	10	11
1	Mandohal	0.00	1.23	1.34	0.00	0.00	1.23	1.34
2	Mula	59.12	86.07	57.19	7.29	3.71	93.36	60.90
3	Bhandardara	0.00	45.19	90.46	23.12	5.01	68.31	95.47
4	Nilwande	0.00	13.15	11.54	0.00	0.00	13.15	11.54
5	Adhala	0.00	1.82	1.11	0.00	0.00	1.82	1.11
6	Bhojapur	2.57	3.04	15.91	0.00	0.00	3.04	15.91
7	Gautami	0.00	49.20	1.21	0.05	0.01	49.25	1.22
8	Kashyapi	33.98	31.15	0.00	0.00	0.00	31.15	0.00
9	Gangapur	2.83	77.23	151.01	59.37	14.15	136.60	165.16
10	Alandi	0.00	1.07	0.00	0.21	0.12	1.28	0.12
11	Kadwa	0.60	18.70	15.55	0.00	0.00	18.70	15.55
12	Bham	0.00	0.81	0.00	0.00	0.00	0.81	0.00
13	Bhavali	0.00	18.78	0.01	0.00	0.12	18.78	0.13
14	Waki	9.12	0.00	0.00	0.00	0.00	0.00	0.00
15	Mukane	71.81	73.11	56.54	2.77	5.55	75.88	62.09
16	Darna	0.00	93.65	132.93	8.07	13.40	101.72	146.33
17	Waldevi	12.18	0.14	2.50	12.19	5.43	12.33	7.93
18	Karanjwan	0.00	1.57	0.31	1.30	0.36	2.87	0.67
19	Ozarkhed	1.27	9.87	8.65	1.09	0.50	10.96	9.15
20	Waghad	0.00	1.30	0.30	0.78	0.00	2.08	0.30
21	Punegaon	0.00	0.39	0.34	0.00	0.00	0.39	0.34
22	Palkhed	19.35	40.30	107.18	6.78	2.84	47.08	110.02
23	Tisgaon	0.00	1.94	0.15	0.00	0.00	1.94	0.15
	Sub-Total (1 - 23)	212.83	569.71	654.22	123.01	51.21	692.73	705.43

Statement - 2

Statement Showing Non Irrigation Use from Major & Medium Projects in Upper Godavari (up to Paithan dam) sub-basin

(All Figures in Mm^3)

Sr. No.	Name of Dam	NI Provision in Project Report	Domestic Use		Industrial Use		Total	
			Sanctioned (Active)	Actual 2022-23	Sanctioned (Active)	Actual 2022-23	Sanctioned (Active)	Actual 2022-23
1	2	3	4	5	7	8	10	11
24	Tembhapuri	0.56	2.14	0.89	0.00	0.00	2.14	0.89
25	Dheku	0.00	1.59	0.52	0.00	0.00	1.59	0.52
26	Kohli	0.00	0.00	0.65	0.00	0.00	0.00	0.65
27	Narangi	5.30	4.30	0.56	0.00	0.00	4.30	0.56
28	Bor Dahegaon	0.23	1.15	0.13	0.00	0.00	1.15	0.13
29	Ambadi	2.50	3.48	2.02	0.11	0.10	3.59	2.12
30	Shivana Takli	3.79	3.69	0.13	0.00	0.00	3.69	0.13
	Sub-Total (24 - 30)	12.38	16.35	4.90	0.11	0.10	16.46	4.90
31	Paithan Dam	0.00	401.90	75.03	117.27	41.62	519.17	116.65
	Grand Total	419.32	987.96	734.16	240.39	93.13	1228.36	827.18

(Er. Mahendra Amale)
S. E. & Administrator
C.A.D.A ,Nashik &
Member Secretary

(Er. Samadhan Sabbinwar)
S.E.& Administrtor,
CADA ,Ch. Sambhaji Nagar.
Special Invitee Member.

(Er.Pramod Mandade)
Chairman Godavari Study Group-II
& Director General, D.T.H.R.S (MERI)
Nashik

Annual Observed Net Yield Series at Paithan Dam
for the Period from 1975 to 2022

Sr. No.	Year	Annual Yield (Mm^3)	Year	Annual Yield in Decending Order (Mm^3)	Dependable Yield		
					Depend-ability	Yield (Mm^3)	Year
1	2	3	4	5	6	7	8
1	1975	4296.07	2006	7658.18			
2	1976	7283.82	1976	7283.82			
3	1977	2198.86	2022	6426			
4	1978	974.63	2005	4727.63			
5	1979	3201.87	1975	4296.07			
6	1980	3303.82	1994	4084.38			
7	1981	3007.86	1990	3701.66			
8	1982	1162.88	1991	3606.95			
9	1983	3090.99	2019	3469			
10	1984	1376.88	2020	3451			
11	1985	515.25	1980	3303.82			
12	1986	638.88	1979	3201.87			
13	1987	706.99	1983	3090.99			
14	1988	2334.90	2008	3046.28			
15	1989	1753.44	1981	3007.86			
16	1990	3701.66	2021	2925			
17	1991	3606.95	2007	2657.04			
18	1992	843.13	1998	2645.62			
19	1993	844.21	2017	2465.23			
20	1994	4084.38	2004	2354.52			
21	1995	339.54	1988	2334.9			
22	1996	1115.16	2016	2199.74			
23	1997	1267.69	1977	2198.86			
24	1998	2645.62	1999	1920.09	50%	1753.44	1989
25	1999	1920.09	1989	1753.44			
26	2000	855.64	1984	1376.88			
27	2001	580.38	2010	1345.05			
28	2002	541.45	1997	1267.69			
29	2003	566.96	1982	1162.88			
30	2004	2354.52	2011	1135.53			
31	2005	4727.63	1996	1115.16			
32	2006	7658.18	2014	1071.74			
33	2007	2657.04	1978	974.63			
34	2008	3046.28	2013	949.69			
35	2009	388.15	2000	855.64			
36	2010	1345.05	1993	844.21	75%	844.21	1993
37	2011	1135.53	1992	843.13			
38	2012	174.27	2018	778.04			
39	2013	949.69	1987	706.99			

Annual Observed Net Yield Series at Paithan Dam
for the Period from 1975 to 2022

Sr. No.	Year	Annual Yield (Mm^3)	Year	Annual Yield in Decending Order (Mm^3)	Dependable Yield		
					Depend-ability	Yield (Mm^3)	Year
40	2014	1071.74	1986	638.88			
41	2015	309.22	2001	580.38			
42	2016	2199.74	2003	566.96			
43	2017	2465.23	2002	541.45	90%	541.45	2002
44	2018	778.04	1985	515.25			
45	2019	3469.01	2009	388.15			
46	2020	3451.49	1995	339.54			
47	2021	2924.84	2015	309.22			
48	2022	6426.32	2012	174.27	100%	174.27	2012
	Average	2170.13		2198.86	Average	2198.86	1977

टिप : सन 2018-22 साठी महामंडळात उपलब्ध होणारा 15/10 च्या पाणीसाठ्यातील आवक गृहित धरण्यात आलेली आहे.

(Er. Rajendra Amale)
S.E.& Administrator
C.A.D.A.,Nashik &
Member Secretary

(Er. Samadhan Sabbinwar)
S.E.& Administrtor,CADA
Ch. Sambhaji Nagar.
Special Invitee Member.

(Er.Pramod Mandade)
Chairman Godavari Study Group-II
& Director General, D.T.H.R.S (MERI)
Nashik

Statement - 4

Statement Showing Observed Yeild & Corresponding Spills at Dependable Year of Jayakwadi Project

(All figures in Mm^3)

Sr. No.	Name of Dam/ Complex	Yield					Spills				
		2012-13	2002-03	1993-94	1977-78	2017-18	2012-13	2002-03	1993-94	1977-78	2017-18
		100% Dependable Year	90% Dependable Year	75% Dependable Year	Average Yield Year	Good Year	100% Dependable Year	90% Dependable Year	75% Dependable Year	Average Yield Year	Good Year
1	2	4	3	5	6	7	9	8	10	11	12
1	Mula	530.17	473.78	641.51	705.07	850.47	0.00	0.00	1.22	29.15	33.36
2	Ozer Weir	546.12	578.17	708.80	970.94	957.97	2.51	47.06	104.63	242.57	329.39
3	Gangapur	261.62	222.46	369.44	245.53	495.75	0.00	0.00	48.40	0.00	236.34
4	Palkhed	262.86	286.00	262.32	0.00	627.28	5.66	0.00	4.27	0.00	205.76
5	N. M. Weir	931.91	866.49	1908.91	1939.03	2683.91	249.38	0.00	934.05	1107.92	1879.64
6	Paithan Dam	174.27	541.45	844.21	2198.86	2465.23	0.00	0.00	0.00	0.00	300.00

(Er. Mahendra Amale)
S. E. & Administrator
C.A.D.A ,Nashik &
Member Secretary

(Er. Samadhan Sabbinwar)
S.E.& Administrtor,
CADA ,Ch. Sambhaji Nagar.
Special Invitee Member.

(Er.Pramod Mandade)
Chairman Godavari Study Group-II
& Director General, D.T.H.R.S (MERI)
Nashik

Statement Showing the Live Storage and Design Water Utilisation of Irrigation Projects in Upper Godavari (up to Paithan dam) Sub Basin

(All figures in Mm^3)

Sr. No.	Name of Dam and System	Design Live Storage				Effective Live Storage After Silt Survey If	Design Water Use			
		Major	Medium	Minor	Total		Major	Medium	Minor	Total
1	2	3	4	5	6	7	7	8	9	10
A	Mula System									
1	Mandohal		8.78		8.78	5.68		13.15		13.15
2	Mula	608.45			608.45	546.55	704.61			704.61
	U.S.Mula									
3	M.I.& KTW.(State) (38 Nos.)			82.96	82.96	82.96			91.79	91.79
4	MI,KT,PT,ST ...(Local Sector - 97)			25.79	25.79	25.79			25.79	25.79
	Total of A	608.45	8.78	108.75	725.98	660.98	704.61	13.15	117.58	835.34
B	Pravara System									
1	Bhandardara	304.10			304.10	307.61	33.97			33.97
2	Nilwande	228.75			228.75	228.75	326.06			326.06
3	Adhala		27.61		27.61	21.97		38.73		38.73
4	Bhojapur + Flood Canals		10.22		10.22	9.86		20.30		20.30
5	Ozar weir (Pravara Canal)				0.00	0.00	421.90			421.90
	U.S.Ozer Weir									
6	M.I.(State) 5 Nos			17.21	17.21	17.21			16.90	16.90
7	MI,KT,PT,ST ...(Local Sector - 27)			6.84	6.84	6.84			6.84	6.84
	Total of B	532.85	37.83	24.05	594.73	592.24	781.93	59.03	23.74	864.70

Statement - 5

Statement Showing the Live Storage and Design Water Utilisation of Irrigation Projects in Upper Godavari (up to Paithan dam) Sub Basin

(All figures in Mm^3)

Sr. No.	Name of Dam and System	Design Live Storage				Effective Live Storage After Silt Survey If	Design Water Use			
		Major	Medium	Minor	Total		Major	Medium	Minor	Total
1	2	3	4	5	6	7	7	8	9	10
C	Gangapur System									
1	Gauatami		52.90		52.90	46.13		0.00		0.00
2	Kashyapi		51.75		51.75	59.06		33.98		33.98
3	Gangapur	203.88			203.88	159.42	231.82			231.82
	U.S.Gangapur									
4	M.I.(State) (5 Nos.)			15.33	15.33	15.33			16.40	16.40
5	MI,KT,PT,ST...(Local Sector -19)			11.61	11.61	11.61			11.61	11.61
	Total of C	203.88	104.65	26.94	335.47	291.55	231.82	33.98	28.01	293.81
E	Darna System									
1	Alandi		27.47		27.47	23.85		40.67		40.67
2	Kadwa	52.90			52.90	50.59	80.70			80.70
3	Bham	69.76			69.76	69.76	10.18			10.18
4	Bhavali	40.79			40.79	40.79	17.06			17.06
5	Waki	70.57			70.57	70.57	18.16			18.16
6	Darna	219.82			219.82	188.66	56.91			56.91
7	Mukane	204.98			204.98	198.39	105.00			105.00
8	Waldevi		32.09		32.09	32.09		25.76		25.76

Statement - 5

Statement Showing the Live Storage and Design Water Utilisation of Irrigation Projects in Upper Godavari (up to Paithan dam) Sub Basin

(All figures in Mm^3)

Sr. No.	Name of Dam and System	Design Live Storage				Effective Live Storage After Silt Survey If	Design Water Use			
		Major	Medium	Minor	Total		Major	Medium	Minor	Total
1	2	3	4	5	6	7	7	8	9	10
9	N.M.Weir									
	(A)NM Express Canal				0.00	0.00	317.37			317.37
	(B) Godavari canals				0.00	0.00	362.45			362.45
	U.S.of Darna									
9	MI (State)– 6 nos			13.77	13.77	13.77			15.09	15.09
10	MI,KT,PT,ST...(Local Sector -18)			4.93	4.93	4.93			4.93	4.93
	Total of E	658.82	59.56	18.70	737.08	693.40	967.83	66.43	20.02	1054.28
F	**Palkhed System**									
1	Karanjwan	166.22			166.22	152.00	24.92			24.92
2	Waghad	72.23			72.23	64.95	46.29			46.29
3	Punegaon	17.57			17.57	16.64	21.22			21.22
4	Ozarkhed (including C.A. of Punegaon)	60.32			60.32	56.69	79.59			79.59
	Daraswadi (Water from Ozarkhed & Punegaon)				0.00		10.13			10.13
5	Palkhed	21.24			21.24	18.49	283.06			283.06
6	Tisgaon	12.87			12.87	10.78	3.20			3.20
	U.S.of Palkhed									
7	M.I.(State) (9 Nos.)			20.77	20.77	20.77			20.77	20.77
8	MI,KT,PT,ST...(Local Sector -59)			15.90	15.90	15.90			15.90	15.90
	Total of F	350.45	0.00	36.67	387.12	356.22	468.41	0.00	36.67	505.08

Statement Showing the Live Storage and Design Water Utilisation of Irrigation Projects in Upper Godavari (up to Paithan dam) Sub Basin

(All figures in Mm³)

Sr. No.	Name of Dam and System	Design Live Storage				Effective Live Storage After Silt Survey If	Design Water Use			
		Major	Medium	Minor	Total		Major	Medium	Minor	Total
1	2	3	4	5	6	7	7	8	9	10
G	**Remaining Upto Paithan**									
1	**Below Mula**									
	M.I.& KTW.(State) (13 Nos.)			16.83	16.83	16.83			18.99	18.99
	MI,KT,PT,ST...(Local Sector -17)			5.80	5.80	5.80			5.80	5.80
2	**Below N M Weir**									
	M.I.& KTW.(State) (25 Nos.)			78.43	78.43	78.43			80.20	80.20
	MI,KT,PT,ST...(Local Sector -138)			36.61	36.61	36.61			36.61	36.61
3	**Below Ozar weir**									
	M.I.& KTW.(State) (16 Nos.)			32.62	32.62	32.62			34.56	34.56
	MI,KT,PT,ST...(Local Sector -33)			9.48	9.48	9.48			9.48	9.48
	Total of G	0.00	0.00	179.77	179.77	179.77	0.00	0.00	185.64	185.64
H	**U/s of Jayakwadi**									
1	Tembhapuri		19.61		19.61	19.61		22.13		22.13
2	Dheku		12.17		12.17	12.17		13.00		13.00
3	Kohli		3.24		3.24	3.24		3.10		3.10
4	Narangi		11.50		11.50	11.50		13.30		13.30
5	Bor Dahegaon		11.47		11.47	11.47		15.10		15.10
6	Ambadi		9.42		9.42	9.42		12.78		12.78

Statement - 5 -

Statement Showing the Live Storage and Design Water Utilisation of Irrigation Projects in Upper Godavari (up to Paithan dam) Sub Basin

(All figures in Mm^3)

Sr. No.	Name of Dam and System	Design Live Storage				Effective Live Storage After Silt Survey If	Design Water Use			
		Major	Medium	Minor	Total		Major	Medium	Minor	Total
1	2	3	4	5	6	7	7	8	9	10
7	Shivana Takli		36.45		36.45	36.45		45.58		45.58
8	M. I. Projects (45 No.)			99.69	99.69	99.69			108.46	108.46
9	MI,KT,PT,ST...(Local Sector -93)			28.25	28.25	28.25			28.25	28.25
	Total of H	**0.00**	**103.86**	**127.94**	**231.80**	**231.80**	**0.00**	**124.99**	**136.71**	**261.70**
	Total of A to H	**2354.45**	**314.68**	**522.82**	**3191.95**	**3005.96**	**3154.60**	**297.58**	**548.37**	**4000.55**
J	**Paithan Dam (Including LIS on Backwater)**	2170.94			2170.94	1991.98	2618.21			2618.21

(Er. [illegible] Amale)
S. E. & Administrator
C.A.D.A. Nashik &
Member Secretary

(Er. Sambhajee Sabbinwar)
S.E.& Administrtor,
CADA ,Ch. Sambhaji Nagar.
Special Invitee Member.

(Er.Pramod Mandade)
Chairman Godavari Study Group-II
& Director General, D.T.H.R.S (MERI)
Nashik

Statement - 6

Statement Showing water planning in Upper Godavari (up to Paithan dam) Sub Basin considering 100% dependable year (2012-13)

(All figures in Mm³)

Sr. No.	Name of Dam and System	Gated / Ungated	Yield In Year 2012	Spills	Design Live Storage (Excluding Silt as per Survey)	Mandatory Live Storage Below Crest	Domestic Use (87.19% Allocation)	Industrial Use (82.92% Allocation)	Tharif Use (80% Allocation)	Rabi Use (0% Allocation)	H. W. Use (0% Allocation)	Evaporation	Total Use (Col 8 to 13) Restricted to Yield	Balance Yeild After Total Use (Col 4 - Col 14)	Balance Water available for Jayakwadi (Col 15 or [Col 4-7] which ever is less)
Ref.	Annexure Ref.	Anx 1 Col 12	CADA Nashik Mar 2019		Anx 1 Col 10	Anx 1 Col 14	Anx 4 Col 4 X 0.8719	Anx 4 Col 7 X 0.8292	Anx 3 Col 22 X 0.8	Anx 3 Col 23 X 0.0	Anx 3 Col 24 X 0.0				
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
A	Mula System														
1	Mandohol	Ungated	2.55		5.68	5.68	1.07	0.00	3.09	0.00	0.00	0.23	4.39		
2	Mula	Gated	527.62	0.00	546.55	243.24	75.01	6.04	126.64	0.00	0.00	51.51	259.24		
	Total of A		530.17	0.00	552.23	248.92	76.12	6.04	129.73	0.00	0.00	51.74	263.63	266.54	266.54
B	Pravara System														
1	Bhandardara	Gated	310.51		307.61	176.14	39.40	19.17	78.98	0.00	0.00	18.04	155.60		
2	Nilwande	Gated	129.28		228.75	178.01	11.47	0.00	98.26	0.00	0.00	12.60	122.32		
3	Adhala	Ungated	17.39		21.97	21.97	1.59	0.00	10.02	0.00	0.00	0.00	11.60		
4	Bhojapur	Ungated	12.99		9.86	9.86	2.65	0.00	6.48	0.00	0.00	1.32	10.45		
5	Ozar weir	Ungated	81.95	2.51											
	Total of B		546.12	2.51	569.19	385.98	55.10	19.17	193.74	0.00	0.00	31.96	299.97	246.15	160.14
C	Gangapur System														
1	Gautami	Gated	46.13		46.13	36.83	42.90	0.04	0.00	0.00	0.00	0.00	42.94		
2	Kashyapi	Gated	57.79		59.06	43.18	27.16	0.00	0.00	0.00	0.00	0.00	27.16		
3	Gangapur	Gated	157.70		159.42	78.54	67.31	49.23	2.54	0.00	0.00	18.33	137.43		
	Total of C		261.62	0.00	264.61	158.55	137.39	49.27	2.54	0.00	0.00	18.33	207.53	54.09	54.09
D	Palkhed System														
1	Karanjwan	Gated	94.44		152.00	79.13	1.37	1.06	1.43	0.00	0.00	9.73	13.61		
2	Waghad	Ungated	73.19		64.95	64.95	1.13	0.65	9.33	0.00	0.00	5.30	16.41		
3	Punegaon	Gated	17.97		16.64	4.10	0.34	0.00	2.07	0.00	0.00	1.31	3.72		
4	Ozarkhed	Ungated	21.77		56.69	56.69	8.61	0.90	13.07	0.00	0.00	6.73	29.31		
5	Tisgaon	Ungated	2.21		10.78	10.78	1.09	0.00	1.78	0.00	0.00	0.60	4.07		
6	Daraswadi (Water of Ozarkhed + Punegaon)						0.00		8.10	0.00	0.00		8.10		
7	Palkhed	Gated	53.28		18.49	2.74	35.14	5.62	55.95	0.00	0.00	8.10	104.81		
	Total of D		262.86	5.66	319.55	218.39	46.26	8.25	91.74	0.00	0.00	31.77	180.03	82.83	44.47

Statement - 6

Statement Showing water planning in Upper Godavari (up to Paithan dam) Sub Basin considering 100% dependable year (2012-13)

(All figures in Mm³)

Sr. No.	Name of Dam/ and System	Gated / Ungated	Yield In Year 2012	Spills	Design Live Storage (Excluding Silt as per Survey)	Mandatory Live Storage Below Crest	Domestic Use (87.19% Allocation)	Industrial Use (82.92% Allocation)	Kharif Use (80% - Allocation)	Rabi Use (0% Allocation)	H. W. Use (0% Allocation)	Evaporation	Total Use (Col 8 to 13) Restricted to Yield	Balance Yeild After Total Use (Col 3 - Col 14)	Balance Water available for Jayakwadi (Col 15 or [Col 4-7] which ever is less)
Ref	Annexure Ref.	Anx 1 Col 12	CADA Nashik Mar 2019		Anx 1 Col 10	Anx 1 Col 14	Anx 4 Col 4 X 0.8719	Anx 4 Col 7 X 0.8292	Anx 5 Col 22 X 0.8	Anx 5 Col 23 X 0.0	Anx 5 Col 24 X 0.8				
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
E	Darna System														
1	Alandi	Ungated	28.00		23.85	23.10	0.93	0.17	10.52	0.00	0.00	2.84	14.47		
2	Kashwa	Gated	80.78		50.59	15.82	16.30	0.00	18.10	0.00	0.00	10.28	44.68		
3	Bham	Ungated			69.76	69.76	0.71	0.00	0.00	0.00	0.00	6.62	7.33		
4	Bhavali	Ungated	39.78		40.79	40.79	16.37	0.00	2.10	0.00	0.00	4.30	22.78		
5	Waki	Gated			70.57	46.86	0.00	0.00	0.00	0.00	0.00	5.91	5.91		
6	Darna	Gated	215.43		188.66	91.69	81.65	6.69	0.00	0.00	0.00	26.38	114.72		
7	Mukane	Gated	107.71		198.39	105.97	63.74	2.30	0.43	0.00	0.00	24.72	91.19		
8	Waldevi	Ungated	31.81		32.09	32.06	0.12	10.11	1.84	0.00	0.00	5.00	17.07		
9	N.M.Weir		249.38												
	(A) NM Express Canal		55.79				0.00	0.00	63.49	0.00	0.00		63.49		
	(B) Godavari canals		123.23				0.00	0.00	59.98	0.00	0.00		59.98		
	Total of E		931.91	249.38	674.70	426.05	179.84	19.28	156.46	0.00	0.00	85.05	441.62	490.29	490.29
	Total A to E		2552.68		2379.28	1437.89	496.73	102.01	574.20	0.00	0.00	219.85	1392.79	1159.89	1015.53
															763.64
Spills (Mula + Ozar Weir + N. M. Weir)				251.89											
F	U/s of Jayakwadi														
1	Tembhapuri	Ungated	0.00	0.00	19.61	19.61	1.86	0.00	2.50	0.00	0.00	0.00	4.36	-4.36	0.00
2	Dheku	Ungated	4.86	0.00	12.17	12.17	1.38	0.00	0.90	0.00	0.00	3.21	5.52	-0.66	0.00
3	Kohli	Ungated	0.00	0.00	3.24	3.24	0.00	0.00	0.79	0.00	0.00	0.00	0.79	-0.79	0.00
4	Narangi	Gated	0.00	0.00	11.50	0.00	3.75	0.00	0.11	0.00	0.00	0.00	3.86	-3.86	0.00
5	Bor Dahegaon	Gated	0.00	0.00	11.47	1.44	1.00	0.00	1.50	0.00	0.00	0.00	2.50	-2.50	0.00
6	Ambadi	Ungated	3.45	0.00	9.42	9.42	3.04	0.09	1.90	0.00	0.00	2.85	7.88	-4.42	0.00
7	Shivana Takli	Gated	23.12	0.00	36.45	2.26	3.22	0.00	2.68	0.00	0.00	3.39	9.29	13.83	13.83
	Total of F		31.43	0.00	103.86	48.14	14.25	0.09	10.37	0.00	0.00	9.48	34.19	-2.76	13.83
	Total A to F		2564.11	0.00	2483.14	1486.03	510.98	102.10	584.57	0.00	0.00	229.33	1426.98	1137.13	1078.08

Statement - 6

Statement Showing water planning in Upper Godavari (up to Paithan dam) Sub Basin considering 100% dependable year (2012-13)

(All figures in Mm³)

Sr. No.	Name of Dam and System	Gated/ Ungated	Yield in Year 2012	Spills	Design Live Storage (Excluding Silt as per Survey)	Mandatory Live Storage Below Crest	Domestic Use (87.19% Allocation)	Industrial Use (82.92% Allocation)	Kharif Use (80% Allocation)	Rabi Use (0% Allocation)	H. W. Use (0% Allocation)	Evaporation	Total Use (Col 8 to 13) Restricted to Yield	Balance Yeild After Total Use (Col 4 - Col 14)	Balance Water available for Jayakwadi (Col 15 or [Col 4-7] which ever is less)
Ref	Annexure Ref.	Anx 1 Col 12	CADA Nashik Mar 2019		Anx 1 Col 10	Anx 1 Col 14	Anx 4 Col 4 X 0.8719	Anx 4 Col 7 X 0.8292	Anx 3 Col 22 X 0.8	Anx 3 Col 23 X 0.0	Anx 3 Col 24 X 0.0				
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
Balance water available in Upper Complexes for equitable distribution after monsoon															
F	Paithan Dam	Gated	174.27	0.00	1991.98	60.64	330.42	97.24	283.89	0.00	0.00	206.71	938.26	-763.99	-763.99

Equitable Allocations :
1) In 100% dependable year, the available water scenario indicates that there is no adequate water to satisfy all design demands. Thus, following allocations are proposed:
Domestic : 87.19% of Sanctioned Use
Industry : 82.92% of Sanctioned Use (It is expected that minimum 10% demand shall be satisfied by recycling the domestic waste water).
Kharif : 80% of Planned Kharif Water Use (It is expected that water shall be used economically to give benefits to planned area in Kharif). , Rabi : NIL , H.W. : NIL
2) All complexes satisfy above mentioned allocations.

(Er. Virendra Amale)
S. E.& Administrator
C.A.D.A ,Nashik &
Member Secretary

(Er. Samadhan Sabbinwar)
Superintending Engineer& Administrtor,
CADA ,Chhatrapati Sambhaji Nagar.
Special Invitee Member.

(Er.Pramod Mandade)
Chairman Godavari Study Group-II
& Director General, D.T.H.R.S (MERI)
Nashik

Statement - 7

Statement Showing water planning in Upper Godavari (up to Paithan dam) Sub Basin considering 90% dependable year (2002-2003)

(All figures in Mm³)

Sr. No.	Name of Dam and System	Gated / Ungated	Yield in Year 2002	Spills	Design Live Storage (Excluding Sill as per Survey)	Mandatory Live Storage Below Crest	Domestic Use (87.19% Allocation)	Industrial Use (82.92% Allocation)	Kharif Use (80% Allocation)	Rabi Use (32% Allocation)	H. W. Use (0% Allocation)	Evaporation	Total Use (Col 8 to 13) Restricted to Yield	Balance Yeild After Total Use (Col 5 - Col 14)	Balance Water available for Jayakwadi (Col 15 or [Col 4-7] which ever is less)
Ref	Annexure Ref.	Anx 1 Col 12	CADA Nashik Mar 2019		Anx 1 Col 10	Anx 1 Col 11	Anx 4 Col 4 X 0.8719	Anx 4 Col 7 X 0.8292	Anx 3 Col 22 X 0.8	Anx 3 Col 23 X 0.3	Anx 3 Col 24 X 0.0				
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
A	Mula System														
1	Mandohol	Ungated	2.46	0.00	5.68	5.68	1.07	0.00	3.09	2.12	0.00	1.32	7.60		
2	Mula	Gated	469.32	0.00	546.55	243.24	75.04	6.04	126.64	120.48	0.00	36.03	364.24		
	Total of A		471.78	0.00	552.23	248.92	76.12	6.04	129.73	122.60	0.00	37.35	371.84	99.94	99.94
B	Pravara System														
1	Bhandardara	Gated	364.68		307.61	176.14	39.40	19.17	78.98	37.49	0.00	25.05	200.10		
2	Nilwande	Gated			228.75	178.01	11.47	0.00	98.26	56.80	0.00	12.60	179.12		
3	Adhala	Ungated	23.67		21.97	21.97	1.59	0.00	10.02	4.08	0.00	4.86	17.30		
4	Bhojapur	Ungated	12.62		9.86	9.86	2.65	0.00	6.48	2.50	0.00	1.60	13.23		
5	Ozar weir	Ungated	177.20	47.06											
	Total of B		578.17	47.06	568.19	385.98	55.10	19.17	193.74	100.87	0.00	44.11	409.75	168.42	168.42
C	Gangapur System														
1	Gautami	Gated			46.13	36.83	42.90	0.04	0.00	0.00	0.00	1.10	44.04		
2	Kashyapi	Gated			59.06	43.18	27.16	0.00	0.00	0.00	0.00	2.43	29.59		
3	Gangapur	Gated	222.46		159.42	78.54	67.34	49.23	2.54	5.46	0.00	15.86	140.41		
	Total of C		222.46	0.00	264.61	158.55	137.39	49.27	2.54	5.46	0.00	19.39	214.04	8.42	8.42
D	Palkhed System														
1	Karanjwan	Gated	152.51	0.00	152.00	79.13	1.37	1.08	1.43	1.05	0.00	11.65	16.58		
2	Waghad	Ungated	72.01		64.95	64.95	1.13	0.65	9.33	8.15	0.00	9.41	28.66		
3	Punegaon	Gated	15.49		16.64	4.10	0.34	0.00	2.07	5.12	0.00	2.78	10.31		
4	Ozarkhed	Ungated	44.15		56.69	56.69	8.61	0.90	13.07	11.22	0.00	3.73	37.53		
5	Tisgaon	Ungated	6.63		10.78	10.78	1.69	0.00	1.78	1.53	0.00	0.06	5.06		
6	Daraswadi (Punegaon)						0.00		8.10	0.00	0.00		8.10		
7	Palkhed	Gated	17.33	0.00	16.49	2.74	35.14	5.62	55.95	47.89	0.00	6.63	151.24		
	Total of D		286.00	0.00	319.55	218.39	48.28	8.25	91.74	74.97	0.00	34.23	257.48	28.52	28.52

Statement - 7

Statement Showing water planning in Upper Godavari (up to Paithan dam) Sub Basin considering 90% dependable year (2002-2003)

(All figures in Mm³)

Sr. No.	Name of Dam and System	Gated / Ungated	Yield in Year 2002	Spills	Design Live Storage (Excluding Silt as per Survey)	Mandatory Live Storage Below Crest	Domestic Use (87.19% Allocation)	Industrial Use (82.92% Allocation)	Kharif Use (80% Allocation)	Rabi Use (32% Allocation)	H. W. Use (0% Allocation)	Evaporation	Total Use (Col 8 to 13) Restricted to Yield	Balance Yeild After Total Use (Col 4 - Col 14)	Balance Water available for Jayakwadi (Col 15 or Col 6-7 which ever is less)
Ref.	Annexure Ref.	Anx 1 Col 12	CADA Nashik Mar 2019		Anx 1 Col 10	Anx 1 Col 14	Anx 4 Col 4 X 0.8719	Anx 4 Col 7 X 0.9292	Anx 3 Col 22 X 0.8	Anx 3 Col 23 X 0.3	Anx 3 Col 26 X 0.0				
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
E	Dama System														
1	Alandi	Ungated	26.69		23.85	23.10	0.93	0.17	10.52	7.48	0.00	5.22	24.33		
2	Kadwa	Gated			50.59	15.82	16.30	0.00	18.10	8.44	0.00	5.55	48.39		
3	Bham	Ungated			69.76	69.76	0.71	0.00	0.00	0.00	0.00	2.22	2.93		
4	Bhavali	Ungated			40.79	40.79	16.37	0.00	2.10	1.50	0.00	1.11	21.10		
5	Waki	Gated			70.57	46.86	0.00	0.00	0.00	0.00	0.00	5.91	5.91		
6	Dama	Gated	293.57		188.66	91.69	81.65	6.09	0.00	0.00	0.00	16.55	104.89		
7	Mukane	Gated			198.39	105.97	63.74	2.30	8.43	0.31	0.00	10.81	77.59		
8	Waldevi	Ungated			32.09	32.06	0.12	10.11	1.84	1.56	0.00	5.90	19.53		
9	N.M.Weir		382.25							0.00					
	(A)NM Express Canal						0.00	0.00	65.49	43.73	0.00		109.22		
	(B) Godavari canals		163.98				0.00	0.00	59.98	55.62	0.00		115.60		
	Total of E		866.49	0.00	674.70	426.05	179.84	19.28	156.46	120.66	0.00	53.26	529.49	337.00	337.00
	Total A to E		2424.90	47.06	2379.28	1437.69	496.73	102.01	574.20	424.55	0.00	188.35	1762.60	642.30	642.30
Spills (Mula + Ozar Weir + N. M. Weir)				47.06											
F	U/s of Jayakwadi														
1	Tembhapuri	Ungated	0.00	0.00	19.61	19.61	1.86	0.00	2.50	3.68	0.00	5.36	13.40	-13.40	-19.61
2	Dhekn	Ungated	3.84	0.00	12.17	12.17	1.38	0.00	0.90	2.26	0.00	3.24	7.78	-3.94	-8.33
3	Kohli	Ungated	0.00	0.00	3.24	3.24	0.00	0.00	0.79	0.35	0.00	0.00	1.14	-1.14	-3.24
4	Narangi	Gated	0.00	0.00	11.50	0.00	3.75	0.00	0.11	0.73	0.00	0.00	4.59	-4.59	-4.59
5	Bor Dahegaon	Gated	0.00	0.00	11.47	1.44	1.00	0.00	1.50	2.13	0.00	0.00	4.63	-4.63	-4.63
6	Ambadi	Ungated	11.77	0.00	9.42	9.42	3.01	0.09	1.90	1.02	0.00	2.85	8.89	2.88	2.35
7	Shivana Takli	Gated	0.00	0.00	36.45	2.26	3.22	0.00	2.68	9.98	0.00	0.00	15.87	-15.87	-15.87
	Total of F		15.61		103.86	48.14	14.25	0.09	10.37	20.15	0.00	11.45	56.31	-40.70	-40.70

Statement - 7

Statement Showing water planning in Upper Godavari (up to Paithan dam) Sub Basin considering 90% dependable year (2002-2003)

(All figures in Mm^3)

Sr. No.	Name of Dam and System	Gated / Ungated	Yield In Year 2002	Spills	Design Live Storage (Excluding Silt as per Survey)	Mandatory Live Storage Below Crest	Domestic Use (87.19% Allocation)	Industrial Use (82.92% Allocation)	Kharif Use (80% Allocation)	Rabi Use (32% Allocation)	H. W. Use (0% Allocation)	Evaporation	Total Use (Col 8 to 13) Restricted to Yield	Balance Yeild After Total Use (Col 4 - Col 14)	Balance Water available for Jayakwadi (Col 15 or Col 4-7 which ever is less)
Ref	Annexure Ref.	Anx 1 Col 12	CADA Nashik Mar 2019		Anx 1 Col 10	Anx 1 Col 14	Anx 4 Col 4 X 0.8719	Anx 4 Col 7 X 0.4292	Anx 3 Col 22 X 0.8	Anx 3 Col 23 X 0.3	Anx 3 Col 24 X 0.0				
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
	Total A to F		2440.51	47.06	2483.14	1486.03	510.98	102.10	584.57	444.70	0.00	199.80	1812.15	601.60	601.60
Balance water available in Upper Complexes for equitable distribution after monsoon															595.24
F	Paithan Dam	Gated	541.45	0.00	1991.98	60.64	350.42	97.24	283.89	340.59	0.00	214.26	1286.40	-744.95	-744.95

Equitable Allocations :

1) In 90% dependable year, the available water scenario indicates that there is no adequate water to satisfy all design demands. Thus, following allocations are proposed:
Domestic : 87.19% of Sanctioned Use
Industry : 82.92% of Sanctioned Use (It is expected that minimum 10% demand shall be satisfied by recycling the domestic waste water).
Kharif : 80% of Planned Kharif Water Use, Rabi : 32% of Planned Rabi Water Use. H.W. : NIL.

2) All complexes satisfy above mentioned allocations. (Except Jayakwadi Dam)

3) In year when it is decided to use this Strategy, if the balance water available for Jayakwadi Project (i. e. column no 16) is more than balance yield after total use of Jayakwadi (i.e. column no 15), Then the strategy will be applicable, Otherwise quantity of release of water to Jayakwadi shall be restricted to balance water available for Jayakwadi Project.

(Er. Mahendra Amale)
S. E. & Administrator
C.A.D.A ,Nashik &
Member Secretary

(Er. Santadhan Sabbinwar)
Superintending Engineer& Administrtor,
CADA ,Chhatrapati Sambhaji Nagar,
Special Invitee Member.

(Er.Pramod Mandade)
Chairman Godavari Study Group-II
& Director General, D.T.H.R.S (MERI)
Nashik

Statement - 8

Statement Showing water planning in Upper Godavari (up to Paithan dam) Sub Basin considering 75% dependable year (1993-94)

(All figures in Mm³)

Sr. No.	Name of Dam and System	Gated/ Ungated	Yield in Year 1993	Spills	Design Live Storage (Excluding Silt as per Survey)	Mandatory Live Storage Below Crest	Domestic Use (87.19% Allocation)	Industrial Use (82.92% Allocation)	Kharif Use (100% Allocation)	Rabi Use (52% Allocation)	H. W. Use (0% Allocation)	Evaporation	Total Use (Col 8 to 13)	Balance Yeild After Total Use (Col 4 - Col 14)	Balance Water available for Jayakwadi (Col 15 or [Col 4-7] which ever is Less)
Ref	Annexure Ref.	Anx 1 Col 12	CADA Nashik, Mar 2019		Anx 1 Col 10	Anx 1 Col 14	Anx 4 Col 8 X 0.8719	Anx 4 Col 7 X 0.8292	Anx 3 Col 22 X 1.0	Anx 3 Col 23 X 0.5	Anx 3 Col 24 X 0.0				
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
A	Mula System														
1	Mandohol	Ungated	8.46		5.68	5.68	1.07	0.00	3.86	3.45	0.00	0.06	8.44		
2	Mula	Gated	633.05	1.22	546.55	243.24	75.04	6.04	156.31	195.76	0.00	73.79	508.96		
	Total of A		641.51	1.22	552.23	248.92	76.12	6.04	162.17	199.23	0.00	73.85	517.40	124.11	124.11
B	Pravara System														
1	Bhandardara	Gated	417.03		307.61	176.14	39.40	19.17	98.73	60.92	0.00	24.30	242.53		
2	Nilwande	Gated			228.75	178.01	11.47	0.00	122.82	92.29	0.00	12.60	239.18		
3	Adhala	Ungated	35.62		21.97	21.97	1.59	0.00	12.52	6.64	0.00	2.20	22.94		
4	Bhojapur	Ungated	15.45		9.86	9.86	2.65	0.00	8.10	4.06	0.00	0.52	15.33		
5	Ozar weir	Ungated	240.70	104.63											
	Total of B		708.80	104.63	568.19	385.98	55.10	19.17	242.17	163.91	0.00	39.62	519.98	188.82	188.82
C	Gangapur System														
1	Gautami	Gated			46.13	36.83	42.90	0.04	0.00	0.00	0.00	0.00	42.94		
2	Kashyapi	Gated			59.06	43.18	27.16	0.00	0.00	0.00	0.00	0.00	27.16		
3	Gangapur	Gated	369.44	153.59	159.42	78.54	67.34	49.23	3.17	8.87	0.00	20.38	148.98		
	Total of C		369.44	48.40	264.61	158.55	137.39	49.27	3.17	8.87	0.00	20.38	219.08	150.36	150.36
D	Palkhed System														
1	Karanjwan	Gated	115.98	0.00	152.00	79.13	1.37	1.08	1.79	1.70	0.00	11.82	17.76		
2	Waghad	Ungated	65.06		64.95	64.95	1.13	0.65	11.66	13.24	0.00	6.25	32.91		
3	Punegaon	Gated	0.00		16.64	4.10	0.34	0.00	2.59	8.32	0.00	2.24	13.49		
4	Ozarkhed	Ungated	52.99		56.69	56.69	8.61	0.90	16.34	17.54	0.00	7.08	50.46		
5	Tisgaon	Ungated	0.00		10.78	10.78	1.69	0.00	2.22	2.49	0.00	3.20	9.60		
6	Daraswadi (Water of Ozarkhed + Punegaon)						0.00		10.13	0.00	0.00		10.13		
7	Palkhed	Gated	28.29	4.27	18.49	2.74	35.14	5.62	69.94	77.63	0.00	6.00	156.53		
	Total of D		262.32	4.27	319.55	218.39	48.28	8.25	114.67	121.12	0.00	38.57	330.89	-68.57	-68.57

Statement - 8

Statement Showing water planning in Upper Godavari (up to Paithan dam) Sub Basin considering 75% dependable year (1993-94)

(All figures in Mm³)

Sr. No.	Name of Dam and System	Gated/ Ungated	Yield in Year 1993	Spills	Design Live Storage (Excluding Silt as per Survey)	Mandatory Live Storage Below Crest	Domestic Use (87.19% Allocation)	Industrial Use (62.92% Allocation)	Kharif Use (100% Allocation)	Rabi Use (50% Allocation)	H. W. Use (0% Allocation)	Evaporation	Total Use (Col 8 to 13)	Balance Yeild After Total Use (Col 6 - Col 14)	Balance Water available for Jayakwadi (Col 15 or [Col 4-7] which ever is less)
Ref	Annexure Ref.	Anx 1 Col 12	CADA Nashik Mar 2019		Anx 1 Col 10	Anx 1 Col 14	Anx 4 Col 4 X 0.5719	Anx 4 - Col 7 X 0.4292	Anx 3 Col 21 x 1.0	Anx 3 Col 23 X 0.5	Anx 3 Col 25 X 0.0				
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
E	Darna System														
1	Alandi	Ungated	30.45		23.85	23.10	0.93	0.17	13.15	12.16	0.00	2.85	29.27		
2	Kadwa	Gated	95.82		50.59	15.82	16.30	0.00	22.62	13.72	0.00	10.28	62.92		
3	Bham	Ungated			69.76	69.76	0.71	0.00	0.00	0.00	0.00	6.62	7.33		
4	Bhavali	Ungated			40.79	40.79	16.37	0.00	2.63	2.44	0.00	4.30	25.75		
5	Waki	Gated			70.57	46.86	0.00	0.00	0.00	0.00	0.00	5.91	5.91		
6	Darna	Gated	253.48		188.66	91.69	81.65	6.69	0.00	0.00	0.00	24.28	112.62		
7	Mukane	Gated			198.39	105.97	63.74	2.30	0.54	0.50	0.00	24.72	91.81		
8	Waldevi	Ungated			32.09	32.06	0.12	10.11	2.30	2.54	0.00	5.00	20.07		
9	N.M.Weir		1340.14							0.00					
	(A)NM Express Canal						0.00	0.00	79.36	74.32	0.00		153.68		
	(B) Godavari canals		189.01				0.00	0.00	74.97	90.38	0.00		165.35		
	Total of E		**1908.90**	**934.05**	**674.70**	**426.05**	**179.84**	**19.28**	**195.57**	**196.07**	**0.00**	**83.96**	**674.72**	**1234.18**	**1234.18**
	Total A to E		**3590.97**		**2379.28**	**1437.89**	**496.73**	**102.01**	**717.75**	**689.20**	**0.00**	**256.38**	**2262.07**	**1628.90**	**1628.90**
Spills (Mula + Ozar Weir + N. M. Weir)				**1039.90**											
F	U/s of Jayakwadi														
1	Tembhapuri	Ungated	0.00	0.00	19.61	19.61	1.86	0.00	3.12	5.99	0.00	5.36	16.33	-16.33	-19.61
2	Dheku	Ungated	6.71	0.00	12.17	12.17	1.38	0.00	1.12	3.67	0.00	3.24	9.41	-2.70	-5.46
3	Kohli	Ungated	0.00	0.00	3.24	3.24	0.00	0.00	0.99	0.57	0.00	0.00	1.56	-1.56	-3.24
4	Narangi	Gated	0.00	0.00	11.50	0.00	3.75	0.00	0.13	1.19	0.00	0.00	5.07	-5.07	-5.07
5	Bor Dahegaon	Gated	0.00	0.00	11.47	1.44	1.00	0.00	1.87	3.46	0.00	0.00	6.34	-6.34	-6.34
6	Ambadi	Ungated	8.34	0.00	9.42	9.42	3.04	0.09	2.37	1.65	0.00	2.85	10.00	-1.66	-1.66
7	Shivana Takli	Gated	0.00	0.00	36.45	2.26	3.22	0.00	3.35	16.21	0.00	0.00	22.78	-22.78	-22.78
	Total of F		15.05	0.00	103.86	48.14	14.25	0.09	12.96	32.74	0.00	11.45	71.49	-56.44	-64.16

Statement - 8

Statement Showing water planning in Upper Godavari (up to Paithan dam) Sub Basin considering 75% dependable year (1993-94)

(All figures in Mm^3)

Sr. No.	Name of Dam and System	Gated / Ungated	Yield in Year 1993	Spills	Design Live Storage (Excluding Silt as per Survey)	Mandatory Live Storage Below Crest	Domestic Use (67.19% Allocation)	Industrial Use (82.92% Allocation)	Kharif Use (100% Allocation)	Rabi Use (52% Allocation)	H.W. Use (0% Allocation)	Evaporation	Total Use (Col 8 to 13)	Balance Yeild After Total Use (Col 4 - Col 14)	Balance Water available for Jayakwadi (Col 15 or [Col 4-7] which ever is less)
Ref	Annexure Ref.	Anx 1 Col 32	CADA Nashik Mar 2019		Anx 1 Col 10	Anx 1 Col 14	Anx 4 Col 4 X 0.6719	Anx 4 Col 7 X 0.8292	Anx 3 Col 22 X 1.0	Anx 3 Col 23 X 0.5	Anx 3 Col 24 X 0.0				
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
	Total A to F		3906.02	0.00	2483.14	1486.03	510.98	102.10	730.71	721.93	0.00	267.83	2333.56	1572.46	1572.46
Balance water available in Upper Complexes for equitable distribution after monsoon															589.00
F	Paithan Dam	Gated	844.21	0.00	1991.98	60.64	350.42	97.24	354.86	533.46	0.00	288.65	1644.00	-799.79	

Equitable Allocations

1) In 75% dependable year, the available water scenario indicates that there is no adequate water to satisfy all design demands. Thus, following allocations are proposed;
Domestic : 67.19% of Sanctioned Use
Industry : 82.92% of Sanctioned Use (It is expected that minimum 10% demand shall be satisfied by recycling the domestic waste water).
Kharif : 100% of Planned Kharif Water Use. Rabi : 52% of Planned Rabi Water Use. H.W. : NIL.
2) All complexes except Palkhed, satisfy above mentioned allocations. Carryover will have to be used in Jayakwadi.
3) In year when it is decided to use this Strategy, if the balance water available for Jayakwadi Project (i. e. column no 16) is more than balance yield after total use of Jayakwadi (i.e. column no 15), Then the strategy will be applicable, Otherwise quantity of release of water to Jayakwadi shall be restricted to balance water available for Jayakwadi Project.

(Er. Mahendra Amale)
S. E. & Administrator
C.A.D.A ,Nashik &
Member Secretary

(Er. Samadhan Sabbinwar)
Superintending Engineer& Administrtor,
CADA ,Chhatrapati Sambhaji Nagar,
Special Invitee Member.

(Er.Pramod Mandade)
Chairman Godavari Study Group-II
& Director General, G.I.H.R.S (MERI)
Nashik

Statement - 9

Statement Showing water planning in Upper Godavari (up to Paithan dam) Sub Basin considering Average Yield Year (1977-1978)

(All figures in Mm³)

Sr. No.	Name of Dam and System	Gated/ Ungated	Yield in Year 1977-1978	Spills	Design Live Storage (Excluding Silt as per Survey)	Mandatory Live Storage Below Crest	Domestic Use (87.19% Allocation)	Industrial Use (82.92% Allocation)	Kharif Use (100% Allocation)	Rabi Use (80% Allocation)	Il. Wi. Use (0% Allocation)	Evaporation	Total Use (Col 8 to 13)	Balance Yeild After Total Use (Col 4 - Col 14)	Balance Water available for Jayakwadi (Col 15 or [Col 4-7] which ever is less)
Ref	Annexure Ref.	Anx 1 Col 12	CADA Nashik Mar 2019		Anx 1 Col 10	Anx 1 Col 14	Anx 4 Col 4 X 0.8719	Anx 4 Col 7 X 0.8292	Anx 3 Col 22 X 1.0	Anx 3 Col 23 X 0.8	Anx 3 Col 24 X 0.0				
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
A	Mula System														
1	Mandohol	Ungated	9.24		5.68	5.68	1.07	0.00	3.86	5.30	0.00	0.88	11.12		
2	Mula	Gated	695.83	29.15	546.55	243.24	75.04	6.04	158.31	301.20	0.00	54.34	594.93		
	Total of A		705.07	29.15	552.23	248.92	76.12	6.04	162.17	306.50	0.00	55.22	606.05	99.02	99.02
B	Pravara System														
1	Bhandardara	Gated	552.52		307.61	176.14	39.40	19.17	98.73	93.73	0.00	24.15	275.18		
2	Nilwande	Gated	134.96		228.75	178.01	11.47	0.00	122.82	141.99	0.00	12.60	288.88		
3	Adhala	Ungated			21.97	21.97	1.59	0.00	12.52	10.21	0.00	2.19	26.50		
4	Bhojapur	Ungated	18.32		9.86	9.86	2.65	0.00	8.10	6.25	0.00	1.03	18.03		
5	Ozar weir	Ungated	400.10	242.57											
	Total of B		970.91	242.57	568.19	385.98	55.10	19.17	242.17	252.18	0.00	39.97	608.59	362.35	362.35
C	Gangapur System														
1	Gautami	Gated	20.32		46.13	36.83	42.90	0.01	0.00	0.00	0.00	0.00	42.91		
2	Kashyapi	Gated	18.12		59.06	43.18	27.16	0.00	0.00	0.00	0.00	0.00	27.16		
3	Gangapur	Gated	227.41		159.42	78.54	67.34	19.23	3.17	13.64	0.00	20.38	123.76		
	Total of C		245.53	0.00	264.61	158.55	137.39	49.27	3.17	13.61	0.00	20.38	223.85	21.67	21.67
D	Palkhed System														
1	Karanjwan	Gated	0.00	0.00	152.00	79.13	1.37	1.08	1.79	2.62	0.00	16.99	23.84		
2	Waghad	Ungated	0.00		64.95	64.95	1.13	0.65	11.66	20.38	0.00	7.07	40.89		
3	Punegaon	Gated	0.00		16.64	4.10	0.34	0.00	2.59	12.80	0.00	1.02	16.75		
4	Ozarkhed	Ungated	0.00		56.69	56.69	8.61	0.90	16.34	28.06	0.00	8.27	62.18		
5	Tisgaon	Ungated	0.00		10.78	10.78	1.69	0.00	2.22	3.83	0.00	1.60	9.34		
6	Daraswadi (Water of Ozarkhed + Punegaon)						0.00		10.13	0.00	0.00		10.13		
7	Palkhed	Gated	0.00	0.00	18.49	2.74	33.14	5.62	69.91	119.74	0.00	8.10	238.54		
	Total of D		0.00	0.00	319.55	218.39	48.28	8.25	114.67	187.42	0.00	43.05	401.66	-401.66	-401.66

Statement - 9

Statement Showing water planning in Upper Godavari (up to Paithan dam) Sub Basin considering Average Yield Year (1977-1978)

(All figures in Mm³)

Sr. No.	Name of Dam and System	Gated/ Ungated	Yield in Year 1977-1978	Spills	Design Live Storage (Excluding Silt as per Survey)	Mandatory Live Storage Below Crest	Domestic Use (67.19% Allocation)	Industrial Use (62.92% Allocation)	Kharif Use (100% Allocation)	Rabi Use (50% Allocation)	H. W. Use (0% Allocation)	Evaporation	Total Use (Col 8 to 13)	Balance Yeild After Total Use (Col 4 - Col 14)	Balance Water available for Jayakwadi (Col 15 or (Col 4-7) which ever is less)
Ref	Annexure Ref.	Anx 1 Col 12	CaDA Nashik Mar 2019		Anx 1 Col 10	Anx 1 Col 14	Anx 6 Col 5 X 0.6719	Anx 4 Col 7 X 0.6292	Anx 3 Col 22 X 1.0	Anx 3 Col 23 X 0.5	Anx 3 Col 24 X 0.0				
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
E	Darna System														
1	Alandi	Ungated	20.67		23.85	23.10	0.93	0.17	13.15	18.71	0.00	2.85	35.82		
2	Kadwa	Gated	45.29		50.59	15.82	16.30	0.00	22.62	21.10	0.00	7.94	67.97		
3	Bham	Ungated	69.76	69.76	69.76	69.76	0.71	0.00	0.00	0.00	0.00	6.62	7.33		
4	Bhavali	Ungated	35.20	35.20	40.79	40.79	16.37	0.00	2.63	3.76	0.00	4.30	27.07		
5	Waki	Gated	70.57	70.57	70.57	46.86	0.00	0.00	0.00	0.00	0.00	5.91	5.91		
6	Darna	Gated	227.51		188.66	91.69	81.65	6.69	0.00	0.00	0.00	17.70	106.04		
7	Mukane	Gated	105.14		198.39	105.97	63.74	2.30	0.54	0.78	0.00	10.51	77.87		
8	Waldevi	Ungated	23.95	23.95	32.09	32.06	0.12	10.11	2.30	3.91	0.00	5.00	21.44		
9	N.M.Weir		1405.69	1405.69						0.00					
	(A)NM Express Canal		98.29	98.29			0.00	0.00	79.36	114.34	0.00		193.70		
	(B) Godavari canals		134.73				0.00	0.00	74.97	139.05	0.00		214.02		
	Total of E		1939.03	1107.92	674.70	426.05	179.84	19.26	195.57	301.65	0.00	60.83	757.16	1181.87	1181.87
	Total A to E		3860.57		2379.28	1437.89	496.73	102.01	717.75	1061.39	0.00	219.65	2597.32	1263.25	1263.25
Spills (Mula + Ozar Weir + N. M. Weir)				1379.64											
F	U/s of Jayakwadi														
1	Tembhapuri	Ungated	0.00	0.00	19.61	19.61	1.86	0.00	3.12	9.21	0.00	0.00	14.19	-14.19	-19.61
2	Dheku	Ungated	3.45	0.00	12.17	12.17	1.38	0.00	1.12	5.64	0.00	3.24	11.39	-7.94	-8.72
3	Kohli	Ungated	0.00	0.00	3.24	3.24	0.00	0.00	0.99	0.88	0.00	0.00	1.87	-1.87	-3.24
4	Narangi	Gated	0.00	0.00	11.50	0.00	3.75	0.00	0.13	1.82	0.00	0.00	5.71	-5.71	-5.71
5	Bor Dahegaon	Gated	0.00	0.00	11.47	1.44	1.00	0.00	1.87	5.33	0.00	0.00	8.21	-8.21	-8.21
6	Ambadi	Ungated	0.00	0.00	9.42	9.42	3.04	0.09	2.37	2.54	0.00	0.00	8.04	-8.04	-9.42
7	Shivana Takli	Gated	0.00	0.00	36.45	2.26	3.22	0.00	3.35	24.94	0.00	0.00	31.51	-31.51	-31.51
	Total of F		3.45	0.00	103.66	48.14	14.25	0.09	12.96	50.36	0.00	3.24	80.91	-77.46	-86.41
	Total A to F		3864.02	0.00	2383.14	1486.03	510.98	102.10	730.71	1111.75	0.00	222.69	2678.23	1185.79	1185.79
Balance water available in Upper Complexes for equitable distribution after monsoon															-116.39

Statement - 9

Statement Showing water planning in Upper Godavari (up to Paithan dam) Sub Basin considering Average Yield Year (1977-1978)

(All figures in Mm³)

Sr. No.	Name of Dam and System	Gated/ Ungated	Yield in Year 1977-1978	Spills	Design Live Storage (Excluding Silt as per Survey)	Mandatory Live Storage Below Crest	Domestic Use (87.19% Allocation)	Industrial Use (82.92% Allocation)	Kharif Use (100% Allocation)	Rabi Use (50% Allocation)	H. W. Use (0% Allocation)	Evaporation	Total Use (Col 8 to 13)	Balance Yeild After Total Use (Col 4 - Col 14)	Balance Water available for Jayakwadi (Col 15 or |Col 4-7| which ever is less)
Ref	Annexure Ref.	Anx 1 Col 12	CADA Nashik Mar 2019		Anx 1 Col 10	Anx 1 Col 14	Anx 4 Col 4 X 0.8719	Anx 4 Col 7 X 0.8292	Anx 3 Col 22 X 1.0	Anx 3 Col 23 X 0.5	Anx 3 Col 24 X 0.0				
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
F	Paithan Dam	Gated	2198.86		1991.98	60.64	350.42	97.24	354.86	1064.36	0.00	323.10	2189.98	8.88	

Equitable Allocations

3) In Average dependable year, the available water scenario indicates that there is no adequate water to satisfy all design demands. Thus, following allocations are proposed:

Domestic : 87.19% of Sanctioned Use

Industry : 82.92% of Sanctioned Use (It is expected that minimum 10% demand shall be satisfied by recycling the domestic waste water).

Kharif : 100% of Planned Kharif Water Use. Rabi : 50% of Planned Rabi Water Use. H.W. : NIL

2) All complexes except Palkhed satisfy above mentioned allocations.

(Er. Mahesh Jr. Avhale)
S. E. & Administrator
C.A.D.A. Nashik &
Member Secretary

(Er. Sambhaji Sabhinwar)
Superintending Engineer& Administrator,
CADA ,Chhatrapati Sambhaji Nagar.
Special Invitee Member.

(Er.Pramod Mandade)
Chairman Godavari Study Group-II
& Director General, D.T.I.R.S (MERI)
Nashik

Statement - 10

Statement Showing water planning in Upper Godavari (up to Paithan dam) Sub Basin considering Yield observed in Good Year (2017-18)

(All figures in Mm³)

Sr. No.	Name of Dam and System	Gated / Ungated	Yield in Year 2017	Spills	Design Live Storage (Excluding Silt as per Survey)	Mandatory Live Storage Below Crest	Domestic Use (100% Allocation)	Industrial Use (100% Allocation)	Kharif Use (100% Allocation)	Rabi Use (100% Allocation)	H. W. Use (100% Allocation)	Evaporation	Total Use (Col 8 to 13)	Balance Yelid After Total Use (Col 4 - Col 14)	Balance Water available for Jayakwadi (Col 15 or [Col 4-7] which ever is less)
Ref	Annexure Ref.	Anx 1 Col 12	CADA Nashik Mar 2019		Anx 1 Col 10	Anx 1 Col 14	Anx 4 Col 4 X 1.0	Anx 4 Col 7 X1	Anx 3 Col 22 X 1.0	Anx 3 Col 23 X 0.7	Anx 3 Col 24 X 0.0				
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
A	Mula System														
1	Mandoholi	Ungated	21.02		5.68	5.68	1.23	0.00	3.86	6.63	0.00	1.31	13.03		
1	Mula	Gated	829.45	33.36	546.55	243.24	86.07	7.29	158.31	376.50	0.00	64.20	692.36		
	Total of A		850.47	33.36	552.23	248.92	87.30	7.29	162.17	383.13	0.00	65.51	705.39	145.08	145.08
B	Pravara System														
1	Bhandardara	Gated	271.92		307.61	176.14	45.19	23.12	98.73	117.16	137.70	25.98	447.88		
2	Nilwande	Gated	225.61		228.75	178.01	13.15	0.00	122.82	177.49	0.00	12.60	326.06		
3	Adhala	Ungated	26.67		21.97	21.97	1.82	0.00	12.52	12.76	8.52	6.28	41.90		
4	Bhojapur	Ungated	22.32		9.86	9.86	3.04	0.00	8.10	7.81	0.00	2.14	21.09		
5	Ozar weir	Ungated	413.45												
	Total of B		937.97	329.39	568.19	385.98	63.20	23.12	242.17	315.22	146.22	47.00	836.93	121.04	121.04
C	Gangapur System														
1	Gautami	Gated	52.00		46.13	36.83	49.20	0.05	0.00	0.00	0.00	0.00	49.25		
2	Kashyapi	Gated	43.37		59.06	43.18	31.15	0.00	0.00	0.00	0.00	0.00	31.15		
3	Gangapur	Gated	400.38	236.34	159.42	78.54	77.23	59.37	3.17	17.05	10.76	16.04	183.62		
	Total of C		495.75	236.34	264.61	158.55	157.58	59.42	3.17	17.05	10.76	16.04	264.02	231.73	231.73
D	Palkhed System														
1	Karanjwan	Gated	154.81		152.00	79.13	1.57	1.30	1.79	3.27	0.00	12.33	20.26		
2	Waghad	Ungated	65.73		64.95	64.95	1.30	0.78	11.66	25.47	0.00	6.52	45.73		
3	Punegaon	Gated	19.68		16.64	4.10	0.39	0.00	2.59	16.00	0.00	3.83	22.81		
4	Ozarkhed	Ungated	62.23		56.69	56.69	9.87	1.09	16.34	35.07	0.00	8.54	70.91		
5	Tisgaon	Ungated	13.02		10.78	10.78	1.94	0.00	2.22	4.79	0.00	3.08	12.03		
6	Daraswadi (Water of Ozarkhed + Punegaon)						0.00		10.13	0.00	0.00		10.13		
7	Palkhed	Gated	311.81		18.49	2.74	40.39	6.78	69.94	149.67	4.39	5.37	276.45		
	Total of D		627.28	205.76	319.55	218.39	55.37	9.95	114.67	234.27	4.39	39.67	458.32	168.96	168.96

Statement - 10

Statement Showing water planning in Upper Godavari (up to Paithan dam) Sub Basin considering Yield observed in Good Year (2017-18)

(All figures in Mm³)

Sr. No.	Name of Dam and System	Gated / Ungated	Yield in Year 2017	Spills	Design Live Storage (Excluding Silt as per Survey)	Mandatory Live Storage Below Crest	Domestic Use (100% Allocation)	Industrial Use (100% Allocation)	Kharif Use (100% Allocation)	Rabi Use (100% Allocation)	H. W. Use (100% Allocation)	Evaporation	Total Use (Col 8 to 13)	Balance Yeild After Total Use (Col 4 - Col 14)	Balance Water available for Jayakwadi [Col 15 or [Col 4-7] which ever is less]
Ref	Annexure Ref.	Anx 1 Col 12	CADA Nashik Mar 2019		Anx 1 Col 10	Anx 1 Col 14	Anx 4 Col 6 X 1.0	Anx 4 Col 7 X1	Anx 3 Col 22 X 1.0	Anx 3 Col 23 X 0.7	Anx 3 Col 24 X 0.0				
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
F	Darna System														
1	Alandi	Ungated	27.87		23.85	23.10	1.07	0.21	13.15	23.39	0.00	5.83	43.65		
1	Kadwa	Gated	73.25		50.59	15.82	18.70	0.00	22.62	26.38	1.90	7.22	76.82		
3	Bham	Ungated		69.76	69.76	69.76	0.81	0.01	0.00	0.00	0.00	6.62	7.44		
4	Bhavali	Ungated	35.43		40.79	40.79	18.78	0.01	2.63	4.70	1.14	4.88	32.14		
2	Waki	Gated	51.01		70.57	46.86	0.00	0.00	0.00	0.00	0.00	5.91	5.91		
3	Darna	Gated	214.20		188.66	91.69	93.65	8.07	0.00	0.00	0.00	22.97	124.69		
4	Mukane	Gated	200.07		198.39	105.97	73.11	2.77	0.54	0.97	0.25	9.64	87.28		
8	Waldevi	Ungated	33.01		32.09	32.06	0.11	12.19	2.30	4.89	0.00	4.40	23.89		
5	N.M.Weir		1949.40	1949.40						0.00					
	(A)NM Express Canal		35.02				0.00	0.00	79.36	142.92	43.64		265.92		
	(B) Godavari canals		64.65				0.00	0.00	74.97	173.81	54.90		303.68		
	Total of E		2683.91	1879.64	674.70	426.05	206.23	23.25	195.57	377.06	101.84	67.47	971.42	1712.49	1712.49
	Total A to E		5615.38		2379.28	1437.59	569.68	123.02	717.75	1326.73	263.21	235.69	3236.08	2379.30	2379.30
Spills (Mula + Ozar Weir + N. M. Weir)				2242.39											
	Tembhapuri		0.00	0.00	19.61	19.61	2.14	0.00	3.12	11.51	0.00	0.00	16.77	-16.77	-19.61
	Dheku		5.23	0.00	12.17	12.17	1.59	0.00	1.12	7.05	0.00	3.24	13.00	-7.77	-7.77
	Kolti		3.13	0.00	3.24	3.24	0.00	0.00	0.99	1.10	0.00	0.00	2.09	1.04	-0.11
	Narangi		11.84	0.00	11.50	8.00	4.30	0.00	0.13	2.28	0.00	0.00	6.71	5.13	5.13
	Bor Dahegaon		11.10	0.00	11.47	1.44	1.15	0.00	1.87	6.66	0.00	0.00	9.69	1.42	1.42
	Ambadi		5.28	0.00	9.42	9.42	3.48	0.11	2.37	3.17	0.00	2.85	11.99	-6.71	-6.71
	Shivana Takli		12.15	0.00	36.45	2.26	3.69	0.00	3.35	31.17	0.00	3.39	41.60	-29.45	-29.45
	Total of F		48.73	0.00	103.86	48.14	16.34	0.11	12.96	62.96	0.00	9.48	101.85	-53.12	-57.11
	Total A to F		5664.11	0.00	2483.14	1486.03	586.03	123.13	730.71	1389.68	263.21	245.17	3337.93	2326.18	2322.19
Balance water available in Upper Complexes for equitable distribution after monsoon															136.91
F	Paithan Dam	Gated	2465.23	300.00	1991.98	60.64	401.90	117.27	354.86	1061.36	356.72	323.10	2618.20	-152.97	

Statement - 10

Statement Showing water planning in Upper Godavari (up to Paithan dam) Sub Basin considering Yield observed in Good Year (2017-18)

(All figures in Mm^3)

Sr. No.	Name of Dam and System	Gated / Ungated	Yield in Year 2017	Spills	Design Live Storage (Excluding Silt as per Survey)	Mandatory Live Storage Below Crest	Domestic Use (100% Allocation)	Industrial Use (100% Allocation)	Kharif Use (100% Allocation)	Rabi Use (100% Allocation)	H. W. Use (100% Allocation)	Evaporation	Total Use (Col 8 to 13)	Balance Yeild After Total Use (Col 4 - Col 14)	Balance Water available for Jayakwadi (Col 15 or [Col 4-7] which ever is less)
Ref	Annexure Ref.	Anx 1 Col 12	CADA Nashik Mar 2019		Anx 1 Col 10	Anx 1 Col 14	Anx 4 Col 4 X 1.0	Anx 4 Col 7 X1	Anx 3 Col 22 X 1.0	Anx 3 Col 23 X 0.7	Anx 3 Col 24 X 0.0				
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16

Equitable Allocations

1) In Good year, it is observed that there are spills from all complexes including Jayakwadi reservoir. Thus, water is adequate to meet all the 100% design demands. Therefore, following allocations are proposed;

Domestic : 100% of Sanctioned Use

Industry : 100% of Sanctioned Use (It is expected that minimum 10% demand shall be satisfied by recycling the domestic waste water).

Kharif : 100% of Planned Kharif Water Use. Rabi : 100% of Planned Rabi Water Use. H.W. : 100% of Planned H.W. Water Use.

2) The Kharif use shall be restricted to design Kharif use till Jayakwadi dam spills.

(Er. Mahendra Amale)
S. E. & Administrator
C.A.D.A. Nashik &
Member Secretary

(Er. Sanjaykiran Sabnirwar)
Superintending Engineer& Administrtor,
CADA ,Chhatrapati Sambhaji Nagar.
Special Invitee Member.

(Er.Pramod Mandade)
Chairman Godavari Study Group-II
& Director General, D.T.H.R.S (MERI)
Nashik

Distribution of Utilizable Water Available in the Upper Godavari (upto Paithan dam) Sub-basin among the various complex/systems of Reservoirs under different conditions of Probabilities of Inflows in Paithan dam

Table : 5

Review 2023

Strategy No.	Scenario						Utilizable Water including Kharif/Monsoon Use (Mcum)						
	Complex →						Mula	Pravara	Gangapur	Godavari - Darna	Palkhed	Paithan	Shivana
	Dams/Systems in complex →						Mandhol, Mula	Bhandardara, Nilwande, Adhala, Bhojapur	Gangapur, Kashyapi, Gautami	Alandi, Kadwa, Bham, Bhawali, Waki, Darna, Mukane, Waldevi	Karanjwan, Waghad, Punegaon, Ojharkhed, Palkhed, Tisgaon	Paithan	Ambadi, Dheku, Tembhapuri Kotla, Narangi, Bor, Shivana Takli
	Design Live storage (Mcum) →						725.98	594.73	335.47	737.08	387.12	2170.94	231.80
	Carry over (Mcum) →						28.32	0.00	11.64	0.00	0.00	381.70	0.00
	Design Water Use (Mcum) →						835.34	864.70	293.81	1054.28	505.08	2618.21	261.70
1	2						3	4	5	6	7	8	
	Paithan observed Net	% Demands											
		D-NI	I-NI	K-I	R-I	HW-I							
1	100% dep. Year	87.19	82.92	80	0	0	263.63	385.98	207.53	441.62	218.39	938.26	48.14
2	90% dep. Year	87.19	82.92	80	32	0	371.84	409.75	214.04	529.49	257.48	1286.40	56.31
3	75% dep. Year	87.19	82.92	100	52	0	517.40	519.98	219.08	674.72	330.89	1644.00	71.49
4	Average yield	87.19	82.92	100	80	0	606.05	608.59	223.86	757.16	401.66	2189.98	80.91
5	Good year	100	100	100	100	100	705.39	836.93	264.02	971.42	458.32	2618.20	101.85

Table : 6 (Modified) 2024 Considering with Design Live Storage as per 2018 report GSG-II

Upper Reservoirs' Storages to be synchronized with the state of Paithan dam storage for different Operating Strategies during filling (Monsoon) period

Operating Strategy →	Utilizable Water including Kharif Monsoon Use (Mcum) Used Design Live Storage													
Complex →	Paithan		Mula		Pravara		Ganganpur		Godavari - Darna		Palkhed		Shivana	
Dams/Systems in complex →	Paithan		Mandhol, Mula		Bhandardara, Nilwande, Adhala, Bhojapur		Ganganpur, Kashyapi, Gautami		Alandi, Kadwa, Dham, Bhavadi, Waki, Darna, Makane, Waldevi		Karanjwan, Waghad, Panegaon, Dharkhed, Palkhed, Tisgaon		Ambadi, Dheku, Tembhapuri Kohli, Narangi, Bor, Shivana Takli	
Design Live storage (Mcum) →	2171		726		595		335		737		357		232	
Carry over (Mcum) →	381.70		28.32		0.00		11.64		0.00		0.00		0.00	
Design Water Use (Mcum) →	2618		835		865		294		1054		505		262	
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
Strategy -I	557	26	235	32	386	65	196	59	442	60	218	56	48	21
Strategy - II	905	42	344	47	410	69	202	61	529	72	257	67	56	24
Strategy - III	1262	58	489	67	529	87	207	62	675	92	331	86	71	31
Strategy -IV	1808	83	578	80	609	102	212	63	757	103	402	104	81	35
Strategy - V	2237	103	677	93	837	141	252	75	971	132	458	118	102	44

Table : 6 (Old) 2013 as per GSG-I(Mendhegiri Report)

Upper Reservoirs' Storages to be synchronized with the state of Paithan dam storage for different Operating Strategies during filling (Monsoon) period

Operating Strategy →	Utilizable Water(including Kharif/Monsoon Use excluding carry over (Mcum) (% of Design Live Storage)					
Complex →	Paithan	Mula	Pravara	Gangapur	Godavari - Darna	Palkhed
Dams/Systems in complex →	Paithan	Mandhol, Mula	Bhandardara, Nilwande, Adhala, Bhojapur	Gangapur, Kashyapi, Gautami	Alandi, Kadwa, Bham, Bhawali, Waki, Darna, Mukane, Waldevi	Karanjwan, Waghad, Punegaon, Ojharkhed, Palkhed, Tisgaon
Design Live storage (Mcum) →	2171	618	571	309	718	350
Carry over (Mcum) →	381.70	28.32	0.00	11.64	0.00	0.00
Design Water Use (Mcum) →	2618	811	870	341	941	512
1	2	3	4	5	6	7
Strategy -I	797 (37%)	303 (49%)	320 (56%)	187 (61%)	461 (64%)	254 (73%)
Strategy - II	1173 (54%)	402 (65%)	425 (74%)	227 (74%)	604 (84%)	254 (73%)
Strategy - III	1409 (65%)	489 (79%)	500 (88%)	252 (82%)	736 (102%)	287 (82%)
Strategy -IV	1645 (76%)	576 (93%)	575 (101%)	277 (90%)	870 (121%)	345 (99%)
Strategy - V	1738 (80%)	611 (99%)	605 (106%)	287 (93%)	918 (128%)	369 (105%)
Strategy -VI	2237 (103%)	689 (112%)	836 (146%)	313 (101%)	1220 (170%)	457 (130%)

Annextures

ANNEXURE 1

Information about Major, Medium and Minor Irrigation Projects in Upper Godavari (up to Paithan dam) Sub Basin

(N. A. - Not Applicable, N. S. - No Silt Survey done, All figures in Mm³)

Sr. No.	Name of System	Total Cultivable area of system (Sqkm)	Design Storage (Mcum) (As per DPR) & subsequent approval by Govt.				Design Water Use	Revised Storage (excluding Silt as per Survey)		Estimated Annual Evaporation Losses	Type of Overflow Section (Gated/ Ungated)	Live Storage against Spillway Gates	Live Storage below Crest of Spillway	Spillway Design Discharge (Cumecs)	Canal Outlet Design Discharge (Cumecs)		River Sluice Design Discharge (Cumecs)	Power Outlet Design Discharge (Cumecs)
			Dead	Live	Carry Over	Gross		Dead	Live						L.B.C.	R.B.C.		
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19
A	Mula System																	
1	Mandohal	347	2.82	8.79	0.00	11.61	33.15	2.82	8.65	4.43	Ungated	0.00	5.65	2429	0.04	3.16	-	-
2	Mula	2276	107.34	668.45	28.32	776.82	704.61	125.33	546.38	76.45	Gated	303.67	243.24	5036	7.59	44.22	N.A.	N.A.
	U.S.Mula																	
3	M.I.& KT.W.(State) (36 Nos.)	-	9.71	82.96	0.00	92.67	91.79	N.S.	N.S.	12.94	Ungated	N.A.	82.96	-	-	-	-	-
4	M.I.S.T.P.I.S.T. -(Local Sector - 57)	-	0.00	25.79	0.00	25.79	25.79	N.S.	N.S.	5.18	Ungated	-	25.79	-	-	-	-	-
	Total of A		130.56	725.46	28.32	864.96	855.34	128.87	552.23	95.68		303.67	357.67					
B	Pravara System																	
1	Bhandardara	120	8.85	304.00	0.00	312.85	33.97	8.50	307.61	13.07	Gated	111.47	176.11	1171	0.60	0.00	58.62	55.39
2	Nilwande	222	7.26	226.79	0.00	256.05	326.06	7.25	228.75	12.69	Gated	3.74	179.01	1700	43.43	11.58	50.00	LLDO -50 RDO -50
3	Adhala	227	2.42	27.61	0.00	30.03	36.73	2.42	23.97	3.17	Ungated	N.A.	23.97	1651	3.19	1.92	N.A.	N.A.
4	Bhojapur + Flood Canals	254	3.04	10.22	0.00	13.26	23.93	3.04	9.86	1.35	Ungated	N.A.	9.86	1159	6.08	0.00	N.A.	N.A.
5	Otur weir (Pravara Canal)	1632				0.00	423.90	N.S.	N.S.	0.00	Ungated	N.A.	0.00	2807	30.62	9.71	N.A.	N.A.
	U.S.Otur Weir																	
6	M.I.(State) 5 Nos.		2.35	37.21	0.00	39.56	36.90	N.S.	N.S.	2.58	Ungated	N.A.	17.21	0	N.A.	N.A.	N.A.	N.A.
7	M.I.S.T.P.I.S.T. -(Local Sector - 27)	-	0.00	6.84	0.00	6.84	6.84	N.S.	N.S.	1.37	Ungated	N.A.	6.84	0	N.A.	N.A.	N.A.	N.A.
	Total of B		23.86	594.73	0.00	618.09	864.70	21.21	568.19	31.04		115.21	410.03					
C	Gangapur System																	
1	Caranjani	43	1.02	52.90	0.00	53.92	0.00	0.92	40.10	NA	Gated	9.90	36.83	1648	N.A.	N.A.	N.A.	4.29
2	Kashyapi	46	0.26	51.75	0.00	52.01	0.00	0.26	51.06	NA	Gated	15.65	43.16	568	N.A.	N.A.	N.A.	4.47
3	Gangapur	957	12.00	203.88	11.66	276.98	241.52	6.68	159.42	17.61	Gated	83.86	78.34	2294	8.92	3.98	N.A.	N.A.
	U.S.Gangapur																	
5	M.I.(State) (5 Nos.)		2.42	15.53	0.00	16.95	16.40			2.50	0.00		15.53	0	N.A.	N.A.	N.A.	N.A.
6	M.I.S.T.P.I.S.T. -(Local Sector -24)	-	0.00	11.61	0.00	11.61	11.61	N.S.	N.S.	2.32	Ungated	N.A.	5.16	0	N.A.	N.A.	N.A.	N.A.
	Total of C		15.70	335.67	11.66	369.07	269.53	7.86	264.61	22.43		109.06	179.04					

ANNEXURE 1

Information about Major, Medium and Minor Irrigation Projects in Upper Godavari (up to Paithan dam) Sub Basin

(N. A. - Not Applicable, N. S. - No Silt Survey done, All figures in Mm^3)

Sr. No.	Name of System	Total Catchment area of system (Sqkm)	Design Storage (Mcum) [As per DPR] & subsequent approval by Govt.				Design Water Use	Revised Storage (excluding Silt as per Survey)		Estimated Annual Evaporation Losses	Type of Overflow Section (Gated/ Ungated)	Live Storage against Spillway Gates	Live Storage below Crest of Spillway	Spillway Design Discharge (Cumecs)	Canal Outlet Design Discharge (Cumecs)		River Sluice Design Discharge (Cumecs)	Power Outlet Design Discharge (Cumecs)
			Dead	Live	Carry Over	Gross		Dead	Live						L.B.C.	R.B.C.		
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19
D	Palkhed System	806																
1	Karanjwan	248	9.34	166.22	0.00	175.56	24.92	9.34	152.09	16.99	Gated	72.87	79.13	2724	1.02	N. A.	24.69	12.63
2	Waghad	119	4.25	72.23	0.00	76.48	46.29	2.55	64.95	7.08	Ungated	N. A.	64.95	1350	1.42	13.50	N. A.	N. A.
3	Punegaon	66	2.82	17.57	0.00	20.39	21.22	2.82	16.64	2.21	Gated	12.51	4.10	937	6.27	0.00	N. A.	N. A.
4	Ozarkhed (including C.A. of Punegaon)	182	7.64	60.32	0.00	67.96	79.59	7.61	56.69	8.27	Ungated	N. A.	56.69	2100	12.01	0.00	N. A.	N. A.
	Darawadi (Water from Punegaon)						10.13										N. A.	N. A.
5	Palkhed	257	1.77	21.24	0.00	23.01	293.06	1.75	18.49	8.10	Gated	15.75	2.74	4592	75.91	1.47	N. A.	N. A.
6	Thygaon	97	2.70	12.87	0.00	15.57	3.20	2.70	10.78	3.20	Ungated	N. A.	10.78	1851	0.00	6.31	N. A.	N. A.
	U.S.of Palkhed																	
7	M.I.(Slate) (9 Nos.)		0.47	20.77	0.00	21.44	20.77	N. S.	N. S.	4.00	Ungated	N. A.	25.69	N. A.	N. A.	N. A.	N. A.	N. A.
8	M.I.P.I.P.S.T...(Local Sector-55)	-	0.00	15.90	0.00	15.90	15.90	N. S.	N. S.	3.10	Ungated	N. A.	15.90	N. A.	N. A.	N. A.	N. A.	N. A.
	Total of D		29.19	387.12	0.00	416.31	505.09	26.40	339.55	53.06		101.16	260.18					
E	Dams System																	
1	Alandi	75	2.06	27.47	0.00	29.53	40.67	2.06	23.85	2.85	Ungated	N. A.	23.80	1005	5.98	1.00	N. A.	N. A.
2	Kadwa	173	6.68	52.90	0.00	59.58	80.70	6.68	50.59	10.28	Gated	35.77	15.82	2021	N. A.	11.39	N. A.	11.39
3	Bhatn	51	5.66	60.76	0.00	76.42	30.18	5.66	60.76	4.62	Ungated	0.00	60.76	980	N. A.	N. A.	N. A.	7.56
4	Bhavali	26	3.96	40.79	0.00	44.75	17.06	3.96	40.79	4.30	Ungated	0.00	40.79	662	N. A.	N. A.	N. A.	8.35
5	Waki	32	5.23	70.57	0.00	75.80	18.16	5.21	70.57	5.91	Gated	23.71	46.86	765	N. A.	N. A.	N. A.	7.56
6	Dama	401	7.05	219.82	0.00	226.87	56.91	0.00	188.66	67.16	Gated	96.97	91.69	3035	N. A.	N. A.	N. A.	31.15
7	Mukane	130	9.18	204.99	0.00	214.16	105.00	9.18	198.39	21.72	Gated	92.42	105.97	866	N. A.	N. A.	N. A.	17.00
8	Waldevi	52	1.92	32.09	0.00	34.01	25.76	1.92	32.09	5.00	Ungated	N. A.	32.09	809	N. A.	N. A.	N. A.	7.91
9	N.M.Wele																	
	(A)NM Express Canal (Mukane 107.36+Bhavli 29.67 +Waki 52.41 +Bhatn 69.87+Free Catchment 60.43 = 317.37 Mcum Design Use)						317.37								31.00	N. A.	N. A.	N. A.
	(B) Godavari canals (Gangapur 61.23 (34.26 from Dam +27.47 Regeneration) + Dama 162.91 + Waldevi 36.35 + free catchment 121.66 = 362.45 MCum design Use)						362.45								12.01	21.23	N. A.	N. A.

ANNEXURE 1

Information about Major, Medium and Minor Irrigation Projects in Upper Godavari (up to Paithan dam) Sub Basin

(N. A. - Not Applicable, N. S. - No Silt Survey done, All figures in Mm^3)

Sr. No.	Name of System	Total Catchment area of system (Sqkm)	Design Storage (Mcum) [As per DPR] & subsequent appraisal by Govt.				Design Water Use	Revised Storage (excluding Silt as per Survey)		Estimated Annual Evaporation Losses	Type of Overflow Section (Gated/ Ungated)	Live Storage against Spillway Gates	Live Storage below Crest of Spillway	Spillway Design Discharge (Cumecs)	Canal Outlet Design Discharge (Cumecs)		River Sluice Design Discharge (Cumecs)	Power Outlet Design Discharge (Cumecs)
			Dead	Live	Carry Over	Gross		Dead	Live						L.B.C.	R.B.C.		
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19
	U.S.of Darna																	
10	MI (State) – 6 nos		0.51	13.77	0.00	14.31	15.09	N.S.	N.S.	2.07			13.77	N.A.	N.A.	N.A.	N.A.	N.A.
11	MI,KT,PT,ST...(Local Sector -10)		0.00	4.93	0.00	4.93	4.93	N.S.	N.S.	0.99	Ungated	0.00	14.61	N.A.	N.A.	N.A.	N.A.	N.A.
	U.S.of N.M.Weir																	
12	MI & KT (State) – 13 nos		1.58	20.95	0.00	22.53	22.75	N.S.	N.S.	3.14			20.95	N.A.	N.A.	N.A.	N.A.	N.A.
13	MI,KT,PT,ST...(Local Sector -73)		0.00	20.58	0.00	20.58	20.58	N.S.	N.S.	4.12	Ungated	0.00	14.61	N.A.	N.A.	N.A.	N.A.	N.A.
	Total of E		43.86	778.61	0.00	822.47	1097.61	34.69	674.70	117.16		217.87	489.99					
F	Remaining Upto Paithan																	
1	Below Mula																	
	M.I.& KTW.(State) (13 Nos.)		0.20	16.83	0.00	17.03	18.99	N.S.	N.S.	2.52	Ungated	N.A.	16.83	N.A.	N.A.	N.A.	N.A.	N.A.
	MI,KT,PT,ST...(Local Sector -17)		0.00	5.80	0.00	5.80	5.80	N.S.	N.S.	1.16	Ungated	0.00	5.80	N.A.	N.A.	N.A.	N.A.	N.A.
2	Below N M Weir																	
	M.I.& KTW.(State) (25 Nos.)		6.41	78.43	0.00	84.82	89.20	N.S.	N.S.	11.76	Ungated	N.A.	78.43	N.A.	N.A.	N.A.	N.A.	N.A.
	MI,KT,PT,ST...(Local Sector -138)		0.00	36.61	0.00	36.61	36.61	N.S.	N.S.	7.32	Ungated	N.A.	36.61	N.A.	N.A.	N.A.	N.A.	N.A.
3	Below Ozar weir																	
	M.I.& KTW.(State) (16 Nos.)		0.57	32.62	0.00	33.19	34.56	N.S.	N.S.	4.89	Ungated	N.A.	32.62	N.A.	N.A.	N.A.	N.A.	N.A.
	MI,KT,PT,ST...(Local Sector -33)		0.00	9.48	0.00	9.48	9.48	N.S.	N.S.	1.90	Ungated	N.A.	9.48	N.A.	N.A.	N.A.	N.A.	N.A.
	Total of upto Paithan -F		7.18	179.77	0.00	186.93	185.84			29.55		0.00	179.77					

ANNEXURE 1

Information about Major, Medium and Minor Irrigation Projects in Upper Godavari (up to Paithan dam) Sub Basin

(N. A. - Not Applicable, N. S. - No Silt Survey done, All figures in Mm^3)

Sr. No.	Name of System	Total Catchment area of system (Sqkm)	Design Storage (Mcum) [As per DPR] & subsequent approval by Govt.				Design Water Use	Revised Storage (including Silt as per Survey)		Estimated Annual Evaporation Losses	Type of Overflow Section (Gated/ Ungated)	Live Storage against Spillway Gates	Live Storage below Crest of Spillway	Spillway Design Discharge (Cumecs)	Canal Outlet Design Discharge (Cumecs)		River Sluice Design Discharge (Cumecs)	Power Outlet Design Discharge (Cumecs)
			Dead	Live	Carry Over	Gross		Dead	Live						L.B.C.	R.B.C.		
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19
G	U/s of Jayakwadi																	
1	Tembhapuri	284	1.66	19.61	0.00	21.27	22.13	N. S.	N. S.	5.36	Ungated	N. A.	19.61	2043	0.00	4.40	N. A.	N. A.
2	Dhaku	259	1.36	12.17	0.00	13.53	13.00	N. S.	N. S.	3.21	Ungated	N. A.	12.17	1924	1.09	0.00	N. A.	N. A.
3	Kohli	42	0.40	3.24	0.00	3.64	3.10	N. S.	N. S.	0.46	Ungated	N. A.	3.24	697	0.32	0.00	N. A.	N. A.
4	Narangi	176	1.79	11.50	0.00	13.29	13.30	N. S.	N. S.	5.59	Gated	11.50	0.00	1599	1.07	0.86	N. A.	N. A.
5	Bor Dahegaon	232	1.93	11.47	0.00	13.40	15.10	N. S.	N. S.	5.43	Gated	10.03	1.44	2310	0.78	0.35	N. A.	N. A.
6	Ambadi	141	2.31	9.42	0.00	11.76	12.78	N. S	N. S.	2.85	Ungated	N. A.	9.42	1433	0.22	0.91	N. A.	N. A.
7	Shivana Takli	375	2.90	36.45	0.00	39.37	45.68	N. S.	N. S.	7.27	Gated	34.20	2.26	5371	2.10	3.85	N. A.	N. A.
8	MI Projects (45 No.)		11.84	99.69	0.00	111.53	108.46	N. S.	N. S.	14.95	Ungated	N. A.	99.69	N. A.	N. A.	N. A.	N. A.	N. A.
9	MI.NT.PT.ST. (Local Sector-93)		0.00	28.25	0.00	28.25	28.25	N. S.	N. S.	5.65	Ungated	N. A.	28.25	N. A.	N. A.	N. A.	N. A.	N. A.
	Total of G		24.23	231.80	0.00	256.04	261.70	0.00	0.00	50.76	0.00	55.73	176.04	13457.15	5.58	10.40	0.00	0.00
	Total A to G		261.00	3203.48	29.92	3514.46	4043.55	713.43	2579.25	402.50	0.00	996.70	2052.76	13457.15	5.58	10.40	0.00	0.00
II	Paithan Dam (Including US on Backwater)	21774.80	758.11	2170.94	381.70	2909.64	2616.23	569.00	1951.96	373.20	Gated	1931.24	60.61	22656	101.94	63.71	N. A.	50.00

(Er. Manohar Amale)
S. E. & Administrator
C.A.D.A ,Nashik &
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CADA ,Chhatrapati Sambhaji Nagar.
Special Invitee Member.

(Er.Pramod Mandade)
Director General ,
Maharashtra Engineering Reasech
(MERI) ,Nashik. & Chairma

ANNEXURE 2

Information about availability of yield at various locations in Upper Godavari (up to Paithan dam) sub-basin

(All figures in Mm³)

Sr. No.	Name of Dam	Design Annual Virgin Yield						Planned u/s utilisations (Design)	Design Net Annual Yield					Regeneration Flow (Design)	Observed Net Yield					
		100% dep	90% dep	75% dep	50% dep	Average	Year of Study		100% dep	90% dep	75% dep	50% dep	Average		100% dep	90% dep	75% dep	50% dep	Average	Data period
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21
A	Mula Complex																			
1	Mandolhal	6.03	8.13	14.15	22.05	27.32	1954-1974	0.00	6.03	8.13	14.15	22.05	27.32	0.00	0.18	2.74	4.75	12.25	19.24	1983-2022
2	Mula Dam (70% Dep.)	328.67	436.01	696.50	822.60	819.34	1999	0.00	328.67	436.01	696.50	822.60	819.34	0.00	328.67	469.32	593.03	765.31	821.97	1961-2022
	TotalA	334.70	444.14	710.65	844.65	846.66	1999.00	0.00	334.70	444.14	710.65	844.65	846.66	0.00	328.85	472.06	597.78	777.56	841.21	0.00
B	Pravara Complex																			
1	Bhandardara	289.37	412.47	480.16	546.45	547.59	1949-1980	33.92	N.A.	N.A.	480.16	546.45	547.59	0.00	233.33	316.05	373.05	426.80	477.54	1976-2022
2	Nilwande	N.A.	N.A.	595.82	693.48	702.79	1993	326.06	N.A.	N.A.	119.66	147.03	165.20	0.00	157.53	172.01	397.13	502.34	511.65	2008-2022
3	Adhala	N.A.	34.43	42.47	56.92	56.63	1986	0.00	N.A.	34.43	42.47	56.92	56.63	0.00	7.36	17.39	23.67	34.87	42.59	1991-2022
4	Bhojapur	N.A.	N.A.	N.A.	32.85	38.51	1934-1946	0.00	N.A.	N.A.	N.A.	32.85	38.51	0.00	3.96	9.25	13.27	21.72	29.49	1977-2022
5	Ozar Weir	420.13	677.30	771.82	884.55	951.14	1949-1980	768.91	N.A.	N.A.	2.91	115.64	182.23	0.00	78.87	131.46	195.14	277.38	331.95	1976-2022
	Total B	709.50	1124.20	1893.27	2214.25	2296.66	3959.00	1128.94	0.00	34.43	644.20	868.89	990.16	0.00	481.05	646.16	992.26	1292.91	1393.12	0.00
C	Gangapur Complex																			
1	Gautami	17.00	30.00	43.70	52.90	55.62	1951-1990	0.00	17.00	30.00	43.70	52.90	55.62	0.00	20.32	30.91	42.96	57.77	59.49	2005-2022
2	Kashyapi	16.46	54.73	68.53	77.59	74.96	1955-1990	6.89	9.57	47.84	61.64	70.70	68.07	0.00	17.36	26.51	34.37	55.02	55.88	1999-2022
3	Gangapur	118.93	163.10	214.85	295.91	297.35	1908-1928	0.00	118.93	163.10	214.85	295.91	297.38	0.00	102.25	186.72	231.29	298.23	320.65	1975-2022
	Total C	152.39	247.83	327.08	426.40	427.96	0.00	6.89	145.50	240.94	320.19	419.51	421.07	0.00	139.93	244.17	308.62	411.02	435.82	0.00
D	Palkhed Complex																			
1	Karanjwan	N.A.	N.A.	173.300	N.A.	N.A.	N.A.	1.73	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.	57.14	90.33	115.98	162.99	171.32	1981-2022
2	Waghad	N.A.	N.A.	92.88	N.A.	N.A.	N.A.	3.6	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.	42.39	51.65	65.58	73.68	69.22	1981-2022
3	Ozerkhed	N.A.	N.A.	92.31	N.A.	N.A.	N.A.	6.03	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.	20.23	24.15	41.37	58.15	64.27	1982-2022
4	Pungaon	N.A.	N.A.		N.A.	N.A.	N.A.		N.A.	N.A.	N.A	N.A.	N.A.	N.A.	4.42	7.87	15.49	19.06	27.99	1997-2022
5	Palkhed	N.A.	N.A.	86.08	N.A.	N.A.	N.A.	0	N.A.	N.A.	86.08	N.A	N.A.	N.A.	17.33	21.24	34.07	68.27	160.70	1981-2022
	Palkhed Complex	206.71	297.32	444.57	571.99	666.27	1909-1926	184.56	22.15	112.76	260.01	347.43	481.71	0.00	182.94	262.46	271.81	349.26	430.16	1981-2022
6	Tisgaon	N.A.	N.A.	N.A.	25.62	N.A.	1993	0.84	N.A.	N.A.	N.A.	24.78	N.A.	0	0.00	2.21	5.21	12.51	14.87	1997-2022
	Total D	206.71	297.32	889.14	997.61	668.27	1993.00	196.76	22.15	112.76	346.09	412.21	481.71	0.00	324.44	459.91	549.51	744.25	958.53	0.00
E	Dams Complex																			
1	Alandi	13.40	23.93	42.21	51.00	50.47	1965-1983	0.00	13.40	23.93	42.21	51.00	50.47	0.00	13.90	24.89	25.39	39.90	49.71	1985-2022
2	Kadwa	66.48	71.72	85.74	106.61	130.54	1948-1983	3.76	62.72	67.96	81.98	102.85	126.78	0.00	49.49	74.62	109.76	137.47	165.80	1993-2022
3	Bham	34.23	57.90	75.10	83.09	85.73	1999-1925	0.00	34.23	57.90	75.10	83.09	85.73	0.00	75.80	75.80	145.03	176.24	188.22	2018-2022
4	Bhavli	17.56	29.69	38.51	42.61	43.98	1999-1925	0.00	17.56	29.69	38.51	42.61	43.98	0.00	52.73	52.90	66.84	82.40	76.51	2010-2022

ANNEXURE 2

Information about availability of yield at various locations in Upper Godavari (up to Paithan dam) sub-basin

[All figures in Mm³]

Sr. No.	Name of Dam	Design Annual Virgin Yield						Planned u/s utilisations (Design)	Design Net Annual Yield					Regeneration Flow (Design)	Observed Net Yield					
		100% dep	90% dep	75% dep	50% dep	Average	Year of Study		100% dep	90% dep	75% dep	50% dep	Average		100% dep	90% dep	75% dep	50% dep	Average	Data period
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21
5	Waki	21.94	37.11	48.14	53.26	54.98	1906-1923	0.00	21.94	37.11	48.14	53.26	54.98	0.00	67.05	67.05	29.32	102.24	93.38	2018-2022
6	Darna	273.86	463.20	600.79	664.69	686.11	1906-1923	0.00	273.86	463.20	600.79	664.69	686.11	0.00	258.93	311.07	490.54	616.82	715.02	1923-2022
7	Mukane	87.79	148.46	191.16	211.16	216.49	1906-1923	0.00	87.75	148.46	191.16	211.16	216.49	0.00	65.17	89.24	109.71	127.21	143.58	1946-2022
8	Waldevi	19.38	27.80	31.56	42.16	44.22	1923-1939	0.00	19.38	27.80	31.56	42.16	44.22	0.00	25.11	31.81	55.22	70.84	72.40	2003-2022
9	N M Weir			1879.37	N M Project Page No.30			1429.99	Not Available			449.38	0.00	0.00	124.59	245.08	541.11	743.25	1317.50	1545.62	1976-2022
	Total E	534.00	859.81	2992.58	1258.18	1312.57	0.00	1433.75	501.84	856.05	1558.83	1294.47	1338.81	124.59	653.44	1360.69	1623.12	2770.65	3052.37	0.00
F	U/s of Jayakwadi																			
1	Tembhapuri	6.86	15.26	20.93	29.39	33.07	1976	3.91	2.95	11.35	17.02	25.48	33.06	1.3	0	0	0	9.67	9.93	2006-2022
2	Dheku	0.23	1.24	2.87	4.52	2.16	1957	0.00	0.23	1.24	2.87	4.52	2.16	0	3.69	3.84	7.23	9.41	13.09	1974-2022
3	Kohli	0.29	1.95	3.00	4.756	2.498	1961	0.00	0.29	1.95	3.00	4.76	2.50	0	0	0	0.0	1.02	1.64	1999-2022
4	Narangi	0.00	7.99	10.95	14.66	13.83	1993	0.00	0.00	7.99	10.95	14.66	13.83	0	0	0	0	0	1.91	4.56	1999-2022
5	Bor Dahegaon	0.00	9.20	12.70	17.02	16.05	1992	0.00	0.00	9.20	12.75	17.02	16.05	0	0	0	0.31	3.62	5.81	1999-2022
6	Ambadi	2.48	3.80	9.50	16.83	8.9	1969	0.00	2.48	3.80	9.50	16.83	8.90	0	1.665	3.261	6.246	9.767	11.082	1965-2022
7	Shivana Takli	41.63	43.07	73.63	113.052	132.54	1976	31.53	0.00	0.00	21.30	63.52	91.04	6	5.2	6.2	17.1	23.42	36.62	2003-2022
	Total F	51.48	82.52	133.64	202.23	219.93	13926.00	55.61	5.91	35.54	83.19	146.79	165.51	1.30	8.55	13.32	28.56	55.41	78.63	0.00
	Total A to F	1989.38	3055.82	6949.36	5543.32	5772.07	21772.00	2521.75	1039.13	1723.86	3660.15	3976.47	4204.92	125.89	2130.74	3196.35	4299.85	6911.89	6757.68	0.00
G	Jayakwadi Project	3184.00	4751.00	5566.00	6634.00	6955.00	1965.00	3270.00	0.00	145.00	2296.00	3361.00	3656.00	243.52	174.27	541.45	844.21	1753.44	2170.13	1976-2022

(Er. A[illegible] Ambale)
S. E. & Administrator
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CADA ,Chhatrapati Sambhaji Nagar.
Special Invitee Member.

(Er.Pramod Mandade)
Director General,
Maharashtra Engineering Research Institute
(MERI) Nashik & Chairman

Annexure - 3

Information of Water Requirement (Demand) from various Reservoirs / Dams (Major & Medium projects)in Upper Godavari (up to Paithan dam)sub-basin

(All Figures in Mm^3)

Sr. No.	Name of Dam/ System	Live Storage excluding Silt (As per Silt Survey)	Planned Irrigation Use (DPR Provisions)				Planned NI Provision	Design Evaporation Losses				Transit Losses from Dam to Pickup Weir	Total Annual Design Water Use (7+8+12+13)	Annual Non-Irrigation Reservations Granted (only Active Schemes)			Contingency Rural Domestic Reservations by Collector in 2022-23	Quantity of NI in Excess of Planned NI use	Reduced Irrigation Use after Deducting Excess NI use	reducing factor	Revised Planned Irrigation Use (After Deducting Excess NI Use)				Total Design Use
			Kharif	Rabi	HW	Annual		Kharif	Rabi	HW	Annual			Domestic	Industrial	Total		col. 17- 8	col. 7 + 19	col. 20/7	Kharif	Rabi	HW	Annual	
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26
A	Mula System																								
1	Mandoha	5.68	4.31	7.41	0.00	11.72	0.00	-	-	-	1.43	-	13.15	1.25	0.00	1.25	1.25	1.25	10.46	0.92	3.84	6.63	-	10.46	13.15
2	Mula	546.55	168.44	470.60	0.00	569.04	59.12	-	-	-	76.49	-	704.61	46.02	7.29	93.36	29.92	34.24	534.81	0.91	158.34	376.50	-	534.81	704.61
	Total of A	552.23	172.75	478.01	-	580.76	59.12	-	-	-	77.86	-	717.76	47.30	7.29	94.59	29.92	35.47	545.30		162.17	383.13	-	545.30	717.76
B	Pravara System																								
1	Bhandardara Dam	307.61	117.85	139.60	164.20	421.90	0.00	-	-	-	13.02	20.95	455.87	45.19	23.32	68.51	7.68	68.51	387.59	0.84	98.75	132.14	157.70	387.59	455.87
2	Nilwande	228.75	128.25	165.26	0.00	315.46	0.00	-	-	-	12.60	-	326.06	13.33	0.00	13.33	0.00	13.33	302.31	0.96	122.27	177.44	-	302.31	326.06
3	Adhale Dam	21.97	13.19	15.45	8.98	35.62	0.00	-	-	-	3.11	-	38.73	1.62	0.00	1.62	0.33	1.62	33.60	0.93	12.57	12.74	8.31	33.60	36.73
4	Bhojapur + Flood Canal [7.12 Mcum]	9.66	8.34	8.04	0.00	16.38	2.57	0.27	0.45	0.61	1.35	-	20.30	3.01	0.00	5.01	0.29	0.47	15.91	0.92	4.30	7.31	-	15.91	20.30
	Total of B	568.19	267.63	346.85	173.28	787.36	2.57	0.27	0.45	0.61	30.08	20.95	848.96	63.20	23.32	86.52	8.09	83.93	703.61		242.17	315.22	166.2	703.61	848.96
C	Ganga pur System																								
1	Gautami	46.13	0.00	0.00	0.00	0.00	0.00	NA	NA	NA	0.00	0.00	-	49.20	0.05	49.25	0	180.14							
2	Kashyapi	39.00	0.00	0.00	0.00	0.00	53.98	NA	NA	NA	0.00	0.00	53.98	31.13	0.00	31.13	-								
3	Gangapur	150.42	23.61	136.21	73.36	231.18	2.63	0.00	9.03	6.78	17.81	0.00	251.62	77.23	59.12	136.60	0.76		30.99	0.13	3.17	17.05	10.76	30.98	265.79
	Total of C	235.55	23.61	136.21	73.36	231.18	56.61	0.00	9.03	6.78	17.81	0.00	265.60	157.56	59.12	217.00	0.76	180.14	30.99		3.17	17.05	10.76	30.98	265.79

Annexure - 3

Information of Water Requirement (Demand) from various Reservoirs / Dams (Major & Medium projects)in Upper Godavari (up to Paithan dam)sub-basin

(All Figures in Mm³)

Sr. No.	Name of Dam/ System	Live Storage excluding Silt (As per Silt Survey)	Planned Irrigation Use (GDK Provisions)				Planned NI Provision	Design Evaporation Losses				Transit Losses from Dam to Pickup Weir	Total Annual Design Water Use (7+8+12+13)	Annual Non-Irrigation Reservations Granted (only Active Schemes)			Contingency Rural Domestic Reservations by Collector in 2022-23	Quantity of NI in Excess of Planned NI use	Reduced Irrigation Use after Deducting Excess NI use	reducing factor	Revised Planned Irrigation Use (After Deducting Excess NI Use)				Total Design Use
			Kharif	Rabi	HW	Annual		Kharif	Rabi	HW	Annual			Domestic	Industrial	Total					Kharif	Rabi	HW	Annual	
1	2	3	6	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26
D	Paithan Upregion																								
1	Nandgaon	152.00	2.81	5.12	0.00	7.93	0.00	-	-	-	10.39	-	21.92	1.57	1.30	2.87	0.31	2.42	5.06	0.86	1.79	3.27	-	5.06	24.92
2	Waghad	94.95	12.31	26.90	0.00	39.21	0.00	-	-	-	7.08	-	46.29	1.30	0.78	2.08	1.75	2.05	37.13	0.95	11.76	25.47	-	37.13	48.29
3	Purnagon	16.61	2.62	16.34	0.00	18.96	0.00	-	-	-	2.23	-	21.22	0.55	0.80	0.35	0.00	0.56	18.59	0.93	7.59	10.00	-	18.59	21.22
4	Overhead	56.96	19.42	41.68	0.00	61.10	1.27	-	-	-	6.27	-	70.64	9.67	1.39	10.96	4.00	9.69	51.41	0.84	16.34	35.07	-	51.41	70.64
5	Nagaon	10.78	2.63	6.12	0.00	8.95	0.00	-	-	-	3.23	-	12.15	1.94	0.00	1.94	0.00	1.94	7.01	1.00	2.22	3.79	-	7.01	12.15
	Darasmadi (Water from Purnagon)		13.13	0.00	0.00	10.13	0.00	-	-	-	-	-	10.13	0.00	0.00	0.00	0.00	-	10.13	1.00	10.13	-	-	10.13	10.13
6	Paithan	18.49	28.69	166.23	4.95	221.73	19.36	-	-	-	6.30	3.66	251.06	40.30	6.78	47.08	21.00	37.78	226.30	0.86	69.98	146.62	4.70	221.30	261.06
Total of D		349.54	126.74	264.26	4.95	396.01	20.62	-	-	-	45.66	3.66	466.31	55.37	9.93	65.31	31.06	44.70	353.33	0.86	114.67	234.22	4.70	353.31	466.31
E	Dapra System																								
1	Alandi Dam	23.65	23.61	24.21	0.00	37.82	0.00	2.03	3.62	0.00	2.65	0.00	43.67	1.07	0.21	1.28	0.00	1.28	36.54	0.92	13.15	23.39	-	36.54	44.67
2	Kachra	50.59	30.54	35.61	3.67	69.83	0.00	3.79	3.49	3.00	10.28	-	83.23	14.70	0.00	14.70	3.14	18.10	51.72	0.74	22.43	26.38	2.72	51.72	61.72
3	Bhasa	69.76	0.00	0.00	0.00	0.00	0.00	2.65	3.20	1.37	6.62	5.56	19.18	0.00	0.00	0.00	-								19.99
4	Bhavadi	42.79	3.31	5.61	1.56	10.70	0.00	1.53	2.08	0.00	4.39	2.06	17.06	19.76	0.0035	19.79	3.35			0.84	7.61	4.70	1.63	9.96	31.13
5	Wakl	70.57	0.00	0.00	0.00	0.00	9.12	1.83	2.86	1.22	5.91	3.13	18.16	0.00	0.00	-	-								0.00
6	Darpa	166.66	0.00	0.00	0.00	0.00	0.00	14.63	22.80	9.75	47.16	9.23	56.39	93.65	6.02	101.72	9.23								158.03
7	Markumbi	146.30	0.00	0.16	0.43	2.21	71.91	7.67	11.99	5.19	24.72	6.23	105.02	71.11	2.77	73.88	0.17	333.73	567.67	0.84	0.85	0.93	0.36	1.87	105.20
8	Waldevi	52.60	2.71	5.44	0.00	8.58	12.18	3.25	5.25	0.00	5.03	0.00	23.76	0.14	12.19	12.33	0.00			0.81	2.30	4.89	-	7.19	21.52
9	NM Weir					-																			
	a) NMLExpress Canal		94.72	170.56	52.68	317.97	0.00	0.00	0.00	0.00	0.00	0.00	317.97	0.00	0.00	0.00	-			0.84	79.56	142.92	43.64	265.92	265.92
	b) Godavari Canal		87.63	237.45	62.32	387.40	0.00	0.00	0.00	0.00	0.00	0.00	387.40	0.00	0.00	0.00	-			0.84	73.62	173.81	52.00	305.68	305.68
Total of E		674.07	354.04	680.66	123.65	858.95	93.71	33.56	51.95	21.31	106.84	24.73	1084.26	296.26	23.21	319.50	12.75	333.01	675.68		196.52	377.05	100.35	673.89	1010.95
Total of A to E		2,379.23	825.51	1,565.59	375.23	2,766.31	242.93	55.83	81.83	30.71	229.49	44.56	3,327.19	566.21	121.92	693.75	84.01	477.22	2,839.10		717.73	1,324.71	264.62	2,839.10	3,329.98

Annexure - 3

Information of Water Requirement (Demand) from various Reservoirs / Dams (Major & Medium projects)in Upper Godavari (up to Paithan dam)sub-basin

(All Figures in Mm³)

Sr. No.	Name of Dam/ System	Live Storage excluding Silt (As per Silt Survey)	Planned Irrigation Use (DPR Provisions)				Planned NI Provision	Design Evaporation Losses				Transit Losses from Dam to Pickup Weir	Total Annual Design Water Use (7+8+12+13)	Annual Non-Irrigation Reservations Created (only Active Schemes)			Contingency Rural Domestic Reservation as by Collector in 2022-23	Quantity of NI in Excess of Planned NI use	Reduced Irrigation Use after Deducting Excess NI use	reducing factor	Revised Planned Irrigation Use (After Deducting Excess NI Use)				Total Design Use
			Kharif	Rabi	HW	Annual		Kharif	Rabi	HW	Annual			Domestic	Industrial	Total		col. 17-4	col. 7 + 19	col. 20/7	Kharif	Rabi	HW	Annual	
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26
F	U/s of Jayakwadi																	-	-						
1	Tembhapuri	19.61	3.46	12.75	-	16.21	0.36	-	-	-	3.36	-	20.13	2.14	-	2.14	-	1.54	11.61	0.91	3.12	11.31	-	14.44	22.13
2	Dheku	12.12	1.34	8.42	-	9.76	0.00	-	-	-	3.24	-	13.10	1.56	-	1.56	-	1.50	8.18	0.81	1.12	7.05	-	8.18	13.00
3	Kohli	3.24	0.99	1.39	0.54	2.94	0.00	-	-	-	0.46	-	3.40	-	-	-	-	-	2.94	1.00	0.99	1.10	0.54	2.64	3.10
4	Narangi	13.50	0.11	2.25	-	2.43	5.37	-	-	-	3.56	-	11.30	4.30	-	4.30	-	-	2.11	1.00	0.13	2.28	-	2.41	12.30
5	Bor Dahegaon	11.47	2.07	7.50	-	9.45	0.23	1.60	2.60	1.01	3.61	-	15.10	1.15	-	1.15	-	0.92	8.54	0.90	1.87	6.60	-	8.54	15.10
6	Ambadi	9.42	2.76	3.72	0.93	7.41	2.50	-	-	-	2.85	-	12.79	3.10	0.11	3.59	-	3.09	6.34	0.85	2.37	3.17	0.79	6.34	12.79
7	Shivana Tekli	36.45	3.35	31.17	-	34.52	3.79	2.22	3.89	1.16	7.27		45.58	3.79	-	3.79	0.16	-	34.52	1.00	3.35	31.17	-	34.52	45.58
	Total of F	103.86	14.13	66.80	1.47	82.43	12.28	3.82	6.49	2.17	30.18	-	124.99	16.44	0.11	16.55	0.16	6.17	74.26		12.96	62.96	1.34	77.26	123.99
G	Paithan Dam																								
1	Jayakwadi Project	1,991.90	349.84	1,129.86	321.63	1,801.34	164.11	67.85	93.56	162.69	323.10		2,316.79	345.50	78.37	423.96	69.00	229.85	1,571.72	0.87	905.74	963.09	267.29	1,571.72	2,318.79
2	Feeding to Majalgaon		72.75	119.35	107.52	299.62	-	-	-	-	-	-	299.62	56.31	38.90	95.21	-	95.21	204.21	0.96	49.52	91.26	72.33	204.21	299.42
	Total Paithan Dam	1,991	422.62	1,266.01	430.25	2,101	196.11	67.85	93.56	162.69	323.10	-	2,616.21	401.80	117.27	519.17	69.00	325.06	1,775.93		954.66	1,054.34	339.62	1,775.93	2,618.21

*It is proposed not to consider contingency Rural release. These should be adjusted in irrigation use.
*Figures shown in column no 17, are considered as per MWRRA guidelines. Quantities of new working NI schemes are excluded.

(Er. Mahesh Zagade)
S.E. & Administrator
C.A.D.A. ,Nashik &
Member Secretary

(Er. Sachin Sabnis)
Superintending Engineer & Administrator,
CADA, Chhatrapati Sambhaji Nagar
Special Invitee Member.

(Er.Pramod Mandade)
Director General,
Maharashtra Engineering Research Institute
(MERI), Nashik & Chairman

ANNEXURE-4

Details of Non Irrigation Reservation & Actual Water Use from Major & Medium Projects in Upper Godavari (up to Paithan dam) sub-basin (Revised

(All Figures in Mm^3)

Sr. No.	Name of Dam	NI Provision in Project Report	Domestic Use			Industrial Use			Total Non-Irrigation Use				
			Reser vations Granted (Active Schemes)	Entitled as per MWRRA Criteria	Actual 2022-23 (with losses)	Reser vations Granted (Active Schemes)	Entitled as per MWRRA Criteria	Actual 2022-23 (with losses)	Reser vations Granted	Entitled as per MWRRA Criteria	Actual 2022-23 (with losses)	River Losses (for NI)	Total Use (included losses)
I	2	3	4	5	6	7	8	9	10=4+7	11=5+8	12=6+9	13	14=12+13
A	Mula System												
1	Mandohal	0.00	1.23	1.05	1.34	0.00	0.00	0.00	1.23	1.05	1.34	-	1.34
2	Mula	59.12	86.07	42.39	57.19	7.29	12.40	3.71	93.36	54.79	60.90	-	60.90
	Total of A	59.12	87.30	43.44	58.53	7.29	12.40	3.71	94.59	55.84	62.24	0.00	62.24
B	Pravara System												
1	Bhandardara	0.00	45.19	28.05	90.46	23.12	3.42	5.01	68.31	31.48	95.47	-	95.47
2	Nilwande	13.15	13.15	7.89	11.54	0.00	0.00	0.00	13.15	7.89	11.54	-	11.54
3	Adhala	0.00	1.82	0.34	1.11	0.00	0.00	0.00	1.82	0.34	1.11	-	1.11
4	Bhojapur	2.57	3.04	3.04	15.91	0.00	0.00	0.00	3.04	3.04	15.91	-	15.91
	Total of B	15.72	63.20	39.33	119.02	23.12	3.42	5.01	86.32	42.75	124.03	0.00	124.03
C	Gangapur System												
1	Gautami	0.00	49.20	27.17	1.21	0.05	0.05	0.00	49.28	27.22	1.22	-	1.22
2	Kashyapi	33.98	31.15	17.66	0.00	0.00	0.00	0.00	31.15	17.66	0.00	-	0.00
3	Gangapur	2.83	77.23	47.35	151.01	59.37	58.99	14.15	136.60	106.34	165.16	-	165.16
	Total of C	36.81	157.58	92.18	152.22	59.42	59.04	14.15	217.03	151.22	166.38	0.00	166.38
D	Palkhed System												
1	Karnjwan	0.00	1.57	0.89	0.31	1.30	0.54	0.36	2.87	1.43	0.67	-	0.67
2	Waghad	0.00	1.30	0.62	0.30	0.78	0.86	0.00	2.08	1.48	0.30	-	0.30
3	Punegaon	0.00	0.39	0.00	0.34	0.00	0.00	0.00	0.39	0.00	0.34	-	0.34

ANNEXURE-4

Details of Non Irrigation Reservation & Actual Water Use from Major & Medium Projects in Upper Godavari (up to Paithan dam) sub-basin (Revised

(All Figures in Mm^3)

Sr. No.	Name of Dam	NI Provision in Project Report	Domestic Use			Industrial Use			Total Non-Irrigation Use				
			Reservations Granted (Active Schemes)	Entitled as per MWRRA Criteria	Actual 2022-23 (with losses)	Reservations Granted (Active Schemes)	Entitled as per MWRRA Criteria	Actual 2022-23 (with losses)	Reservations Granted	Entitled as per MWRRA Criteria	Actual 2022-23 (with losses)	River Losses (for NI)	Total Use (included losses)
1	2	3	4	5	6	7	8	9	10=4+7	11=5+8	12=6+9	13	14=12+13
4	Ozarkhed	1.27	9.87	6.54	8.65	1.09	1.12	0.50	10.96	7.66	9.15	-	9.15
5	Palkhed	19.36	40.30	67.48	107.18	6.78	10.70	2.84	47.08	78.18	110.02	14.94	124.96
6	Tisgaon	0.00	1.94	0.87	0.15	0.00	0.00	0.00	1.94	0.87	0.15	-	0.15
	Total of D	20.63	55.37	76.40	116.93	9.95	13.22	3.70	65.32	89.62	120.63	14.94	135.57
E	Darna System												
1	Alandi	0.00	1.07	1.07	0.00	0.21	0.13	0.12	1.28	1.20	0.12	-	0.12
2	Kadwa	0.60	18.70	11.20	15.55	0.00	0.00	0.00	18.70	11.20	15.55	-	15.55
3	Bham	0.00	0.81	0.81	0.00	0.01	0.01	0.00	0.82	0.82	0.00	-	0.00
4	Bhavali	0.00	18.78	18.78	0.80	0.005	0.005	0.00	18.79	18.79	0.80	-	0.80
5	Waki	9.12	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	-	0.00
6	Mukane	71.81	73.11	41.59	56.54	2.77	2.77	5.55	75.88	44.36	62.09	-	62.09
7	Darna	0.00	93.65	58.59	19.35	8.07	8.07	0.13	101.72	66.66	19.48		168.32
8	N. M. Weir a) Godavari canals				113.58			13.27			126.85		
	b) N.M.Express Canal												
9	Waldevi	12.18	0.14	0.34	2.50	12.19	12.19	5.43	12.33	12.53	7.93	-	7.93
	Total of E	93.71	206.26	132.98	208.92	23.25	23.17	24.50	229.51	155.55	232.82	0.00	254.81
	Total A To E	225.99	569.71	383.73	655.02	123.02	111.25	51.07	692.73	494.98	706.10	14.94	743.03
F	U/s of Jayakwadi												
1	Tembhapuri	0.56	2.14	0.98	0.89	0.00	0.00	0.00	2.14	0.98	0.89	-	0.89
2	Dheku	0.00	1.59	0.36	0.52	0.00	0.00	0.00	1.59	0.36	0.52	-	0.52
3	Kohli	0.00	0.00	0.89	0.65	0.00	0.00	0.00	0.00	0.89	0.65	-	0.65
4	Nazngi	5.30	4.30	2.41	0.56	0.00	0.00	0.00	4.30	2.41	0.56	-	0.56
5	Bor Dahegaon	0.23	1.15	0.18	0.13	0.00	0.00	0.00	1.15	0.18	0.13	-	0.13
6	Ambadi	2.50	3.48	1.18	2.02	0.11	0.00	0.10	3.59	1.18	2.12	-	2.12
7	Shivana Takli	3.79	3.69	0.90	0.13	0.00	0.00	0.00	3.69	0.90	0.13	-	0.13
	Total of F	12.35	16.34	6.90	4.90	0.11	0.00	0.10	16.45	6.90	5.00	0.00	5.001

ANNEXURE-4

Details of Non Irrigation Reservation & Actual Water Use from Major & Medium Projects in Upper Godavari (up to Paithan dam) sub-basin (Revised

(All Figures in Mm^3)

Sr. No.	Name of Dam	NI Provision in Project Report	Domestic Use			Industrial Use			Total Non-Irrigation Use				
			Reser vations Granted (Active Schemes)	Entitled as per MWRRA Criteria	Actual 2022-23 (with losses)	Reser vations Granted (Active Schemes)	Entitled as per MWRRA Criteria	Actual 2022-23 (with losses)	Reser vations Granted	Entitled as per MWRRA Criteria	Actual 2022-23 (with losses)	River Losses (for NI)	Total Use (included losses)
1	2	3	4	5	6	7	8	9	10=4+7	11=5+8	12=6+9	13	14=12+13
G	Jayakwadi Project	0.00	401.90	374.24	75.03	117.27	78.37	41.82	519.17	452.61	116.85	0	116.85

*Figures shown in Column no.4,7 and 10, are not corrected as per MWRRA guidelines.

*Entitlement as per MWRRA guidelines may be considered for further calculations.

*Actual water supplies shown in the proforma are inclusive of river losses. However the water lost in the transit that is used for irrigation from surface of groundwater.

(Er. Mahendra Amale)
S. E. & Administrator
C.A.D.A ,Nashik &
Member Secretary

(Er. Sambhan Sabbanwar)
Superintending Engineer& Administrtor,
CADA ,Chhatrapati Sambhaji Nagar,
Special Invitee Member.

(Er.Pramod Mandade)
Director General ,
Maharashtra Engineering Reasech
(MERI) ,Nashik. & Chairman

ANNEXURE-5

Information about Kharif utilizations from Major and Medium projects in Upper Godavari (upto Paithan dam) fig. in MCM

Inform

Sr. No.	Name of Dam/ System	Planned Kharif Use		2012-13			2013-14			2014-15			2015-16			2016-17			2017-18		
		Area irrigated (Ha.)	Water Use (Mm^3)	Area irrigated (Ha.)	Water Use (Mm^3)	Losses (Mm3)	Area irrigated (Ha.)	Water Use (Mm^3)	Losses (Mm3)	Area irrigated (Ha.)	Water Use (Mm^3)	Losses (Mm3)	Area irrigated (Ha.)	Water Use (Mm^3)	Losses (Mm3)	Area irrigated (Ha.)	Water Use (Mm^3)	Losses (Mm3)	Area irrigated (Ha.)	Water Use (Mm^3)	Losses (Mm3)
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22
A	Mula Complex																				
1	Manjara	2256.00	9.21	0.00	0.00	0.00	0.00	0.00	0.00	0	0.00	0.00	0.00	0.00	0.00	175.00	0.00	0.00	175.00	0.00	0.00
2	Mula	35556.00	168.42	39323.00	119.73	0.29	39657.00	178.86	0.30	20503	21.48	0.34	2603.00	5.35	0.24	35879.00	95.69	0.41	35988.00	104.02	0.43
Total Mula Complex		37822.00	177.63	39323.00	119.73	0.29	39657.00	178.86	0.30	20503	21.48	0.34	2603.00	5.35	0.24	35879.00	95.69	0.41	35988.00	104.02	0.43
B	Pravara Complex																				
1	Bhandardara	11136.00	127.85	13939.00	17.24	0.00	13518.00	32.79	2.53	13111	34.71	0.01	12956.00	9.25		2679.00	14.84		19365.00	7.93	
2	Nilwande	64260.00	328.50	0.00	0.00		0.00	0.00		34	0.02		42.00	0.02	0.00	64.00	0.04	0.00	859.00	0.25	
3	Ozar Weir																				
	Pravara Canal			8559.00	64.25		10550.00	108.05		9379	82.27		9383.00	78.47		9205.00	93.71		6172.00	80.74	
	Total	75446.00	346.00	22504.00	81.99	0.00	24098.00	121.39	2.53	22426	97.17	0.01	22406.00	87.89	0.00	25060.00	111.76	0.39	26521.00	98.42	0.00
4	Adhala	1774.00	13.19	2943.00	0.00	0.00	2943.00	9.27	0.00	0	0.00	0.39	0.00	0.00	0.00	0.00	0.00	0.00	375.35	1.78	
5	Bhojapur+Flood cana	3576.00	8.34	0.00	0.00	0.00	38.00	0.00	0.00	66	0.00	0.00	66.00	0.00	0.00	148.00	0.00	0.00	344.00	2.13	
Total Pravara Complex		80856.00	367.53	22758.00	81.99	0.00	24430.00	121.76	2.53	22490	97.17	0.40	22470.00	87.89	0.39	25208.00	111.76	0.78	27240.75	102.33	0.00
C	Gangapur Complex																				
1	Gautami Godavari	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2	Kashyapi	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
3	Gangapur	9735.00	21.61	9926.86	0.56	0.00	9404.13	9.31	0.00	11165.66	14.28	0.00	2663.00	0.00	0.00	2894.93	0.55	0.00	3468.69	0.17	
Total Gangapur Complex		9735.00	21.61	9926.86	0.56	0.00	9404.13	9.31	0.00	11165.66	14.28	0.00	2663.00	0.00	0.00	2894.93	0.55	0.00	3468.69	0.17	0.00
E	Darna Complex																				
1	Alandi Dam	2266.00	19.43	2177.00	0.00	0.00	2281.00	0.00	0.53	1853	0.00	0.59	1853.00	0.00	0.00	1351.00	0.00	0.00	1467.20		
2	Kadwa	5514.00	50.82	3782.18	29.11	0.00	4869.58	45.18	0.00	3685	0.79	0.00	3692.82	25.28	0.00	4255.08	18.00	0.00	3851.53	13.95	
3	Dham		0.00		0.00			0.00			0.00			0.00			0.00				
4	Bhavali	738.00	3.16	0.00	0.00	0.00	0.00	0.00	0.22	0	0.00	0.00	0.00	0.00		0.00	0.00	0.00			
5	Waki		0.00		0.00			0.00			0.00			0.00			0.00				
6	Darna	0.00	0.00	2820.75	0.41	24.67	3318.41	0.34	24.81	1747	1.21	2.64	3070.34	10.55	2.82	3129.43	3.09	0.00	7824.00	3.46	34.96
7	Mukane	453.00	0.65	502.75	3.00	0.00	502.75	0.62	0.00	3011	2.66	0.00	0.00	0.00	0.00	0.00	0.00	0.00	2673.00	0.51	
8	Waldevi	666.00	2.74	502.75	0.21	0.00	502.75	0.21	0.00	502	0.21	0.00	0.00	0.00	0.00	0.00	0.00	0.00	31.00	0.00	
9	NM Weir																				
	a)NM Pipeline Canal	22906.00	99.29	503.00	52.79		0.00	53.42		2300	62.24		4749.00	50.98		6855.00	42.76		5392.00	35.81	
	b)Gulancanal	17228.00	85.49	21755.00	84.43		20299.13	83.05		14569	39.90		13507.11	37.12		14495.96	47.36		13026.01	23.41	
Total Darna Complex		49821.00	238.45	31179.51	174.00	24.67	29331.62	175.86	25.36	21346.94	65.40	3.18	34592.92	144.94	3.34	33422.99	103.15	0.00	31560.44	74.84	34.96

ANNEXURE-5

Information about Kharif utilizations from Major and Medium projects in Upper Godavari (upto Paithan dam) fig. in MCM

Inform

Sr. No.	Name of Dam/ System	Planned Kharif Use		2012-13			2013-14			2014-15			2015-16			2016-17			2017-18		
		Area irrigated (Ha.)	Water Use (Mm^3)	Area irrigated (Ha.)	Water Use (Mm^3)	Losses (Mm3)	Area irrigated (Ha.)	Water Use (Mm^3)	Losses (Mm3)	Area irrigated (Ha.)	Water Use (Mm^3)	Losses (Mm3)	Area irrigated (Ha.)	Water Use (Mm^3)	Losses (Mm3)	Area irrigated (Ha.)	Water Use (Mm^3)	Losses (Mm3)	Area irrigated (Ha.)	Water Use (Mm^3)	Losses (Mm3)
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22
F	Paithan Complex																				
1	Katanpur	567.00	2.81	175.00	0.00	0.01	185.90	0.00	0.02	184.65	0.00	0.29	185.90	0.00	0.06	395.40	0.00	0.29	554.00	0.00	0.290
2	Waghad	2439.00	12.31	2258.60	0.00	0.43	2763.70	0.00	0.50	1244	0.00	0.50	2503.46	0.00	0.54	1829.27	0.00	0.03	1783.85	0.00	0.117
3	Paithan	23380.00	78.60	11451.23	6.23	1.02	19652.13	52.43	1.02	14772.69	27.54	0.18	9935.90	1.03	0.71	14758.35	10.09	0.91	19331.00	26.98	4.340
	Total	26377.00	93.72	13884.83	6.27	2.08	22606.73	52.45	5.04	17202	27.54	3.47	12688.26	1.03	1.91	16973.22	10.09	2.88	21340.85	26.98	7.25
4	Puregaon	3509.00	2.64	304.65	0.00	0.12	297.60	0.00	0.32	301.10	0.27	0.03	199.85	0.00	0.00	344.85	3.10	0.09	348.90	1.86	0.000
5	Ozarkhed	4692.00	19.42	5759.00	0.00	0.00	6924.11	0.00	0.66	6637.87	6.00	0.14	6679.06	0.00	0.11	7066.38	3.52	0.45	6928.27	4.14	0.498
	Darawadi (Water of Ozarkhed + Puregaon)		10.13		0.00			0.00			0.89			0.00			0.00			0.00	0.00	0.00
6	Tisgaon	622.00	2.83	0.00	0.00	0.01	6.93	0.00	0.07	0.00	0.00	0.00	78.60	0.00	0.00	85.00	1.28	0.00	87.20	0.00	0.000
Total Paithan Complex		35190.00	128.74	19948.48	6.27	2.29	29828.44	52.45	6.09	24143	27.82	3.64	19645.92	1.03	2.03	24496.05	19.99	3.33	28605.72	32.98	7.75
Total CADA Nashik (A To F)		213424.00	829.08	123175.85	378.56	27.25	142651.19	538.23	34.28	101646.11	246.14	7.56	81974.84	239.20	6.00	121960.93	332.44	4.52	125862.91	314.35	43.14
G	U/s of Jayakwadi																				
1	Terabhapuri	256.00	3.45	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	43.00	0.00	0.00
2	Dheku	1392.00	1.34	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	86.00	0.50	0.00	0.00	0.00	0.00	0.00	0.00	0.00
3	Kohli	250.00	0.99	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
4	Narangi	300.00	0.13	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
5	Bor Dahegaon	370.00	2.07	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
6	Ambadi	1075.00	7.13	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
7	Shivana Takli	2284.00	10.33	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Total of G		5755.00	16.43	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	86.00	0.50	0.00	0.00	0.00	0.00	43.00	0.00	0.00
H	Jayakwadi Project																				

ANNEXURE-5

Information about Kharif utilizations from Major and Medium projects in Upper Godavari (upto Paithan dam) fig. in MCM

Inform

Sr. No.	Name of Dam/ System	Planned Kharif Use		2012-13			2013-14			2014-15			2015-16			2016-17			2017-18		
		Area irrigated (Ha.)	Water Use (Mm^3)	Area irrigated (Ha.)	Water Use (Mm^3)	Losses (Mm3)	Area irrigated (Ha.)	Water Use (Mm^3)	Losses (Mm3)	Area irrigated (Ha.)	Water Use (Mm^3)	Losses (Mm3)	Area irrigated (Ha.)	Water Use (Mm^3)	Losses (Mm3)	Area irrigated (Ha.)	Water Use (Mm^3)	Losses (Mm3)	Area irrigated (Ha.)	Water Use (Mm^3)	Losses (Mm3)
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22
1	Paithan Dam	135853.00	349.85	9699.00	32.71	0.00	7142.00	28.25	0.00	8748.00	144.96	0.00	6749.00	92.05	0.00	3464.00	33.26	0.00	12666.00	275.87	0.00
	Majalgaon Feeding	-	27.17	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-

Note ; water was released from upstream reservoirs for Jayakwadi in 2012-13 (249.78 MCM), 2014-15 (201.61 MCM), 2015-16 (294.49 MCM)

ANNEXURE-5

ation about Kharif utilizations from Major and Medium projects in Upper Godavari (upto Paithan dam) fig. in MCM

Sr. No.	Name of Dam/ System	2018-19			2019-20			2020-21			2021-22			2022-23			Average		
		Area irrigated (Ha.)	Water Use (Mm^3)	Losses (Mm3)	Area irrigated (Ha.)	Water Use (Mm^3)	Losses (Mm3)	Area irrigated (Ha.)	Water Use (Mm^3)	Losses (Mm3)	Area irrigated (Ha.)	Water Use (Mm^3)	Losses (Mm3)	Area irrigated (Ha.)	Water Use (Mm^3)	Losses (Mm3)	Area irrigated (Ha.)	Water Use (Mm^3)	Losses (Mm3)
1	2	23	24	25	26	27	28	29	30	31	32	33	34	35	36	37	39	39	40
A	Mula Complex																		
1	Mandohal	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00		83.00	0.00		41.00	1.00	0.00
2	Mula	58894.00	157.76	0.36	40551.00	131.75	0.44	16625.00	3.90	0.35	21897.00	3.77	0.33	24428.00	0.34	0.12	31455.00	75.09	1.00
Total Mula Complex		58894.00	157.76	0.36	40551.00	131.75	0.44	16625.00	3.90	0.35	21897.00	3.77	0.33	24511.00	0.34	0.12	31495.00	75.09	1.00
B	Pravara Complex																0.00	0.00	0.00
1	Bhandardara	19462.52	0.35		19837.70	1.05		20402.00	1.45		15598.00	11.21		18078.15	10.85		16654.00	10.00	1.50
2	Nilwande	2120.17	10.08		2222.24	10.58		2283.69	7.83		2333.70	7.83		2445.82	7.91		1130.00	6.00	1.00
	Ozar-Weir																0.00	0.00	0.00
	Pravara Canal	5562.68	61.48		6485.00	95.81		0.00	4.37		0.00	11.42		0.00	0.00		5838.00	62.00	0.00
	Total	27125.37	71.91	0.00	28544.94	108.07	0.00	22685.69	13.45	0.00	17931.70	30.46	0.00	20523.97	19.13	0.00	23621.00	77.00	1.00
4	Adhala	379.00	1.80		902.00	8.90		670.50	4.03		688.00	2.41		1992.65	10.87		569.00	3.00	1.00
5	Bhojapur+Flood cana	297.10	2.43		467			1281.00	4.92		689.00			365.80	1.00		341.00	1.00	0.00
Total Pravara Complex		27801.47	76.15	0.00	29913.94	116.97	0.00	24637.19	22.40	0.00	19299.70	32.87	0.00	22882.42	31.90	0.00	24471.00	81.00	2.00
C	Gangapur Complex																0.00	0.00	0.00
1	Gautami Godavari	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	1.84	0.00	0.00	1.84
2	Kashyapi	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
3	Gangapur	3831.28	6.10		2893	0.17		3040.00	0.87		3134.90	0.46		3017.20	0.00	0.00	4950.00	3.00	1.00
Total Gangapur Complex		3831.28	6.10	0.00	2893.70	0.17	0.00	3040.00	0.87	0.00	3134.90	0.46	0.00	3017.20	0.00	1.84	4950.00	3.00	1.00
D	Darna Complex																0.00	0.00	0.00
1	Alandi Dam	1440.00			1478			975.50			1421.70			1252.48			1595.00	0.00	1.00
2	Kadwa	4370.50	22.15	0.55	3684	13.26	0.54	3543.05	2.85	0.32	2899.20	1.27		2130.00	0.83		3640.00	14.00	1.00
3	Dham																0.00	0.00	0.00
4	Bhawali																0.00	0.00	0.00
5	Waki												0.01			0.00	0.00	0.00	1.00
6	Darna	8275.00	3.15	24.57	8529	1.07	24.87	8275.50	5.34	1.26	8453.59	3.62	5.07	8216.81	2.89	0.75	6763.00	3.00	14.00
7	Mukane	271.53	1.59		375	1.05	1.24	525.00	1.75		525.60	1.75		475.00	1.57	0.11	290.00	2.00	1.00
8	Waldevi	138.61	0.60		139	0.62		295.00	0.96		295.60	0.44		267.50	0.87		341.00	1.00	0.00
9	N.M. Weir																0.00	0.00	0.00
	a)N.M.Kapera Canal	12962.00	52.01		5562.00	15.13		842.00	0.00		1337.00	0.00		3681.00	0.00		1778.00	32.00	0.00
	b)Gokarni canal	14083.01	31.28		14188	36.64		19392.69	0.01		10683.00			9499.72	1.54		13021.00	37.00	0.00
Total Darna Complex		41544.35	108.68	25.22	33421.86	61.03	26.65	34646.83	11.53	1.58	25614.47	7.08	5.08	24823.21	7.39	0.89	31230.00	89.00	18.00

ANNEXURE-5

ation about Kharif utilizations from Major and Medium projects in Upper Godavari (upto Paithan dam) fig. in MCM

Sr. No.	Name of Dam/ System	2018-19			2019-20			2020-21			2021-22			2022-23			Average		
		Area irrigated (Ha.)	Water Use (Mm^3)	Losses (Mm3)	Area irrigated (Ha.)	Water Use (Mm^3)	Losses (Mm3)	Area irrigated (Ha.)	Water Use (Mm^3)	Losses (Mm3)	Area irrigated (Ha.)	Water Use (Mm^3)	Losses (Mm3)	Area irrigated (Ha.)	Water Use (Mm^3)	Losses (Mm3)	Area irrigated (Ha.)	Water Use (Mm^3)	Losses (Mm3)
1	2	23	24	25	26	27	28	29	30	31	32	33	34	35	36	37	38	39	40
F	Palkhed Complex																		
1	Karanjwan	765.00	0.95	0.00	952.40	1.40	0.00	953.21	1.55	0.000	740.00	0.87	0.00	726.00	0.365	0.000	522.00	1.00	2.00
2	Waghad	2535.13	0.32	0.696	2169.10	0.15	0.73	2212.40	0.00	0.220	2190.00	0.82	0.00	2095.00	0.000	0.219	2145.00	1.00	1.00
3	Palkhed	19742.21	43.76	0.00	21173.74	29.64	0.01	14728.03	0.49	5.445	15667.74	0.10	3.81	15812.00	0.117	0.389	16169.00	19.00	2.00
	Total	23062.34	45.04	0.70	24295.24	31.19	0.74	17893.69	2.04	5.67	18597.74	1.78	3.81	18633.00	0.48	0.61	18835.00	19.00	4.00
4	Paregaon	805.35	0.90	0.00	527.42	0.00	0.00	318.52	3.326	0.000	323.02	0.00	0.00	323.74	0.000	0.000	355.60	1.00	1.00
5	OzarKhed	9077.48	11.10	0.498	6826.14	5.28	0.42	6537.85	0.00	0.374	6515.78	0.00	0.34	6000.46	0.000	0.345	6818.00	3.00	1.00
	Darawadi (Water of Ozarkhed + Paregaon)	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
6	Tisgaon	88.20	0.22	0.101	77.70	0.55	0.00	76.90	0.00	0.000	76.90	0.00	0.00	71.00	0.000	0.000	59.00	1.00	1.00
Total Palkhed Complex		33033.37	57.25	1.30	31546.50	37.02	1.17	24826.96	5.37	6.04	25513.44	1.78	4.16	25118.20	0.48	0.95	26004.00	23.00	4.00
Total CADA Nashik (A To F)		165104.47	405.93	26.87	158027.00	346.95	28.26	103775.98	44.07	7.97	95459.51	45.95	9.57	100352.03	40.12	3.80	118210.00	271.00	25.00
G	Uts of Jayakwadi																0.00	0.00	0.00
1	Tembhapuri	32.00	0.00	0.00	31.00	0.00	0.00	91.00	0.00	0.00	90.00	0.18	0.00	780.00	0.000	0.00	97.00	1.00	0.00
2	Dhaku	35.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	302.00	0.000	0.00	39.00	1.00	0.00
3	Kohli	23.00	0.00	0.00	40.00	0.00	0.00	60.00	0.00	0.00	102.00	0.00	0.00	252.00	0.000	0.00	40.00	0.00	0.00
4	Narangi	22.00	0.00	0.00	8.00	0.00	0.00	54.05	0.00	0.00	103.00	0.00	0.00	513.00	0.000	0.00	64.00	0.00	0.00
5	Bor Dahegaon	19.00	0.00	0.00	25.00	0.00	0.00	66.05	0.00	0.00	117.00	0.00	0.00	460.00	0.000	0.00	64.00	0.00	0.00
6	Ambadi	180.00	0.00	0.00	40.00	0.41	0.00	0.00	0.00	0.00	0.00	0.00	0.00	63.00	0.000	0.00	25.00	1.00	0.00
7	Shivam Takli	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.000	0.00	0.00	0.00	0.00
Total of G		311.00	0.00	0.00	154.00	0.41	0.00	271.09	0.00	0.00	412.00	0.18	0.00	2370.00	0.000	0.00	330.00	3.00	0.00
H	Jayakwadi Project																		

ANNEXURE-5

ation about Kharif utilizations from Major and Medium projects in Upper Godavari (upto Paithan dam) fig. in MCM

Sr. No.	Name of Dam/ System	2018-19			2019-20			2020-21			2021-22			2022-23			Average		
		Area irrigated (Ha.)	Water Use (Mm^3)	Losses (Mm3)	Area irrigated (Ha.)	Water Use (Mm^3)	Losses (Mm3)	Area irrigated (Ha.)	Water Use (Mm^3)	Losses (Mm3)	Area irrigated (Ha.)	Water Use (Mm^3)	Losses (Mm3)	Area irrigated (Ha.)	Water Use (Mm^3)	Losses (Mm3)	Area irrigated (Ha.)	Water Use (Mm^3)	Losses (Mm3)
1	2	23	24	25	26	27	28	29	30	31	32	33	34	35	36	37	38	39	40
1	Paithan Dam	16918.00	306.58	0.00	9083.00	64.66	0.00	43750.00	43.00	0.00	2579.00	0.00	0.00	8332.00	26.49	0.00	7200.40	64.36	0.00
	Majalgaon Feeding	-	-	-	-	-	-	-	19.97	-	-	-	-	-	105.61	-	-	-	-

Note : water was cl

(Er. [illegible])
S.E. & Ad[illegible]
CAD[illegible]
Member Secretary

(Er. Subhash Sabbinwar)
Superintending Engineer & Administrator,
CADA, Chhatrapati Sambhaji Nagar.
Special Invitee Member.

(Er Pramod Mandade)
Director General,
Maharashtra Engineering Research
(MERI), Nashik & Chairman

ANNEXURE -6

Information about Rabi utilizations from Major ,Medium Projects in Upper Godavari (upto Paithan dam) Sub Basin

Sr. No.	Name of Dam/ System	Planned Rabi Use		2012-13			2013-14			2014-15			2015-16			2016-17			2017-18		
		Area Irrigated (Ha.)	Water Use (Mm^3)	Area Irrigated (Ha.)	Water Use (Mm^3)	Losses (Mm3)	Area Irrigated (Ha.)	Water Use (Mm^3)	Losses (Mm3)	Area Irrigated (Ha.)	Water Use (Mm^3)	Losses (Mm3)	Area Irrigated (Ha.)	Water Use (Mm^3)	Losses (Mm3)	Area Irrigated (Ha.)	Water Use (Mm^3)	Losses (Mm3)	Area Irrigated (Ha.)	Water Use (Mm^3)	Losses (Mm3)
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22
A	Mula Complex																				
1	Mandohal	1427	7.41	237	0.00	-	579	4.48	-	277	0.00	-	0	0.00	-	887	4.26	0.498	841.50	4.45	
2	Mula	47668	400.60	41618	118.63	0.39	58206	193.74	0.49	62712	233.56	0.48	37990	132.03	0.66	69419	220.48	0.51	46905	132.72	0.67
	Total Mula Complex	49095	408.01	41855	118.63	0.39	58785	198.23	0.49	62989	233.56	0.48	37990	132.03	0.66	69306	224.74	1.041			
B	Pravara Complex																				
1	Bhandardara	15235	139.80	15922	24.33	0.00	15883	31.37	3.32	15483	21.73	0.02	14120	46.90	0.00	18194	93.42	0.80	21223.00	14.33	
2	Nilwande	59900	185.26	0	0.00		0	0.00		36	0.24		400	2.24		64	0.30		880.00	13.91	
3	Ozer Weir																				
	Pravara Canal			8610	67.96	36.53	7224	75.90	23.63	8668	66.67	0.00	7793	69.20	10.83	6908	97.32	15.19	5856.03	82.13	0.00
	Total	75135	325.06	24532	92.29	36.53	23105	107.27	25.95	24169	88.59	0.02	21953	118.34	19.53	25166	192.04	15.99	27958.09	230.34	0.00
4	Adhala	3134	13.45	2734	13.37	-	3867	18.91	-	3121	17.84	1.01	3127	19.60	0.82	1720	13.08	1.40	2093.35	10.89	0.00
5	Bhojapur+Flood canal	2500	8.04	534	3.29	-	1046	4.14	0.62	1272	6.43	-	102	0.00	-	1601	5.41	-	1650	7.12	
	Total Pravara Complex	80769	346.55	27800	108.95	36.53	28018	130.32	27.57	28581	112.85	1.05	25181	137.94	20.65	28487	210.53	17.38	31901.80	128.35	0.00
C	Gangapur Complex																				
1	Gautami Godavari	0	0.00	295	1.21	-	309	2.12	-	469	4.93	-	157	0.91	-	470	0.94	-	492	4.33	0.03
2	Kashyapi	0	0.00	131	0.95	-	136	1.33	-	197	1.40	-	21	0.17	-	375	0.92	-	167	1.47	1.45
3	Gangapur	10374	116.21	12547	27.88	0.00	16648	28.84	0.03	15707	25.39	0.00	5624	6.95	0.47	6925	24.37	0.03	5750	22.99	
Total Gangapur Complex		10374.00	116.21	12973.22	30.03	0.00	19093.03	32.29	0.03	16332.85	26.94	0.00	5803.77	8.07	0.42	7569.64	26.23	0.03	6408.99	28.98	7.68
E	Darna System																				
1	Alandi	4030	24.21	2715	9.66	0.89	2744	7.95	0.85	2744	7.68	0.83	2338	6.98	1.01	3201	8.45	1.85	2938	5.66	2.51
2	Kadwa	4633	35.61	5161	30.26	-	5222	37.12	-	5234	39.72	-	4003	21.77	0.64	5193	32.83	0.85	5419	27.73	0.39
3	Bham	0	0.03	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00			
4	Bhawali Dam	476	5.61	50	0.42	0.70	65	0.58	0.99	71	1.08	1.47	0	0.00	0.21	124	1.18	0.73	133	0.81	0.55
5	Waki	0	0.00	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00			
6	Darna Dam	0	0.00	3146	5.27	4.18	2764	8.24	2.74	5644	21.89	2.98	12830	5.08	3.12	12968	18.33	5.81	16273	19.33	6.71
7	Mukane Dam	204	1.16	740	2.25	0.00	676	2.66	0.34	744	4.85	0.00	180	0.43	0.00	843	5.71	0.33	751	5.02	
8	Waldevi Dam	815	5.84	477	1.46	0.00	443	2.15	0.39	450	1.76	0.00	254	1.25	1.92	427	3.05	1.68	789	3.21	
9	K.M. Weir																				
	a) N.M.Express Canal	19248	153.10	0	19.22	28.36	8130	63.36	11.86	4402	63.14	0.00	4525	23.88	11.48	14363	72.78	16.46	15854	57.95	
	b) Godavari canal	27441	207.45	19059	53.57	33.19	25322	115.61	8.15	20150	98.68	0.00	10762	20.82	4.91	19167	61.86	6.17	17063	60.96	
	Total Darna System	56817.00	432.98	31347.53	122.11	67.32	45364.65	237.67	22.81	40237.19	238.79	5.27	35764.32	79.20	23.28	56041.59	204.19	33.67	59219.74	160.68	9.96
F	Palkhed Complex																				
1	Karanjwan	1009	5.12	1358	4.70	1.32	1430	7.24	3.63	1430	4.76	2.67	288	0.53	1.00	1780	5.51	2.04	1487	5.237	1.628
2	Waghad	4320	26.90	4502	23.66	0.69	4109	21.42	0.66	5214	21.96	0.66	3321	11.91	0.50	4188	19.50	0.67	4179.58	15.561	0.729
3	Palkhed	20341	168.20	5402	8.26	2.99	17210	84.07	7.54	19168	100.36	0.27	6259	12.11	5.23	21300	83.27	11.24	21452.23	59.739	3.227
	Total	25670	200.22	11262	36.63	5.00	22749	132.73	11.83	25832	127.07	3.60	9868	23.67	6.73	28169	108.27	13.95	27118.81	80.54	5.59

ANNEXURE -6

Information about Rabi utilizations from Major ,Medium Projects in Upper Godavari (upto Paithan dam) Sub Basin

Sr. No.	Name of Dam/ System	Planned Rabi Use		2012-13			2013-14			2014-15			2015-16			2016-17			2017-18		
		Area irrigated (Ha.)	Water Use (Mm^3)	Area irrigated (Ha.)	Water Use (Mm^3)	Losses (Mm3)	Area irrigated (Ha.)	Water Use (Mm^3)	Losses (Mm3)	Area irrigated (Ha.)	Water Use (Mm^3)	Losses (Mm3)	Area irrigated (Ha.)	Water Use (Mm^3)	Losses (Mm3)	Area irrigated (Ha.)	Water Use (Mm^3)	Losses (Mm3)	Area irrigated (Ha.)	Water Use (Mm^3)	Losses (Mm3)
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22
4	Punegaon	3475	16.34	1818	6.47	0.83	1389	8.42	0.43	1451	6.77	0.25	963	1.34	0.28	1484	7.09	0.32	1557.98	6.007	0.216
5	Ozarkhed	8323	43.68	1092	3.86	0.14	3312	16.23	0.13	2939	11.40	0.44	1683	1.35	0.44	3445	17.71	0.69	3827.36	14.401	0.652
	Ozarkhed + Punegaon)	0	0.00		0.00	-		0.00	-		0.00	-		0.00	-		0.00	-		0.00	
6	Hingoni	1103	6.12	214	0.49	0.04	720	1.53	0.07	262	1.31	0.30	392	2.11	0.59	411	5.88	0.5	398	0.929	0.00
Total	Palkhed Complex	36573	264.36	14991	45.65	6.00	27600	135.92	12.46	30453	146.55	4.39	12911	28.71	7.95	33510	135.89	15.46	32732.15	101.87	6.45
	Total CADA Nashik	235628.00	1568.11	128966.60	425.38	110.29	179059.19	737.44	63.33	178622.89	760.70	11.20	117670.51	365.93	52.96	188914.26	864.56	67.57	130262.68	439.89	24.09
G	U/s of Jayakwadi																				
1	Tembhapuri	4528	12.75	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	913	5.42	0.00	473.00	0.00	0.00
2	Dhoku	1370	8.42	79	0.65	0.00	0	0.00	0.00	0	0.00	0.00	702	2.36	0.00	1398	9.32	0.00	340.00	1.45	0.00
3	Kohli	231	1.10	61	0.35	0.00	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	476	3.17	0.00	28.00	0.00	0.00
4	Narangi	800	2.28	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	815	5.43	0.00	75.00	0.00	0.00
5	Ber Dahegaon	2580	7.38	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	1320	8.80	0.00	70.00	0.00	0.00
6	Ambadi	1009	2.78	0	0.00	0.00	714	5.05	0.00	46	0.22	0.00	6	0.03	0.00	1111	7.41	0.00	33.00	0.00	0.00
7	Shivana Takli	4103	32.69	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0.00	0.00	0.00
	Total of G	13323	67.40	140	1	0	714	5	0	46	0	0	702	2	0	5933	39.55	0	1169.00	1.45	0.00
II	Jayakwadi Project																				
1	Paithan Dam	195009	1126.26	17762	369.99	0.00	48147	248.01	0.00	90366	477.41	0.00	19592	105.46	0.00	95973	510.61	0.00	92586.00	663.19	0.00
	Majalgaon Feeding	..	39.34	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..

Note : water was released from upstream reservoirs for Jayakwadi in 2012-13 (249.78 MCM), 2014-15 (201.61 MCM), 2015-16 (294.49 MCM)

ANNEXURE -6

Information about Rabi utilizations from Major ,Medium Projects in Upper Godavari (upto Paithan dam) Sub Basin

Sr. No.	Name of Dam/ System	2018-19			2019-20			2020-21			2021-22			2022-23			Average		
		Area Irrigated (Ha.)	Water Use (Mm^3)	Losses (Mm3)	Area Irrigated (Ha.)	Water Use (Mm^3)	Losses (Mm3)	Area Irrigated (Ha.)	Water Use (Mm^3)	Losses (Mm3)	Area Irrigated (Ha.)	Water Use (Mm^3)	Losses (Mm3)	Area Irrigated (Ha.)	Water Use (Mm^3)	Losses (Mm3)	Area Irrigated (Ha.)	Water Use (Mm^3)	Losses (Mm3)
1	2	23	24	25	26	27	28	29	30	31	32	33	34	35	36	37	38	39	40
A	Mula Complex																		
1	Mandohal	0.00	0.00	0.00	821.60	1.92		643.40	1.03		831.60	4.43		870.78	4.02		539.08	3.08	1.03
2	Mula	65874	174.52	0.69	57367	137.7	0.47	58526	130.96	0.59	53060	108.06	0.6	49655.82	137.22	0.76	54215.09	137.09	2.69
	Total Mula Complex																24055.09	83.61	3.19
																	0.00	0.00	0.00
B	Pravara Complex																38581.09	234.69	1.06
1	Bhandardara	20151.50	2.46		21901.65	3.46		23165.40	3.33		19166.20	14.12		19204.08	15.12		1358.63	9.04	0.00
2	Nilwande	2224.47	14.83		2222.24	14.81		3009.45	15.70		3078.44	16.40		3265.98	15.70		0.00	0.00	0.00
3	Ozar Weir																1954.00	25.00	0.00
	Pravara Canal	7598.77	133.10		3530.00	39.74		2939.00	62.54		3008.55	59.05		2230.70	62.11		24786.00	100.00	2.00
	Total	29974.74	150.39	0.00	27653.89	58.02	0.00	29113.85	81.56	0.00	25253.19	90.07	0.00	24701.76	92.93	0.00	2218.00	12.00	1.00
4	Adhala	2283.00	9.82		1265.36	4.86		1143.51	3.83		1713.91	4.68		1826.24	6.19		1695.00	5.00	1.00
5	Bhojapur Flood Canal	253	2.03		1133	9.39		1536	9.31	0.73	317	0.14	0.15	1425	4.52	5.07	29011.00	125.00	12.00
	Total Pravara Complex	32510.31	162.23	0.00	30052.35	72.27	0.00	31793.69	94.73	0.73	26785.60	95.29	0.15	27993.90	103.64	5.07	AVALUE	0.00	0.00
C	Gangapur Complex																		
1	Gautami Godavari	561	2.92	3.80	574	1.12	2.07	572	3.21	2.74	6063	3.76	5.82	512.41	0.56	3.54	452.00	1.56	1.03
2	Kashyapi	200	2.51	1.37	223	1.32	0.91	221	0.64		283	0.56	0.83	168.03	0.35	3.38	172.00	2.00	1.00
3	Gangapur	6712	28.21		5904	14.93	0.34	6915	14.00		6713	12.41		6348.40	12.77	6.96	8891.00	20.00	3.00
Total Gangapur Complex		7471.84	33.65	4.97	6700.24	17.36	3.12	7707.50	17.65	2.74	7603.65	14.74	6.66	7025.84	13.68	14.97	9520.00	25.00	5.00
																	#VALUE!	0.00	0.00
E	Darna System																2813.00	9.00	2.00
1	Alandi	2889	9.30	4.32	2889	11.41	2.13	3089	6.23	1.31	2963	10.12	0.02	2,664.40	7.42	0.74	0.00	0.00	0.00
2	Kadwa	5401	21.82	0.19	5035	14.76	2.08	5496	28.58	1.31	5038	27.56	0.36	5,232.00	21.96	0.00	0.00	0.00	0.00
3	Bham																1741.00	3.00	1.00
4	Bhawali Dam	277	1.38		240	1.41	0.06	242	1.42		223	1.36		171.52	1.01	0.31	0.00	0.00	0.00
5	Waki																12289.00	14.00	5.00
6	Darna Dam	12119	16.52	2.95	9199	15.61	8.99	9148	15.83	2.60	11858	15.44	3.26	12,218.82	10.89	6.50	664.00	3.00	2.00
7	Mukane Dam	686	4.49	2.16	751	4.44	4.35	643	3.46	1.41	645	3.74	1.46	615.00	3.47	3.62	561.00	3.00	1.00
8	Waldevi Dam	685	3.44	4.96	715	3.34		686	2.61		639	2.32	0.33	583.60	2.83		0.00	0.00	0.00
9	N.M. Weir																18576.00	44.00	7.00
	a) N.M.Express Canal	23151	56.07		10596	34.75		7589	33.16		22805	31.85		15943.03	22.00		13767.00	53.00	6.00
	b) Godavari canal	14965	68.40	6.63	13559	23.44		27098	10.33		15322	17.49		12719.51	9.00				
	Total Darna System	60150.49	181.41	21.16	42974.49	109.16	17.60	135981.82	103.09	6.46	59450.80	109.59	5.37	50177.68	78.60	11.26	50516.09	125.09	24.09
																	0.00	0.00	0.00
F	Palkhed Complex																1165.00	6.00	2.00
1	Karanjwan	1278.1	3.42	0.312	1379	5.93	0.286	1555.1	7.625	0.000	1595	6.473	0.000	1513	10.465	0.00	4811.00	16.95	1.00
2	Waghad	4945.03	21.377	0.738	5431.27	15.548	2.137	6000.39	18.15	1.149	5620.13	13.595	0.526	5403.59	18.451	0.312	16710.00	51.00	4.00
3	Palkhed	17552.66	49.764	0.552	17393.73	31.162	0.496	18762.96	38.35	5.075	19628.65	39.936	4.055	18675.02	44.545	0.503	22655.00	24.00	6.00
	Total	23775.79	74.56	1.60	24204.00	52.62	2.92	26318.45	64.13	6.22	25843.78	60.00	4.38	25591.41	73.46	0.82			

ANNEXURE -6

Information about Rabi utilizations from Major ,Medium Projects in Upper Godavari (upto Paithan dam) Sub Basin

Sr. No.	Name of Dam/ System	2018-19			2019-20			2020-21			2021-22			2022-23			Average		
		Area irrigated (Ha.)	Water Use (Mm^3)	Losses (Mm3)	Area Irrigated (Ha.)	Water Use (Mm^3)	Losses (Mm3)	Area irrigated (Ha.)	Water Use (Mm^3)	Losses (Mm3)	Area irrigated (Ha.)	Water Use (Mm^3)	Losses (Mm3)	Area Irrigated (Ha.)	Water Use (Mm^3)	Losses (Mm3)	Area Irrigated (Ha.)	Water Use (Mm^3)	Losses (Mm3)
1	2	23	24	25	26	27	28	29	30	31	32	33	34	35	36	37	38	39	40
4	Finegaon	1743.57	8.36	0.099	1380.85	4.32	0.133	1581.1	5.501	0.695	1442.7	4.385	0.000	1453.83	4.906	0.495	1464.09	6.03	1.60
5	Ozarkhed	5087.19	19.559	0.652	3074.09	9.277	0.59	3403.3	13.062	0.523	2693.39	5.848	0.438	3391.54	12.005	0.438	3744.09	12.00	1.00
	Ozarkhed + Punegaon)		0.00			0.00			0.00			0.00			0.00		0.00	0.00	0.00
6	Tisgaon	829.5	7.181	0.328	496.25	3.19	0.000	525.1	4.511	0.000	307.8	1.59	0.000	1279	4.595	0.100	485.66	4.02	1.00
Total	Palkhed Complex	31436.05	109.66	2.65	29155.19	69.41	3.64	31827.95	87.00	7.44	31257.67	71.83	4.82	31715.78	95.97	3.75	27987.00	84.00	7.00
	Total CADA Nashik	131568.76	486.95	28.81	103662.27	268.30	24.36	207310.96	302.47	17.37	125127.72	291.74	17.00	116917.40	290.89	33.07	141319.09	452.09	49.09
G	G/s of Jayakwadi																		
1	Tembhapuri	173.00	0.00	0.00	40.00	0.00	0.00	545.00	1.74	0.00	505.00	2.00	0.00	1458.00	3.83	0.00	372.00	2.00	0.00
2	Dhoke	60.00	0.00	0.00	529.00	1.72	0.00	576.00	2.40	0.00	920.00	2.52	0.00	1391.00	0.85	0.00	537.00	2.00	0.00
3	Kohli	107.00	0.00	0.00	153.00	0.87	0.00	155.00	0.00	0.00	305.00	0.13	0.00	247.00	0.34	0.00	145.00	4.00	0.00
4	Narangi	143.00	0.00	0.00	24.00	0.00	0.00	281.00	0.00	0.00	382.00	0.00	0.00	608.00	0.29	0.00	205.00	2.00	0.00
5	Sor Dahegaon	103.00	0.00	0.00	19.00	0.00	0.00	176.00	0.00	0.00	247.00	0.52	0.00	764.00	0.16	0.00	246.00	1.00	0.00
6	Ambadi	200.00	0.00	0.00	245.00	1.28	0.00	316.00	3.00	0.00	696.00	3.18	0.00	598.00	1.95	0.00	351.00	1.00	0.00
7	Shivana Takli	0.00	0.00	0.00	369.00	2.72	0.00	1502.00	7.60	0.00	1200.00	8.50	0.00	0.00	0.00	0.00	261.00	2.00	1.00
	Total of G	786.00	0.00	0.00	1399.00	6.59	0.00	3551.00	15.01	0	4177.00	16.89	0.00	4966	7.80	0	2147.00	12.00	1.00
H	Jayakwadi Project																0.00	0.00	0.00
I	Paithan Dam	66091.00	508.64	0.00	65813.00	314.93	0.00	64631.00	469.82	0	67282.00	342.06	0	68382.60	453.941	0	64119.60	175.00	0.00
	Majalgaon Feeding	..	..		..	..	..	..	..	..	.	..	..	..	..	..	..	..	..

Note : water was releas

(Er. [illegible])
S. E. & Administrator
CADA, Nashik &
Member Secretary

(Er. Sandesh Salunke)
Superintending Engineer& Administrator,
CADA, Chhatrapati Sambhaji Nagar,
Special Invitee Member.

(Dr.Pramod Mandale)
Director General ,
Maharashtra Engineering Research Institute
(MERI) (Nashik & Chairman)

ANNEXURE -7

Information about Hot Weather utilizations from Major & Medium Projects in Upper Godavari (upto Paithan dam) sub-basin fig. in MCM

Sr. No.	Name of Dam/ System	Planned HW. Use		2012-13			2013-14			2014-15			2015-16			2016-17		
		Area irrigated (Ha.)	Water Use	Area Irrigated (Ha.)	Water Use (Mm^3)	Losses (Mm3)	Area Irrigated (Ha.)	Water Use (Mm^3)	Losses (Mm3)	Area Irrigated (Ha.)	Water Use (Mm^3)	Losses (Mm3)	Area Irrigated (Ha.)	Water Use (Mm^3)	Losses (Mm3)	Area Irrigated (Ha.)	Water Use (Mm^3)	Losses (Mm3)
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19
A	Mula Complex																	
1	Nandoshi	0.00	0.00	0	0.00	-	281	2.31	-	0	0.00	-	0	0.00	-	232	2.25	0.31
2	Mula	0.00	0.00	4354	1.27	0.29	50345	212.78	0.37	22461	146.86	0.30	1386	9.10	0.28	49041	296.51	0.314
	Total Mula Complex	**0.00**	**0.00**	**4354**	**1.27**	**0.29**	**50626**	**215.09**	**0.37**	**22461**	**146.86**	**0.30**	**1386**	**9.10**	**0.28**	**49273**	**298.76**	**0.63**
B	Pravara Complex																	
1	Bhandardara	6072.00	164.30	4949	39.81	0.00	6530	9.17	1.58	7433	30.05	0.00	3199	0.00	0.00	10875	16.97	0.43
2	Nilwande	0.00	0.00	0	0.00		0	0.00		0	0.00		0	0.00		0	2.05	
3	Ozar Weir																	
	Pravara Canal			6728	60.72	35.65	14468	98.84	42.04	6540	120.73	31.10	0	0.00	0.00	6780	144.66	43.68
	Total	**6072.00**	**164.30**	**11677**	**97.53**	**35.65**	**13498**	**107.81**	**43.62**	**13973**	**150.78**	**31.10**	**3199**	**0.00**	**0.00**	**17655**	**163.63**	**44.12**
4	Adhala	1354.00	8.98	0	2.92	-	0	2.68	-	430	2.62	0.40	0	1.09	0.42	599	6.46	0.78
5	Bhojapur (Hood canal)	0.00	0.00	0	0.00	-	25	0.00	-	42	0.00	-	42	0.00	-	102	0.00	-
	Total Pravara Complex	7426.00	173.28	11677	100.45	35.65	13523	110.48	43.62	14445	153.40	31.50	3241	1.09	0.42	18359	170.14	44.90
C	Gangapur Complex																	
1	Gautami Godavari	0.00	0.00	0	0.00	-	0	0.00	-	0	0.00	-	0	0.00	-	0	0.00	1.27
2	Kashyapi	0.00	0.00	0	0.00	-	0	0.00	-	0	0.00	-	0	0.00	-	0	0.00	
3	Gangapur	4150.00	73.36	2955	9.21	0.12	7595	19.02	1.58	5413	14.79	2.25	3216	4.42	0.00	4104	20.09	0.11
Total Gangapur Complex		4150.60	73.36	2955.22	9.21	0.12	7595.20	19.02	1.58	5410.80	14.79	2.25	3216.16	4.42	0.00	4104.77	20.09	1.38
E	Darna Complex																	
4	Alandi	0.00	0.00	2640	8.78	0.35	2462	9.57	0.67	2224	9.68	0.69	2324	8.22	1.13	2685	10.89	1.18
1	Kadwa	202.00	3.67	0	5.35	-	149	0.51	-	0	0.00	-	56	0.00	-	80	1.41	0.99
2	Bham	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00
3	Bhavali	49.00	1.95	0	0.00	0.25	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00
3	Wasi	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00
4	Darna	0.00	0.00	959	0.00	0.00	1441	2.63	1.00	774	0.00	0.71	2537	0.00	1.81	993	2.34	0.63
5	Mukane	0.00	0.45	295	0.92	0.00	300	0.38	0.12	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00
6	Shedgaon	0.00	0.00	225	0.50	0.00	239	1.12	1.20	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00
7	N.M. Weir																	
	to N.M.Upper Canal	1700.00	65.53	0	9.16	27.53	1331	36.20	14.74	1888	21.25	10.67	0	0.00	9.91	235	29.50	10.87
	to Gautami canal	4743.00	65.52	2462	3.25	6.22	6999	36.27	10.51	4383	20.66	14.84	893	0.00	0.00	4604	75.00	21.16
	Total Darna Complex	6700.00	136.90	6621.46	25.74	28.60	11663.63	85.70	29.29	9223.00	51.72	47.49	5786.15	8.36	13.22	11857.56	117.18	64.56
F	Palkhed Complex																	
1	Ganeshwari	0.00	0.00	318	2.38	0.04	430	1.44	0.29	431	1.84	0.50	263	1.57	0.23	80	3.03	0.52
2	Waghad	0.00	0.00	3137	13.16	0.42	3207	14.09	0.92	2876	16.32	0.28	567	0.48	0.32	3110	13.24	0.37
3	Palkhed	456.00	6.98	2944	4.32	2.44	3249	4.76	0.96	3425	4.29	1.27	1365	1.82	0.91	1693	5.67	1.25
	Total	456.00	6.98	5998	18.66	2.66	6886	20.31	2.17	6632	22.26	2.04	2367	3.87	1.46	6372	19.94	2.14

ANNEXURE -7

Information about Hot Weather utilizations from Major & Medium Projects in Upper Godavari (upto Paithan dam) sub-basin fig. in MCM

Sr. No.	Name of Dam/ System	Planned H.W. Use		2012-13			2013-14			2014-15			2015-16			2016-17		
		Area Irrigated (Ha.)	Water Use	Area Irrigated (Ha.)	Water Use (Mm^3)	Losses (Mm3)	Area Irrigated (Ha.)	Water Use (Mm^3)	Losses (Mm3)	Area Irrigated (Ha.)	Water Use (Mm^3)	Losses (Mm3)	Area Irrigated (Ha.)	Water Use (Mm^3)	Losses (Mm3)	Area Irrigated (Ha.)	Water Use (Mm^3)	Losses (Mm3)
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19
4	Punegaon	0.00	0.00	1105	4.22	0.16	1471	6.99	0.14	1443	6.43	-	759	3.81	0.14	1544	8.33	0.03
5	Ozarkhed	0.00	0.00	216	0.00	0.06	2955	17.30	0.73	2720	17.38	0.32	719	3.56	0.24	3141	24.13	0.26
	Daraswadi Pohoch kalwa (Water from Punegaon)				0.00	-		0.00	-		0.00	-		0.00	-		0.00	-
6	Tisgaon	0.00	0.00	160	0.37	-	351	1.97	0.15	422	2.14	0.41	703	2.13	0.47	448	3.29	0.33
Total Palkhed Complex		450.00	4.93	7479	23.44	2.70	11713	46.56	3.13	11216	48.15	2.78	4569	10.37	1.91	13497	55.69	2.76
Total CADA Nashik		18726.00	388.47	33006.71	160.31	67.15	95142.67	479.86	77.99	62756.10	414.92	84.32	18198.47	33.36	15.53	97091.60	661.87	114.21
G	U/s of Jayakwadi																	
1	Tembhapuri	0	0	0	0.00	0	0	0	0	0	0	0	0	0	0	260	1.3	0
2	Dheku	0	0	0	0.00	0	0	0	0	0	0	0	50	0.35	0	0	0	0
3	Kohli	10	0.31	0	0.00	0	0	0	0	0	0	0	0	0	0	50	0.25	0
4	Narangi	0	0	0	0.00	0	0	0	0	0	0	0	0	0	0	64	0.32	0
5	Bor Dalegaon	0	0	0	0.00	0	0	0	0	0	0	0	0	0	0	83	0.42	0
6	Ambodi	0	0	0	0.00	0	0	0	0	0	0	0	0	0	0	60	0.3	0
7	Shivana Takli	0	0	0	0.00	0	0	0	0	0	0	0	0	0	0	0	0	0
Total of G		10.00	0.31	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	50	0.35	0.00	517	2.59	0.00
H	Jayakwadi Project																	
1	Paithan Dam	25914.00	324.53	14096	62.86	0.00	27375	136.57	0.00	32012	142.79	0.00	11920	48.46	0.00	50011	380.22	0.00
	Majalgaon Feeding	-	232.91	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-

Note : water was released from upstream reservoirs for Jayakwadi in 2012-13 (249.78 MCM), 2014-15 (201.61 MCM), 2015-16 (293.49 MCM)

ANNEXURE -7

Information about Hot Weather utilizations from Major & Medium Projects in Upper Godavari (upto Paithan dam) sub-basin fig. in MCM

Sr. No.	Name of Dam/ System	2017-18			2018-19			2019-20			2020-21			2021-22			2022-23			Average		
		Area Irrigated (Ha.)	Water Use (Mm^3)	Losses (Mm3)	Area Irrigated (Ha.)	Water Use (Mm^3)	Losses (Mm3)	Area Irrigated (Ha.)	Water Use (Mm^3)	Losses (Mm3)	Area Irrigated (Ha.)	Water Use (Mm^3)	Losses (Mm3)	Area Irrigated (Ha.)	Water Use (Mm^3)	Losses (Mm3)	Area Irrigated (Ha.)	Water Use (Mm^3)	Losses (Mm3)	Area Irrigated (Ha.)	Water Use (Mm^3)	Losses (Mm3)
1	2	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36	37	38	39	40
A	Mula Complex																					
1	Mandohal	455.70	2.47		0.00	0.00	0.00	436.38	3.21		713.03	5.60		662.60	4.08		411.00	2.92		291.09	3.00	1.00
2	Mula	55,793.000	336.375	0.410	4,987.000	7.135	0.450	63,435	348.507	0.291	54,085.90	320.713	0.386	53,006.63	317.74	0.400	50,697.11	309.032	0.043	0.043	0.043	0.043
	Total Mula Complex	56245.70	338.84	0.41	4987.00	7.14	0.45	63871.20	348.72	0.29	54798.93	326.31	0.39	53669.20	321.82	0.40	51108.11	311.95	0.04	37711.00	212.00	1.00
B	Pravara Complex																			0.00	0.00	0.00
1	Bhandardara	12421.00	13.75		13356.33	1.42		15760.00	2.19		17399.00	2.79	0.00	15093.00	17.23	0.00	15102.17	17.39	2.03	11162.00	14.00	1.00
2	Nilwande	571.00	5.19		1028.80	9.34		1345.90	12.24		1839.66	11.88	0.00	1906.22	11.86	0.00	2130.85	13.45		802.00	7.00	0.00
3	Ozar Weir																			0.00	0.00	0.00
	Pravara Canal	7129.00	170.26	0.00	3925.00	44.97		4970.00	135.99		4130.00	148.44		3507.15	116.91		3308.90	130.23		4831.00	107.00	14.00
	Total	20121.00	189.19	0.00	18309.33	55.73	0.00	22075.90	150.42	0.00	23368.66	163.10	0.00	20506.37	146.01	0.00	20901.92	161.07	2.03	16843.00	126.00	15.00
4	Adhula	1372.05	10.55	0.00	299.00	1.67		3526.55	12.35		1435.99	10.15		1337.80	9.78		1311.67	7.59		755.00	7.00	1.00
5	Bhojapur Flood canal	70		0.69	66		3.45	75	1.95	0.92	80	0.53	1.16	104		1.04	-	-	0.54	36.00	1.00	1.00
	Total Pravara Complex	21563.07	199.74	0.69	18374.33	57.35	3.45	23677.45	163.82	0.92	24882.65	173.79	1.16	21939.17	155.79	1.04	22213.79	168.57	2.57	17655.00	133.00	16.00
C	Gangapur Complex																					
1	Gautami Godavari		0.00	3.39			4.47	115	1.06	2.78	103	0.32	1.93	103	0.59		47.49	0.33	3.75	34.00	1.00	2.00
2	Kashyapi			2.20			2.67	31	0.43	0.62		0.23		41	0.56	1.00	10.00	0.32	4.22	8.00	2.00	1.00
3	Gangapur	3838	18.83		3041	9.20		4159	16.40	0.87	3816	12.93		4482	16.46		3803.81	13.89	9.85	4220.00	15.00	2.00
Total Gangapur Complex		3838.38	18.83	5.59	3040.85	9.20	7.34	4305.28	17.89	4.27	3918.64	13.47	1.93	4625.25	17.61	1.00	3859.30	14.54	17.82	4262.00	17.00	5.00
E	Darna Complex																			0.00	0.00	0.00
4	Alandi	2613	10.49	1.71	2553	8.00	1.79	2558	10.07	3.77	2450	8.26	2.37	2447	11.86	1.17	2,254.62	11.59	0.55	2477.00	10.00	2.00
1	Kadwa	241	1.82	1.27	160	2.67	2.35	3436	11.46	0.95	475	1.09	0.00	395	2.40	0.13	305.00	0.67	0.15	482.00	4.00	1.00
1	Bham																			0.00	0.00	0.00
2	Bhawali	36	0.27	0.74				43	0.32		92	0.67		83	0.61		81.68	0.59	0.05	31.00	1.00	1.00
3	Waki																			0.00	0.00	0.00
4	Darna	4381	7.31	2.43	2773		1.50	4582	5.44	0.96	4969	8.83	0.01	4923	9.03		4,540.20	7.31	1.04	3281.00	5.00	1.00
5	Mukane	350	1.00					562	4.22	1.64	486	1.96	0.30	449	2.05	0.91	456.00	2.11	0.87	246.00	2.00	1.00
6	Waldevi	200	1.43				2.96	235	1.54		245	2.54		245	3.64		245.00	1.32	0.00	149.00	2.00	1.00
7	N.M. Weir																			0.00	0.00	0.00
	a) N.M.Express Canal	9225	39.95		2104	5.45		5638	54.25		7774	61.37		25567	71.16		14174.00	70.78		6168.00	37.00	12.00
	b) Godavari canal	7052	84.45		941	16.57		5983	91.46		14849	90.44		8088	67.56		7835.63	86.94		5761.00	52.00	5.00
	Total Darna Complex	24097.74	146.71	6.14	8531.00	32.69	8.60	23336.75	184.76	7.32	31339.06	175.06	2.68	42249.32	168.32	2.22	29891.13	187.24	2.67	18595.00	113.00	24.00
E	Palkhed Complex																			0.00	0.00	#VALUE!
1	Karanjwan	405	1.149	0.522	230	1.236	0.057	211	1.16	0.040	310	2.16	0.000	609	3.965	0.000	627	2.133	0.00	394.00	2.00	1.00
2	Waghad	3599.55	17.234	0.625	3536.19	13.146	0.234	3294.79	14.707	0.574	3674.2	14.203	0.682	3942.15	17.685	0.240	3699.86	13.033	0.348	3144.00	14.00	1.00
3	Palkhed	3784.36	3.564	0.09	3974.55	5.467	0.250	9440.79	40.765	0.000	8919.35	41.204	0.000	11183.4	38.736	0.668	10109.7	27.995	0.00	5728.00	17.00	1.00
	Total	7788.91	21.95	1.15	7740.74	19.85	0.54	12946.58	56.63	0.61	12903.79	57.57	1.37	15823.55	60.41	0.91	14385.56	43.16	0.35	9265.00	32.00	2.00

ANNEXURE -7

Information about Hot Weather utilizations from Major & Medium Projects in Upper Godavari (upto Paithan dam) sub-basin fig. in MCM

Sr. No.	Name of Dam/ System	2017-18			2018-19			2019-20			2020-21			2021-22			2022-23			Average		
		Area Irrigated (Ha.)	Water Use (Mm^3)	Losses (Mm3)	Area Irrigated (Ha.)	Water Use (Mm^3)	Losses (Mm3)	Area Irrigated (Ha.)	Water Use (Mm^3)	Losses (Mm3)	Area Irrigated (Ha.)	Water Use (Mm^3)	Losses (Mm3)	Area Irrigated (Ha.)	Water Use (Mm^3)	Losses (Mm3)	Area Irrigated (Ha.)	Water Use (Mm^3)	Losses (Mm3)	Area Irrigated (Ha.)	Water Use (Mm^3)	Losses (Mm3)
1	2	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36	37	38	39	40
4	Punegaon	1553.22	7.709	0.068	1292.09	7.236	0.010	1509.26	7.715	0.000	1469.79	6.309	0.460	1546.54	7.272	0.000	1336.44	6.346	0.220	1379.00	7.00	1.00
5	Ozarkhed	4157.28	26.21	0.192	2350.56	14.517	0.140	3573.54	15.119	0.322	3703.49	14.716	0.336	4315.22	18.148	0.250	4259	18.195	0.056	2917.00	16.00	1.00
	Daraswadi Pohoch kalwa		0.00			0.00			0.00			0.00			0.00			0.00			0.00	0.00
6	Tisgaon	508.9	4.502	0.00	476.05	3.155	0.146	720	3.326	0.000	795.31	6.319	0.000	870	9.506	0.000	981.8	5.980	0.000	585.00	5.00	1.00
Total Palkhed Complex		14008.31	60.37	1.43	11859.44	41.79	0.84	16799.38	86.79	0.94	18872.34	84.93	2.17	22755.11	95.94	1.16	20958.60	74.20	0.76	14161.00	58.00	2.00
Total CADA Nashik		119753.20	764.49	14.24	87092.62	151.17	20.68	133990.06	801.97	13.74	133811.44	773.56	8.33	147236.05	758.88	5.83	128071.13	756.50	23.87	92354.00	533.00	48.00
G	U/s of Jayakwadi																			0.00	0.00	0.00
1	Tembhapuri	196	0	0	25	0	0	0	0	0	362	1.08	0	2005	6.637	0	1620	6.93	0	416.00	2.00	0.00
2	Dhoku	0	0.4	0	0	0	0	283	0.8	0	267	0.75	0	249	0.45	0	442	0.3	0	173.00	1.00	0.00
3	Kobli	70	0	0	3	0	0	0	0	0	169	0.63	0	388	1.064	0	174	0.225	0	78.00	1.00	0.00
4	Narangi	93	0	0	3	0	0	0	0	0	162	0.286	0	252	1.575	0	547	1.2	0	102.00	1.00	0.00
5	Bor Dahegaon	121	0	0	2	0	0	0	0	0	179	0.2	0	284	0.746	0	213	0.291	0	73.00	1.00	0.00
6	Ambadi	1	0	0	11	0	0	65	0.408	0	95	0.534	0	172	1.192	0	149	0.486	0	51.00	1.00	0.00
7	Shivana Takli	0	0	0	55	0	0	0	0	0	2195	8.082	0	1000	7.1	2.8	0	0	0	250.00	2.00	1.00
Total of G		481.00	0.40	0.00	99.00	0.00	0.00	348.00	1.21	0.00	3529.00	11.56	0.00	4270.00	18.76	2.80	3145.00	9.44	0.00	1131.00	8.00	1.00
H	Jayakwadi Project																			0.00	0.00	0.00
1	Paithan Dam	64878.00	732.38	0.00	35917.00	106.37	0.00	67231.00	641.58	0.00	73693.00	651.16	0.00	94817.00	641.24	0	92051	674.81	0	53098.00	393.00	0.00
	Majalgaon Feeding																			-	-	-

Note : water was relea

(Er. Manoj Kumar Gunale)
S. E. & Administrator
CADA, Nashik &
Member Secretary

(Er. Sanjay Ram Salunkhe)
Superintending Engineer & Administrator,
CADA, Chhatrapati Sambhaji Nagar.
Special Invitee Member.

(Er Pramod Mandade)
Director General,
Maharashtra Engineering Research
(MERI) ,Nashik & Chairman

Appendices

गोदावरी खोऱ्यातील जलाशयांच्या एकात्मिक प्रवर्तनाकरिता विनियमन तयार करण्यासाठी अभ्यास गटाची नियुक्ती करणेबाबत.

महाराष्ट्र शासन
जलसंपदा विभाग
शासन निर्णय क्रमांक - संकीर्ण-२०२३/प्र.क्र.१८६/२०२३/सिंव्य (धोरण)
मंत्रालय, मुंबई-४०० ०३२
दिनांक - २६ जुलै, २०२३

वाचा :- १) शासन निर्णय क्रमांक -२०१२/प्र.क्र.८९५/२०१२/सिंव्य (धोरण) दि.२९ जानेवारी, २०१३
२) शासन निर्णय क्रमांक -२०१२/प्र.क्र.८९५/२०१२/सिंव्य (धोरण) दि.७ मार्च, २०१३
३) शासन निर्णय क्रमांक -२०१२/प्र.क्र.८९५/२०१२/सिंव्य (धोरण) दि.२७ मे, २०१३
४) शासन निर्णय क्रमांक -२०१२/प्र.क्र.८९५/२०१२/सिंव्य (धोरण) दि.३० जुलै, २०१३

प्रस्तावना

सन २०१२ मध्ये पावसाच्या दुर्भिक्षामुळे जायकवाडी धरणात अत्यल्प पाणीसाठा झाल्याने जायकवाडी धरणाच्या उर्ध्व भागातील १) दारणा २) गंगापूर ३) निळवंडे-मंडारदरा ४) प्रवरा ५) मुळा या पाच उपखोऱ्यांतून पाणी सोडण्याबाबत मराठवाडा जनता विकास परिषद, औरंगाबाद यांनी मा. उच्च न्यायालय खंडपीठ, औरंगाबाद येथे जनहित याचिका क्र.१००/१२ दाखल केली होती.

या याचिकेसंदर्भात शासनाने सादर केलेल्या प्रतिज्ञापत्रानुसार, तसेच दिनांक १९.१२.२०१२ रोजी झालेल्या सुनावणी दरम्यानच्या आदेशात राज्यातील काही भागांमध्ये पाण्याचे दुर्भिक्ष असल्याची वस्तुस्थिती विचारात घेऊन सर्वसाधारणपणे समन्यायी पध्दतीने पाणी वाटप होण्याच्या दृष्टीकोणातून आवश्यक त्या उपाययोजना करण्याची निकड विषद केली. याबाबत राज्य शासनाने दिनांक १७.१२.२०१२ रोजी सादर केलेल्या प्रतिज्ञापत्रात महाराष्ट्र जलसंपत्ती नियमन प्राधिकरण अधिनियम २००५ मधील कलम १२६(क) मध्ये नमूद केल्यानुसार याचिका कर्त्यांनी मागणी केल्यानुसार, पाण्याचे समन्यायी वाटप करणे तांत्रिक दृष्ट्या व प्रत्यक्षरित्या कार्यवाही करणे शक्य होणार नाही असे नमूद केले होते. तथापि, पावसाळ्याच्या कालावधीमध्ये खोरे, उप-खोरे निहाय धरणात साठणाऱ्या पाण्याचे संनियंत्रण व नियोजन करण्याची आवश्यकता असल्याचे नमूद केले. त्यानुसार जायकवाडी धरणाच्या उर्ध्व बाजूकडील धरणात साठणाऱ्या पाण्याचा योग्य प्रकारे वाटप होण्याच्या दृष्टीने खरीप हंगामातील पाण्याची निकड, पाणीभवन, बाष्पीभवन, तसेच व्यवस्थापन इ. विचारात घेऊन मार्गदर्शक तत्त्वे तयार करण्याच्या दृष्टीने संदर्भिय शासन निर्णय क्र.१ द्वारे अभ्यासगट गठीत करण्यात आला होता. सदर समितीच्या दिनांक ०८.०८.२०१३ च्या अहवालामधील प्रकरण क्र. ४ मधील शिफारस क्र.२.३ (४) नुसार जायकवाडी धरणाच्या उर्ध्व बाजूकडील धरणात साठणाऱ्या पाण्याचा योग्य प्रकारे वाटप होण्याच्या दृष्टीने नवीन अभ्यास गट गठीत करण्याचे शासनाचे विचाराधीन होते.

शासन निर्णय

जायकवाडी धरणाच्या उर्ध्व बाजूकडील धरणात साठणाऱ्या पाण्याचा योग्य प्रकारे वाटप होण्याच्या दृष्टीने खरीप हंगामातील पाण्याची निकड, बाष्पीभवन, बाष्पोत्सर्जन इत्यादी तसेच पूर्वीच्या समितीच्या दिनांक ०८.०८.२०१३ च्या अहवालानुसार अंमलबजावणी करताना येणाऱ्या अडचणींचा व मधील कालावधीत नदी खोऱ्याच्या जल नियोजनात झालेले बदल विचारात घेऊन मार्गदर्शक तत्त्वे तयार करण्याच्या दृष्टीने शासन स्तरावर खालीलप्रमाणे अभ्यासगट गठीत करण्यात येत आहे.

१	महासंचालक, संकल्पचित्र, प्रशिक्षण , जलविज्ञान, संशोधन व धरण सुरक्षा, नाशिक	अध्यक्ष
२	कार्यकारी संचालक, गोदावरी मराठवाडा पाटबंधारे विकास महामंडळ, औरंगाबाद	सदस्य
३	मुख्य अभियंता (विनिर्दिष्ट प्रकल्प), जलसंपदा विभाग, पुणे	सदस्य
४	मुख्य अभियंता, जलविज्ञान प्रकल्प, नाशिक	सदस्य
५	मुख्य अभियंता, उत्तर महाराष्ट्र प्रदेश, जलसंपदा विभाग, नाशिक	सदस्य
६	मुख्य अभियंता, जलसंपदा विभाग, लाभक्षेत्र विकास प्राधिकरण, औरंगाबाद	सदस्य
७	अधीक्षक अभियंता, गोदावरी मराठवाडा पाटबंधारे विकास महामंडळ, औरंगाबाद	सदस्य सचिव

सदरहू अभ्यासगटाची कार्यकक्षा खालीलप्रमाणे राहील —

१) गोदावरी खोऱ्यातील जायकवाडी धरणाच्या वर्ष्या बाजुस खोरे/उप खोऱ्यातील सर्व जलाशयांचे एकात्मिक पध्दतीने पावसाळ्यात धरणे भरतांना जायकवाडी प्रकल्पात टंचाई परिस्थिती न उद्भवण्यासाठी प्रचालन करणे बाबतीत मार्गदर्शक विनियम तयार करणे.

२) अशी यंत्रणा प्रभावीपणे राबविण्याच्या दृष्टीने कार्यपध्दती विकसित करणे.

३) उपरोक्त विषयी तांत्रिक, आर्थिक व व्यवस्थापकीय बाबींसंदर्भात सुधारणा सुचविणे.

४) सदरहू समिती आपला अहवाल दि.३१.०८.२०२३ पर्यंत सादर करेल.

अभ्यास गटाच्या सदस्यांनी आपला कार्यरत पदाचा कार्यभार सांभाळून उपरोक्त कार्यवाही पार पाडावी. याबाबत सदस्यांना कोणत्याही प्रकारचे मानधन दिले जाणार नाही. अभ्यास गटाचे कामकाज संपल्यानंतर हा अभ्यास गट आपोआप संपुष्टात येईल.

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महाराष्ट्राचे राज्यपाल यांच्या आदेशानुसार व नावाने

PRANJALI SHAILENDRA TONGSE

(प्रांजली टोंगसे)
अवर सचिव, महाराष्ट्र शासन

प्रत,

अपर मुख्य सचिव, जलसंपदा विभाग, मंत्रालय, मुंबई
सचिव (लाक्षेणि), जलसंपदा विभाग, मंत्रालय, मुंबई
सचिव (प्रकल्प समन्वय), जलसंपदा विभाग, मंत्रालय, मुंबई
सचिव, महाराष्ट्र जलसंपत्ती नियमन प्राधिकरण, मुंबई
महासंचालक, संकल्पचित्र, प्रशिक्षण, जलविज्ञान, संशोधन व धरण सुरक्षा, नाशिक
कार्यकारी संचालक, गोदावरी मराठवाडा पाटबंधारे विकास महामंडळ, औरंगाबाद
मुख्य अभियंता (विनिर्दिष्ट प्रकल्प), जलसंपदा विभाग, पुणे
मुख्य अभियंता, जलविज्ञान प्रकल्प, नाशिक
मुख्य अभियंता, उत्तर महाराष्ट्र प्रदेश, जलसंपदा विभाग, नाशिक
मुख्य अभियंता, जलसंपदा विभाग, लाभक्षेत्र विकास प्राधिकरण, औरंगाबाद

गोदावरी खोऱ्यातील जलाशयांच्या एकात्मिक विनियमन तयार करण्यासाठी अभ्यास गटाची नियुक्ती करणेबाबत.

महाराष्ट्र शासन
जलसंपदा विभाग
शासन निर्णय क्रमांक : संकीर्ण-२०२३/प्र.क्र.१८६ /२०२३/सिंव्य (धोरण)
मंत्रालय, मुंबई-४०००३२
दिनांक- ०१ ऑगस्ट,२०२३

वाचा :- १) शासन निर्णय क्रमांक संकीर्ण-२०२३/प्र.क्र.१८६ /२०२३/सिंव्य (धोरण),दि.२६ जुलै २०२३
२) महासंचालक मैरी यांचे पत्र क्र. मैस/संप्रजसंसु/तांशा/५६४/२०२३,दि.२८.०७.२०२३

शासन निर्णय

नायकवाडी धरणाच्या उर्ध्व बाजूकडील धरणात साठणाऱ्या पाण्याचा योग्य प्रकारे वापर होण्याच्या दृष्टीने तसेच हंगामातील पाण्याची निकड, बाष्पीभवन, वहनव्यय इत्यादी तसेच पूर्वीच्या समितीच्या दिनांक ०८.०८.२०१३ च्या अहवालानुसार अंमलबजावणी करताना येणाऱ्या अडचणींचा व मधील कालावधीत नवी खोऱ्यांच्या जल नियोजनात झालेले बदल विचारात घेऊन मार्गदर्शक तत्वे तयार करण्याच्या दृष्टीने शासन स्तरावर संदर्भ क्र.१ अन्वये अभ्यास गट गठीत करण्यात आला आहे.

सदर अभ्यास गटाचे अध्यक्ष, महासंचालक मैरी, नाशिक यांनी त्यांच्या संदर्भ क्र.२ अन्वये सुचविलेल्या बदला-नुसार संदर्भ क्र.१ च्या शासन निर्णयात खालील बाबींचा समावेश करण्यात येत आहे.

सदर अभ्यास गटामध्ये सदस्य म्हणून अधीक्षक अभियंता, गोदावरी मराठवाडा पाटबंधारे विकास महामंडळ, औरंगाबाद यांची नियुक्ती करण्यात आली होती. तथापि सदर पद रिक्त असल्याकारणाने अधीक्षक अभियंता, गोदावरी मराठवाडा पाटबंधारे विकास महामंडळ, औरंगाबाद यांचे ऐवजी अधीक्षक अभियंता व प्रशासक, लाभक्षेत्र विकास प्राधिकरण, नाशिक यांची सदस्य सचिव म्हणून नियुक्ती करण्यात येत आहे.

तसेच सदर अभ्यास गटामध्ये विशेष निमंत्रित म्हणून खालील सदस्यांचा नव्याने समावेश करण्यात येत आहे.

१) अधीक्षक अभियंता, धरणे मंडळ, मध्यवर्ती संकल्पचित्र संघटना, नाशिक
२) अधीक्षक अभियंता, लाभक्षेत्र विकास प्राधिकरण, औरंगाबाद

वर नमुद नव्याने समाविष्ट विशेष निमंत्रित सदस्य उपरोक्त अभ्यास गटाच्या कार्यक्षेत्रामध्ये समाविष्ट विषयाशी संबंधित उपलब्ध माहिती व अभ्यासानुसार समितीला मार्गदर्शन करतील. तसेच अभ्यास गटाला अंतिम अहवाल सादर करण्यास सहाय्य करतील.

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महाराष्ट्राचे राज्यपाल यांच्या आदेशानुसार व नावाने

PRANJALI SHAILENDRA TONGSE

(प्रांजली टोंगसे)
अवर सचिव, महाराष्ट्र शासन

प्रत,

१. अपर मुख्य सचिव, जलसंपदा विभाग, मंत्रालय, मुंबई
२. सचिव (लाक्षेनि), जलसंपदा विभाग, मंत्रालय, मुंबई
३. सचिव (प्रकल्प समन्वय), जलसंपदा विभाग, मंत्रालय, मुंबई
४. सचिव, महाराष्ट्र जलसंपत्ती नियमन प्राधिकरण, मुंबई
५. महासंचालक, सेकल्पचित्र, प्रशिक्षण, जलविज्ञान, संशोधन व धरण सुरक्षा, नाशिक
६. कार्यकारी संचालक, गोदावरी मराठवाडा पाटबंधारे विकास महामंडळ, औरंगाबाद
७. मुख्य अभियंता (विनिर्दिष्ट प्रकल्प), जलसंपदा विभाग, पुणे
८. मुख्य अभियंता, जलविज्ञान प्रकल्प, नाशिक
९. मुख्य अभियंता, उत्तर महाराष्ट्र प्रदेश, जलसंपदा विभाग, नाशिक
१०. मुख्य अभियंता, जलसंपदा विभाग, लाभक्षेत्र विकास प्राधिकरण, औरंगाबाद
११. मुख्य अभियंता (पी) व सह सचिव , जलसंपदा विभाग, मंत्रालय
१२. मुख्य अभियंता (जसं) व सह सचिव, जलसंपदा विभाग, मंत्रालय, मुंबई
१३. उप सचिव (सिंव्य) जलसंपदा विभाग, मंत्रालय, मुंबई
१४. उप सचिव (जसं) जलसंपदा विभाग, मंत्रालय, मुंबई
१५. अधीक्षक अभियंता, गोदावरी मराठवाडा पाटबंधारे विकास महामंडळ, औरंगाबाद
१६. अधीक्षक अभियंता व प्रशासक, लाभक्षेत्र विकास प्राधिकरण, नाशिक
१७. अधीक्षक अभियंता, लाभक्षेत्र विकास प्राधिकरण, औरंगाबाद
१८. अधीक्षक अभियंता, धरणे मंडळ, मध्यवर्ती संकल्पचित्र संघटना, नाशिक
१९. अवर सचिव (जलसंपत्ती/नियोजन), जलसंपदा विभाग, मंत्रालय, मुंबई.
२०. अवर सचिव (सिंव्य/धोरण), जलसंपदा विभाग, मंत्रालय, मुंबई
२१. सिंव्य (धोरण) संग्रहार्थ

पृष्ठ २ पैकी २

गोदावरी खोऱ्यातील जलाशयांच्या एकात्मिक प्रवर्तनाकरिता विनियमन तयार करण्यासाठी स्थापित अभ्यास गटाला मुदतवाढ मिळणेबाबत.

महाराष्ट्र शासन
जलसंपदा विभाग
शासन निर्णय क्रमांक संकीर्ण-२०२३/प्र.क्र.१८६ /२०२३/(सिंव्य धोरण)
मादाम कामा रोड, हुतात्मा राजगुरु चौक,
मंत्रालय, मुंबई
दिनांक ०१/०४/२०२४

वाचा :- १) शासन निर्णय क्र.संकीर्ण-२०१२/प्र.क्र.८९१/१२/२०१२/सिंव्य (धोरण) दि.२९ जानेवारी, २०१३
२) शासन निर्णय क्र.२०२३/प्र.क्र.१८६/सिंव्य (धोरण) दि.२६ जुलै, २०२३
३) शासन निर्णय क्र.संकीर्ण -२०२३/प्र.क्र.१८६/सिंव्य (धोरण) दि.१ ऑगस्ट, २०२३
४) शासन निर्णय क्र.संकीर्ण -२०२३/प्र.क्र.१८६/सिंव्य (धोरण) दि.२७ ऑक्टोबर, २०२३
५) अधिक्षक अभियंता व प्रशासक लाभक्षेत्र विकास प्राधिकरण, नाशिक यांचे पत्र क्र. लाक्षेविप्रानाः/प्रशा-२/१५३७/सन-२०२४, दि.१५/०३/२०२४

प्रस्तावना :-

जनहित याचिका क्र.१००/१२ मधील सूचनेनुसार दरम्यान दिलेल्या आदेशानुसार राज्यातील काही भागांमध्ये पाण्याचे दुर्भिक्ष असल्याची वस्तुस्थिती विचारात घेऊन सर्वसाधारणपणे समन्यायी पध्दतीने पाणी वाटप होण्याच्या दृष्टीकोणातून आवश्यक त्या उपाययोजना करण्याची निकड निर्माण झाली. तथापि, पावसाळ्याच्या कालावधीमध्ये खोरे, उपखोरे निहाय धरणात साठणाऱ्या पाण्याचे सनियंत्रण व नियोजन करण्याची आवश्यकता असल्याचे नमूद केले. त्यानुसार जायकवाडी धरणाच्या उर्ध्व बाजूकडील धरणात साठणाऱ्या पाण्याचा योग्य प्रकारे वाटप होण्याच्या दृष्टीने खरीप हंगामातील पाण्याची निकड, बाष्पीभवन तसेच वहनव्यय इ.विचारात घेऊन मार्गदर्शक तत्वे तयार करण्याच्या दृष्टीने दि.२९/०१/२०१३ नुसार अभ्यासगट (मॅंढेगिरी समिती) गठीत करण्यात आली होती.

सदर मॅंढेगिरी समितीने केलेला अभ्यास हा सन २०१३ पूर्वीचा आहे व सन २०१३ च्या कालावधीत आजतागायत १० वर्षात सदरहू परिस्थितीत बरेच बदल झालेले आहेत. शासन निर्णय दिनांक २६/०७/२०२३ च्या अन्वये जायकवाडी धरणाच्या उर्ध्व बाजूकडील धरणात साठणाऱ्या पाण्याचा योग्य प्रकारे वाटप होण्याच्या दृष्टीने नवीन अभ्यासगट गठीत करण्यात आला होता. त्यानुषंगाने सध्याची दुष्काळी परिस्थिती पहाता, राज्यात विशेषत: गोदावरी खोऱ्यात उद्भवलेल्या अभूतपूर्व टंचाईमुळे विविध ठिकाणी आढावा बैठकीमध्ये व्यस्त असलेल्या कर्मचारी/अधिकारी वर्ग यामुळे माहिती संकलित करण्यास विलंब होणार असल्याने त्यांनी समितीस शासनास अहवाल सादर करण्यासाठी संदर्भ क्र.४ अन्वये दि.३०/११/२०२३ पर्यंत मुदतवाढ देण्यात आली होती. परंतू संदर्भ क्र.५ अन्वये प्राप्त अहवालानुसार अभ्यासगट समितीच्या आजमितीस दहा बैठका पार पडल्या असून सदर बैठकीत झालेल्या चर्चेनुसार समितीचे कामकाज हे शासनाने ठरवून दिल्याप्रमाणे सुरु असून समितीच्या कामकाजाचे दृष्टीने आवश्यक असलेली माहिती संकलीत करण्यात येत असून तिची तपासणी व पृथ:करण करण्याचे काम प्रगती असून

९० टक्के काम झालेले आहे. तरी समितीचा अभ्यास समर्पक व सर्वसमावेशक होणेसाठी समितीस दि. ३०/०५/२०२४ पर्यंत मुदतवाढ देण्याची बाब शासनाच्या विचाराधीन होती.

शासन निर्णय :-

राज्याची सध्याची दुष्काळी परिस्थिती पाहता, विषयांकित समितीचा अभ्यास, समर्पक व सर्वसमावेशक होणेसाठी, व त्यानंतर अंतिम अहवालास सर्व सदस्यांची मान्यता घेवून अंतिम अहवाल शासनास सादर करणे करीता काही अधीक कालावधी लागणार असल्याने सदर समितीस दिनांक ३०/०५/२०२४ पर्यंत ही अंतिम मुदतवाढ देण्यात येत असून यापुढे समितीस मुदतवाढ देण्यात येणार नाही.

सदर शासन निर्णय महाराष्ट्र शासनाच्या www.maharashtra.gov.in या संकेतस्थळावर उपलब्ध करण्यात आला असून त्याचा संकेतांक २०२४०४०१९५५४२२६८२७ असा आहे. हा आदेश डिजीटल स्वाक्षरीने सांकाकित करुन काढण्यात येत आहे.

महाराष्ट्राचे राज्यपाल यांच्या आदेशानुसार व नावाने

NAMITA GAURAV BASER

(न.गौ.बसेर)
उप सचिव, महाराष्ट्र शासन

प्रत,

अपर मुख्य सचिव, जलसंपदा विभाग, मंत्रालय, मुंबई
सचिव (लाक्षेणि), जलसंपदा विभाग, मंत्रालय, मुंबई
सचिव (प्रकल्प समन्वय), जलसंपदा विभाग, मंत्रालय, मुंबई
सचिव, महाराष्ट्र जलसंपत्ती नियमन प्राधिकरण, मुंबई
महासंचालक, संकल्पचित्र, प्रशिक्षण, जलविज्ञान, संशोधन व धरण सुरक्षा, नाशिक
कार्यकारी संचालक, गोदावरी मराठवाडा पाटबंधारे विकास महामंडळ, छत्रपती संभाजीनगर
मुख्य अभियंता (विनिर्दिष्ट प्रकल्प), जलसंपदा विभाग, पुणे
मुख्य अभियंता, जलविज्ञान प्रकल्प, नाशिक
मुख्य अभियंता, उत्तर महाराष्ट्र प्रदेश, जलसंपदा विभाग, नाशिक
मुख्य अभियंता, जलसंपदा विभाग, लाभक्षेत्र विकास प्राधिकरण, छत्रपती संभाजीनगर
मुख्य अभियंता (पा) व सह सचिव , जलसंपदा विभाग, मंत्रालय
मुख्य अभियंता (जस्रे) व सह सचिव, जलसंपदा विभाग, मंत्रालय, मुंबई
उप सचिव (सिंचन) जलसंपदा विभाग, मंत्रालय, मुंबई
उप सचिव (जस्रे) जलसंपदा विभाग, मंत्रालय, मुंबई
अधीक्षक अभियंता, गोदावरी मराठवाडा पाटबंधारे विकास महामंडळ, छत्रपती संभाजीनगर
अधीक्षक अभियंता व प्रशासक, लाभक्षेत्र विकास प्राधिकरण, नाशिक
अधीक्षक अभियंता, लाभक्षेत्र विकास प्राधिकरण, औरंगाबाद
अवर सचिव (जलसंपत्ती/नियोजन), जलसंपदा विभाग, मंत्रालय, मुंबई.
अवर सचिव (सिंचन/योरण), जलसंपदा विभाग, मंत्रालय, मुंबई
सिंचन (योरण) संग्रहार्थ

पृष्ठ २ पैकी २

IN THE HIGH COURT OF JUDICATURE AT BOMBAY
CIVIL APPELLATE JURISDICTION

Public INTEREST LITIGATION NO. 169 OF 2023
WITH
INTERIM APPLICATION NO. 6572 OF 2024

Bhaskar Rakhmaji Aware & Ors.	}	Petitioners
versus		
The State of Maharashtra,	}	
through its Principal Secretary,	}	
Water Resources Department	}	
& Ors.	}	Respondents

WITH
PUBLIC INTEREST LITIGATION NO. 183 OF 2023
WITH
INTERIM APPLICATION NO. 17570 OF 2023
WITH
INTERIM APPLICATION NO. 17560 OF 2023
WITH
INTERIM APPLICATION NO. 17569 OF 2023

Late Rajabhau Tugar Sahakari	}	
Upsa Sinchan Sanstha Maryadit,	}	
Nashik	}	Petitioner
versus		
The State of Maharashtra,	}	
through the Principal Secretary,	}	
Water Resources Department	}	
& Ors.	}	Respondents

WITH
INTERIM APPLICATION NO. 17571 OF 2023
IN
PUBLIC INTEREST LITIGATION NO. 183 OF 2023

Marathwada Janata Vikas	}	
Parishad	}	Applicant
In the matter between		
Late Rajabhau Tugar Sahakari	}	
Upsa Sinchan Sanstha Maryadit,	}	
Nashik	}	Petitioner

versus

The State of Maharashtra,	}	
through the Principal Secretary,	}	
Water Resources Department	}	
& Ors.	}	**Respondents**

WITH

PUBLIC INTEREST LITIGATION (ST) NO. 30970 OF 2023

Ramesh Shankar Dhongade	}	**Petitioner**

versus

The State of Maharashtra,	}	
through the Principal Secretary,	}	
Water Resources Department	}	
& Ors.	}	**Respondents**

Mr. Nitin Gaware – Patil i/b. Mr. Sahil Choudhari for the petitioner in PIL/169/2023.

Mr. Manish Kelkar for the petitioner in PIL/183/2023.

Mr. Priyansh Jain i/b. Vivek Punjabi for the petitioner in PIL(St)/30970/2023.

Mr. Yashodeep P. Deshmukh (through VC) a/w. Ms. Vaidehi Pradeep for the proposed intervenor – MJUP in IA/17571/2023 in PIL/183/2023.

Mr. R. L. Kute a/w. Mr. Anoop Patil for the intervenor in IA/6572/2023 in PIL/169/2023.

Mr. P. P. Kakade, Government Pleader with Mr. O. A. Chandurkar, Additional Government Pleader and Mrs. R. A. Salunkhe, AGP for the State in all matters except PIL(ST)/30970/2023.

Mr. P. P. Kakade, Government Pleader with Mr. O. A. Chandurkar, Additional Government Pleader with Mrs. R. A. Salunkhe, AGP and Mrs. G. R. Raghuwanshi, AGP for the State in PIL(ST)/30970/2023.

Mr. Abhinandan Vagyani i/b. Ms. Chaitrali Deshmukh for respondent Nos.3 and 4 in PIL/183/2023 and for respondent No.4 in PIL/169/2023.

Mr. M. L. Patil for respondent NO.6 in PIL/183/2023.

Mr. Mahendra K. Wankhede, Superintending Engineer & Deputy Secretary, Catchment Area, Water Resources Department present.

CORAM: DEVENDRA KUMAR UPADHYAYA, CJ. & AMIT BORKAR, J.

DATE: 3rd SEPTEMBER 2024

P.C.:

IA/17571/2023: -

1. This interim application has been moved by Marathwada Janata Vikas Parishad seeking its intervention in Public Interest Litigation No. 183 of 2023.

2. In PIL/183/2023, apart from the prayer for quashing the order dated 30th October 2023 issued by Godavari Marathwada Irrigation Development Corporation (hereinafter referred to as "GMIDC"), the petitioner has also prayed for certain directions for implementing the judgement and order dated 23rd September 2016 passed in Public Interest Litigation No. 173 of 2013, which was filed by the applicant.

3. Since we find that the applicant has sufficient interest in the PIL petition, we permit the applicant to be impleaded as respondent no. 7 in PIL/183/2023.

4. Learned counsel for the petitioner shall incorporate the necessary amendment within a week. Reverification is dispensed with.

5. The interim application is disposed of.

PIL/169/2023 & PIL/183/2023: -

6. Learned counsel for the petitioner in PIL/169/2023 has brought to our notice the judgment rendered by this Court on 23rd September 2016 in a bunch of petitions, leading petition being PIL/173/2013. By rendering the said judgement, the

Court had issued various directions and one of the directions given is that the State Government shall take a policy decision on the issue of carrying out the exercise of the review of storage capacity of all the reservoirs and undertaking hydrology of Godavari sub-basin. The judgement further states that decision shall be taken by the State Government which shall be placed on record within a period of six months.

7. Our attention has also been drawn to the Government Resolution dated 26th July 2023, according to which, in order to properly distribute the water stored in the dam on the upstream of Jayakwadi dam and also in order to submit guidelines considering the relevant factors as per the report of the previous committee dated 8th August 2013, a new study group has been formed, which is headed by the Director General, Landscaping, Training, Hydrology, Research and Dam Safety, Nashik as Chairman and six other members. The Government Resolution also sets out the scope of work entrusted to the study group which includes formulation of guidelines regarding implementation of integrated approach of all reservoirs in the basin/sub-basin upstream of Jayakwadi dam in Godavari basin to avoid shortage situation in Jayakwadi project during monsoons and to develop methodology for effectively implementing such a system and to suggest improvements regarding technical, financial and managerial aspects regarding the said subject. The committee was expected to submit its report by 31st August 2023.

8. Our attention has also been drawn to an affidavit in reply filed by the Superintending Engineer and Administrator, CADA on behalf of respondent no. 3, wherein it has been stated that

on issuance of Government Resolution dated 26th July 2023, as partially modified by a subsequent Government Resolution dated 1st August 2023, study is being carried out by the study group and that accordingly, review of storages has to be taken up by 15th October every year and the Executive Director, GMIDC has to decide the appropriate strategy for equitable distribution of water. The affidavit in reply further states that on request of the study group, the Government had extended the time limit for submitting report, initially on 30th November 2023 and thereafter again a request was made for further extension of time till March 2024.

9. Learned Additional Government Pleader, on instructions, states that the Government has extended time for completion of study by the study group till 30th June 2024, however, since then, the time has not been extended.

10. It is on the basis of the study to be conducted by the study group that the statutory authority, namely, Maharashtra Water Resources Regulatory Authority (hereinafter referred to as "MWRRA") has to make recommendations to the State Government for equitable distribution of water after inviting objections and suggestions from general public.

11. It has also been informed that the hydrological year starts from 15th October every year and accordingly, final decision by the State Government is required to be taken by 15th October every year.

12. Keeping in view all the aforesaid aspects, we direct that the study group shall complete its study as expeditiously as possible and for the said purpose, if extension, as required on

request by the study group, shall be granted by the State Government. Once the study group completes its study and submits report to the MWRRA, it shall, accordingly, publish a public notice inviting objections and suggestions to the report to be submitted by the study group, which will, accordingly, forward its recommendations, which shall be based on the report of the study group as also on the basis of objections and suggestions which may be made to such a report by the general public, to the State Government at the earliest.

13. The learned Additional Government Pleader, on instructions received from Mr. Mahendra K. Wankhede, Superintending Engineer and Deputy Secretary, Catchment Area, Water Resourced Department, has stated that the study group needs a month's time from today to complete the study and submit its report to the MWRRA. Accordingly, our direction as above for earliest completion of the study should be construed to mean that the study group shall conduct and complete the study within a month from today and for that purpose, the State Government shall immediately grant the requisite extension. Once the study group completes its study, it shall prepare the report and submit the same to the MWRRA within a fortnight from completion of the report. The MWRRA shall invite objections and suggestions from the general public giving a fortnight's time for submitting objections and suggestions. Thereafter, the MWRRA shall consider the entire matter as observed above and submit its recommendations to the State Government within a month thereafter, which shall be considered by the State Government and final decision thereon shall be taken by the State Government within four weeks from

the date communications are received from MWRRA.

14. Stand over to **21st October 2024**.

15. The learned Additional Government Pleader shall file an affidavit of the competent authority by the next date of listing bringing on record the steps which may be taken in the meantime for ensuring compliance of this order.

(AMIT BORKAR, J.) **(CHIEF JUSTICE)**

CRITERIA FOR DISTRIBUTION OF SURFACE WATER ENTITLEMENTS BY RIVER BASIN AGENCIES FOR DOMESTIC & INDUSTRIAL USES

Maharashtra Water Resources Regulatory Authority
Mumbai
September 2017

CONTENTS

महाराष्ट्र जलसंपत्ती नियमन प्राधिकरण
Maharashtra Water Resources Regulatory Authority
(MWRRA)
9th Floor, Centre-1, World Trade Centre, Cuffe Parade, Mumbai - 400 005. Tel.: (O) 2215 2019 Fax.: 2215 3765 E-mail.:mwrra@mwrra.org

IN THE MATTER OF

CRITERIA FOR DISTRIBUTION OF SURFACE WATER ENTITLEMENTS BY RIVER BASIN AGENCIES FOR DOMESTIC & INDUSTRIAL USES

CORUM

Shri. K. P. Bakshi, Chairman

Shri. V. M. Kulkarni, Member (Water Resources Engineering)

ORDER

Date: 22nd September 2017

1. PREFACE :

1.1. As per the Constitution of India Water is a State subject. Constitution does not explicitly recognize the right to water as a basic human right. However, this right is recognized implicitly with the Supreme Court's interpretations of the Article 21 of the Constitution as right to life with dignity[1]. To protect the right to drinking water for all, distribution of entitlements & appropriate pricing of water are steps forward in this direction.

1.2. The Maharashtra Water Resources Regulatory Authority (MWRRA) was established as per the provisions in Section 3 of the MWRRA Act 2005 vide notification dated June 8, 2005. Maharashtra is the first State in the country to establish a regulatory authority in water sector. The powers, duties and functions of the Authority are laid down in MWRRA Act 2005 which was amended first in April 2011 & second time in January

[1]Report of the Working Group on Urban and Industrial Water Supply and Sanitation for the Twelfth Five-Year Plan (2012-2017)

recharge in its premises or as CSR activities may be given priority. However, in water deficit sub-basins, additional entitlement for expansion of water intensive industry shall not be given.

(ix) Industries shall not exceed the effluent discharge norms stipulated by MPCB / CPCB whichever is stringent. The industries using recycled water and reducing their freshwater demand shall be incentivized. However, industries using water beyond the entitlement shall be charged at higher rates, as may be indicated in tariff order.

7.3 The following clause should be included in the agreement with IBWU;

"Maharashtra Water Resources Regulatory Authority Act 2005 has empowered the Authority to determine the criteria for the distribution of entitlements by the River Basin Agencies on prescribed terms and conditions and also to establish water tariff system. As per the said Act, the entitlement and tariff system is subject to review at intervals of not less than three years. During the agreement period, changes in entitlement and/or prescribed terms and conditions and/or tariff system made by MWRRA shall be binding on both parties."

7.4 A committee comprising Joint Director of Industries and CE, WRD will decide inter-se priority among competing industries for distribution of entitlement, keeping in view factors like specific water consumption of the industry, importance of the product to the economy of the State, employment potential, pollution aspects etc.

8. SHARING WATER DEFICIT

8.1 As per the State Water Policy, the domestic water use for drinking, cooking, hygiene and sanitation including livestock has first priority. However, natural water availability is extremely diverse across the various river basins and sub-basins of the state. Annual variations are approximately within the range of 30%. The annual fluctuations in rainfall and consequent water deficit in the reservoirs need to be

addressed. During the deficit years, the DBWUs will also have to share some deficit. However, while doing so, the basic needs for health & hygiene should not be lost sight of. Considering this aspect, allocation for DBWUs from the reservoir in the deficit year shall be governed by following formula;

A_D (in percentage) = 70 + [(U x 30) / 100]

Where U = (Reservoir Storage on 15th October + Kharif Utilisation) X 100
Design Annual Utilization from the Reservoir

Applicable cut in % = 100 - A_D

Note - In case the live storage in the reservoir on 15th October is less than or equal to total domestic water entitlements from the reservoir for the balance year, all available water shall be kept reserved for domestic sector.

Illustration :- If the live storage as on 15th October plus the Kharif utilization already done is 90% i.e. deficit in water availability is 10%, the deficit to be shared by domestic sector shall be calculated as under;

A_D = 70 + [(90 x 30) / 100] = 97%

Applicable cut = 100 - 97 = 3%

So Bulk Water User in Sr. No. 4 in Table No 1 will get at

135 x 97% = 131 lpcd

8.2 Allocation for IBWU from the reservoir in the deficit year shall be governed by the following formula;

A_I (in percentage) = 60 + [(U x 40) / 100]

Where U = (Reservoir Storage on 15th October + Kharif Utilisation) X 100
Design Annual Utilization from the Reservoir

Applicable cut in % = 100 - A_I

that can be made available from rain water harvesting and recycling and thus reducing freshwater demand by 15 percent in next three years.

c) Treatment of entire generated sewage to CPCB / MPCB standards, whichever is stringent, and making it available for reuse.

11.2 Industrial Sector:

a) Mandatory guidelines stipulated by MoEF/CPCB/MPCB whichever is most stringent, regarding effluent discharge should be strictly followed.

b) Reduction in consumption by optimizing the process, modifying the equipments and creating awareness amongst the workers.

12. DIFFICULTIES IN IMPLEMENTATION

In case of any difficulty in implementation of these criteria, the DBWU/IBWU/RBA may approach the Authority with specific petition. The decision of the Authority shall be final.

22.9.17

(V. M. Kulkarni)
Member (W. R. Engineering)

22.9.12

(K. P. Bakshi)
Chairman

Statement Showing Allocation for DBWUs & IBWUs in the deficit Year for the Projects in Upper Godavari (As per MWRRA Order dated 22.09.2017) (up to Paithan dam) for the Year 2015 , 2018 & 2023

(All figures in Mm³)

Sr. No.	Name of Dam and System	Design Annual Utilisation from Reservoir			Reservoir Storage on 15th October	Kharif Utilisation	Total	Domestic			Industrial		
		Major	Medium	Total				U	Ad =20+(12X80)/100	Applicable Cut in percentage	U	Ad =60+(13X40)/100	Applicable Cut in percentage
							(Col.6=5)	U = Col.2)x80)/col.3			U = Col.A)x80)/col.3		
1	2	3			4	5	6	7	8	9	11	12	13
A	Mula System												
	Year - 2015	704.61	13.15	717.76	314.3466	37.5406	352.39	49.10	94.73	15.27	49.10	79.64	20.36
	Year - 2018	704.61	13.15	717.76	408.57	199.572	608.14	84.31	95.29	4.71	84.31	93.72	6.28
	Year - 2023	704.61	13.15	717.76	548.151	139.296	687.45	95.36	98.61	1.39	95.36	98.14	1.86
	Total	2113.83	39.45	2153.28	1268.97	376.41	1645.98	76.25	92.88	7.12	76.25	90.50	9.50
	Average	704.61	13.15	717.76	423.66	125.47	548.33	76.26	92.88	7.12	76.26	90.50	9.50
B	Pravara System												
	Year - 2015	781.93	59.03	840.96	339.46	144.593	484.053	99.99	87.98	12.02	99.99	83.97	16.03
	Year - 2018	781.93	59.03	840.96	500.54	109.217	609.757	72.51	91.75	8.25	72.51	89	11
	Year - 2023	781.93	59.03	840.96	569.238	146.054	715.295	85.06	95.52	4.48	85.06	94.02	5.98
	Total	2345.79	177.09	2522.88	1429.19	399.86	1829.06	72.50	91.75	8.25	72.50	89.00	11.00
	Average	781.93	59.03	840.96	476.40	133.29	609.69	72.50	91.75	8.25	72.50	89.00	11.00
C	Ganga pur System												
	Year - 2015	231.82	33.96	265.8	170.8	54.37	225.37	84.79	99.44	4.56	84.79	93.92	6.08
	Year - 2018	231.82	33.96	265.8	240.41	72.369	312.969	119.86	108.96	-8.96	119.86	107.94	-7.94
	Year - 2023	231.82	33.96	265.8	364.76	74.798	439.558	127.75	108.39	-8.39	127.75	111.1	-11.1
	Total	695.46	101.94	797.40	681.97	201.56	883.53	110.80	105.24	-5.24	110.80	104.32	-4.32
	Average	231.82	33.98	265.80	227.32	67.19	294.51	110.80	105.24	-5.24	110.80	104.32	-4.32
D	Darna System												
	Year - 2015	967.85	66.41	1034.26	396.28	165.99	562.27	53.46	86.04	13.96	53.46	81.38	18.62
	Year - 2018	967.85	66.41	1034.26	541.09	132.29	673.379	67.13	90.14	9.86	67.13	86.85	13.15
	Year - 2023	967.85	66.41	1034.26	671.61	184.68	856.286	83.02	94.91	5.09	83.02	93.21	6.79
	Total	2903.49	199.23	3102.78	1608.99	503.08	2108.97	67.87	90.36	9.64	67.87	87.13	12.87
	Average	967.83	66.43	1034.26	536.33	167.69	702.92	67.87	90.36	9.64	67.87	87.13	12.87
E	Palkhed System												
	Year - 2015	468.41	0.00	468.41	264.01	39.65	303.66	43.48	83.04	16.96	43.48	77.39	22.61
	Year - 2018	468.41	0.00	468.41	297.69	188.7171	486.9071	86.33	93.9	6.1	86.33	96.53	3.47
	Year - 2023	468.41	0.00	468.41	302.35	54.894	357.244	76.27	92.88	7.12	76.27	90.51	9.49
	Total	1405.23	0.00	1405.23	864.04	283.23	1147.27	68.69	90.61	9.39	68.69	87.48	12.52
	Average	468.41	0.00	468.41	288.01	94.41	382.42	68.69	90.61	9.39	68.69	87.48	12.52
	Total of A to E	9463.60	617.77	9961.57	5743.46	1662.14	7125.60	74.39	92.32	7.68	74.39	89.76	10.24
	Average A to E	3409.26	372.59	3327.19	1914.49	560.72	2475.21	74.39	92.32	7.68	74.39	89.76	10.24

J	Paithan Dam (Including LIS on Backwater)												
	Year - 2015	2618.21	0.00	2618.21	129.00	187.00	316.00	12.07	73.62	26.38	12.07	64.83	35.17
	Year - 2018	2618.21	0.00	2618.21	795.18	441.26	1236.44	47.22	84.17	15.83	47.22	78.89	21.11
	Year - 2023	2618.21	0.00	2618.21	1023.48	219.424	1242.904	47.47	84.24	15.76	47.47	78.99	21.01
	Total	7854.63	0.00	7854.63	1947.66	847.68	2795.34	35.59	80.68	19.32	35.59	74.24	25.76
	Avarage	2618.21	0.00	2618.21	649.22	282.56	931.78	35.59	80.68	19.32	35.59	74.24	25.76
	Total of All	17318.43	517.77	17836.20	7691.12	2529.82	10220.94	57.30	87.19	12.81	57.30	82.92	17.08
	Avarage of All	1004.58	28.77	990.90	427.29	140.55	567.83	57.30	87.19	12.81	57.30	82.92	17.08
						Applicable Cut in percentage =				12.81%			17.08
						percentage to be appplied				87.19%			82.92

A) **Allocation for DBWUs in the deficit Year**

1) U = (Reservoir Storage on 15 th October + Kharif Utilisation) X 100 / Design Annual Utilisation from Resevoir

2) AD (in percentage) = 70 + ((U X 30) / 30)

3) Applicable Cut in % = 100 - AD

B) **Allocation for IBWUs in the deficit Year**

1) U = (Reservoir Storage on 15 Th October + Kharif Utilisation) X 100 / Design Annual Utilisation from Resevoir

2) AD (in percentage) = 70 + ((U X 30) / 30)

3) Applicable Cut in % = 100 - AD

(M. S. Amale)
Superintending Engineer & Administrator
Command Area Development Authority, Nashik

DUPLICATE (COPY)

महाराष्ट्र MAHARASHTRA ◐ 2023 ◐ CK 670924

12 APR 2024

AGREEMENT

Between

Water Resources Department
(Godavari Marathawada Irrigation Development Corporation (GMIDC)
Chhatrapati Sambhaji Nagar)

And

MRSAC

Maharashtra Remote Sensing Application Centre (MRSAC)
An Autonomous Body under Dept. of Planning Govt. of Maharashtra
V.N.I.T. Campus South Ambazari Road, Nagpur - 440010, Maharashtra

For

Development of plug-in Software Module along with Five Parameters used in MahaMADAT Geo-portal to decide Exact Amount of Water to release from u/s Dams to Jaykawadi Reservoir (Paithan Dam)

Signed on this 25th day. April., Month Year **2024**

1. Prelude: The Upper Godavari sub-basin, extending up to the Paithan dam, covers a total geographical area of 21,774 sq km and is divided into upper and lower reaches. The upper reach, located along the Sahyadri range (Western Ghats), receives heavy rainfall, while the lower reach falls within a rain shadow belt, experiencing lower rainfall. Despite being well-developed in terms of water storage infrastructure, factors such as rapid urbanization and industrial development, driven by population growth, are stressing available water resources. This development has led to a substantial increase in water demands across agriculture and urban sectors, resulting in critical conflicts due to fixed water resources and rapidly increasing demands.

Numerous major and medium dams have been constructed in the upper reach to conserve water and utilize available resources effectively, with many situated in ideal locations within the Ghats. Currently, reservoir operations are conducted independently for each reservoir, treating them as separate entities. However, increased water demands from agricultural and industrial sectors, alongside population growth and urbanization, have surpassed initial projections made during the planning of projects like the Paithan dam. Consequently, this has led to reduced inflows into the Paithan dam, exacerbating water stress in the lower reaches, particularly in the Marathwada region.

The challenge for Water Resources Engineers lies in devising a strategy for the integrated operation of reservoirs during the filling period. This strategy must prioritize the approximate equitable distribution of water at the sub-basin level to optimize the utilization of available water resources and maximize the benefits derived from the reservoir system or systems. By adopting principles of equitable distribution and optimizing system operations, Water Resources Engineers can address the complexities of water management in the Upper Godavari sub-basin, ensuring sustainable water use for all stakeholders.

2. Introduction: The Water Resources Department of the Government of Maharashtra has established a Study Group to address the challenges of water management in the Upper Godavari sub-basin up to the Paithan dam. This initiative stems from concerns regarding the increasing water demands due to rapid development in agriculture, industry, population, and urbanization, which have led to heightened utilization of upstream resources. This heightened utilization has resulted in decreased inflows into the Paithan dam, exacerbating water stress in the lower reaches, particularly in the Marathwada region.

In consideration of the aforementioned context, the Water Resources Department of the Government of Maharashtra established a Study Group chaired by Shri Mendhegiri, who was then Director General of WALMI, Aurangabad. This initiative was formalized through a Marathi Resolution dated 29th January, 2013, with the objective of formulating regulations and guiding principles for the integrated operation of reservoirs during the filling period in the Godavari basin, up to the Paithan dam. The Shri Mendhegiri Committee completed its task and submitted its report on 8th August, 2013.

However, as nearly a decade has passed since the submission of the Shri Mendhegiri Committee Report in 2013, there arises a pressing need to revisit its recommendations. This reconsideration is necessitated by various factors such as the utilization of Kharif water, losses due to evaporation and conveyance, alterations in the water usage patterns of the Jayakwadi project, and the challenges encountered in releasing water from upper upstream reservoirs to the Jayakwadi Reservoir, particularly during periods of yield shortfall. Furthermore, recommendation No. 4 of the Guiding Principles outlined by the Shri Mendhegiri Committee emphasizes the importance of reviewing and updating the operating rules, or guiding principles, presented in Table 6. The committee suggests that this review should occur after a lapse of 5 years, or at shorter intervals as determined by the Government. This periodic review is essential to address any difficulties encountered during implementation and to adapt to changes in the water planning scenario of the sub-basin.

Based on the aforementioned background, the Water Resources Department of the Government of Maharashtra established a Study Group chaired by the Director General of DTHRS (MERI), Nashik. This initiative was formalized through Marathi Resolution No. Misc -2023/ File No 186 / 2023/IM(P) dated 26th July, 2023. The Study Group was tasked with the following Terms of References:

1. To formulate guidelines for the integrated operation of reservoirs during the filling period in the Upper Godavari sub-basin to prevent potential water scarcity situations in the Paithan dam.
2. To develop mechanisms for the effective implementation of these guiding principles.
3. To recommend reforms pertaining to technical, financial, and management aspects to improve water management practices in the sub-basin.

This initiative underscores the government's commitment to addressing water scarcity challenges and ensuring sustainable water management in the Upper Godavari sub-basin. Through collaborative efforts and comprehensive reforms, it aims to optimize water utilization, mitigate conflicts, and enhance the resilience of water resources for present and future generations.

Meanwhile The Executive Director of the Godavari Marathwada Irrigation Development Corporation, Aurangabad instructed the Chief Engineer of Water Resources in North Maharashtra Region, Nashik, to release 243.637 McuM (8.603 TMC) of water from upstream storages. This was based on a strategy outlined in the Mendhegiri Committee report's Table 6. This order is in concurrence with the Mumbai High Court and the Maharashtra Water Resources Regulatory Authority. It also aligned with the priorities set in the State Water Policy of 2019. The decision was made considering factors like evaporation losses from reservoirs and transit losses from the river system, ensuring it was both technically and practically feasible.

3. Declaration of Drought in Maharashtra: Drought is a complex occurrence primarily caused by significant deviations from normal rainfall patterns or the skewed distribution of rainfall over time and space. In India, drought usually coincides with the monsoon season. The severity and extent of drought are influenced by various factors such as the availability of surface and groundwater resources, agro-climatic conditions, crop choices and patterns, and socio-economic vulnerabilities of local communities. Despite efforts, there is no precise indicator or index to forecast the onset and severity of droughts or predict their impacts. However, the impact of drought tends to worsen with successive occurrences.

To aid in the assessment of drought-prone areas in Maharashtra, the Government has adopted a methodology outlined in the Drought Management Manual of 2016 and 2020, using MahaMADAT geoportal developed by the Maharashtra Remote Sensing Application Centre (MRSAC), Nagpur. MahaMADAT is a web-based Geoportal that integrates data from multiple sources, including rainfall (Quantum and distribution), cropping patterns, soil moisture levels, and remote sensing indices, to

provide early warning and agricultural drought assessment at the tahsil level. It consolidates data from multiple sources including rainfall deficiency, spatial and temporal distribution of rainfall, duration of dry spells, and other factors recognized as key triggers for drought. Additionally, the portal considers various impact indicators such as cropping patterns, soil moisture levels, hydrological data, and remote sensing-based indices to assess drought conditions. This comprehensive approach enables the accurate declaration of drought and facilitates timely interventions to mitigate its impacts.

Given the multifaceted nature of drought declaration and water management, the Godavari study group has developed a methodical approach to thoroughly assess and enhance the current procedures.

1. Review the recommendations of the Mendhegiri Study Group Report, considering additional data on water availability, yield, current water usage, climatic and hydrological changes, technological advancements, implementation challenges, and changes in water resource planning.

2. Engage MRSAC Nagpur in the development of Decision Support System for drought declaration, utilizing five parameters specified in the drought manual published by the Government of India viz., Rainfall-related indices, Remote Sensing-based Vegetation indices, Crop Situation Related Indices, Soil moisture-based indices, and Hydrological indices.

3. Enhance the methodology for releasing water from upstream reservoirs by incorporating the aforementioned five parameters in addition to surface water hydrology and kharif water utilization. MRSAC will provide a software module to facilitate the precise determination of water release amounts from upstream dams to the Paithan dam (Jaykwadi project).

This proposed methodology aims to improve the accuracy and effectiveness of drought assessment and water management strategies by leveraging advanced technology and incorporating a broader range of indicators and data sources. By adopting a comprehensive approach, Maharashtra can enhance its resilience to drought and optimize water resource utilization for sustainable development.

4. MRSAC Capacity to Implement Project: The Maharashtra Remote Sensing Application Centre (MRSAC) in Nagpur is an autonomous body under the administrative control of the Planning Department of the Government of Maharashtra. Established in 1988, MRSAC has been actively engaged in the fields of Remote Sensing (RS) and Geographic Information System (GIS) for over three decades. MRSAC has undertaken numerous projects of significance for both the State and Central Governments. Over the years, it has developed a comprehensive geospatial database comprising cadastral information, administrative boundaries, and a wide array of natural resources data generated through satellite remote sensing and GIS technology.

The center's expertise extends to various geo-spatial application areas, including soil and water conservation, drought assessment, watershed development, groundwater prospecting, water supply and sanitation, forest and biodiversity studies, crop acreage estimation, coastal studies, urban and rural development, education, and public health. MRSAC is committed to addressing the challenges of natural resources management through innovative and effective solutions.

With a mandate from the Government of Maharashtra, MRSAC is working on strategies to leverage its extensive database for shared use by both state and central government departments, particularly in the realms of Government-to-Government (G2G) and Government-to-Citizen (G2C) services. MRSAC boasts a team of 19 scientists with expertise in various disciplines related to Remote Sensing and GIS. The centre is equipped with state-of-the-art computer hardware and software infrastructure

essential for Remote Sensing, GIS, and GPS surveying. It has been at the forefront of providing technical solutions in the geo-spatial domain and has developed several information and decision support systems to aid in natural resources management. Through its dedication to preserving the natural resources of the state and its commitment to providing innovative solutions to various departments, MRSAC plays a pivotal role in supporting the sustainable development and effective management of Maharashtra's natural resources.

5. Objectives:

1. Based on the parameters outlined by the Government of Maharashtra for declaring drought, MRSAC Nagpur will provide a software module that integrates the following five parameters:

   1. Rainfall Related Indices
   2. Remote Sensing-based Vegetation Indices
   3. Crop Situation Related Indices
   4. Soil Moisture-based Indices
   5. Hydrological Indices

2. MRSAC will consider the storages of dams and kharif water utilization on 15th October of every year while developing software module. By incorporating these factors, the software will enable the precise determination of the quantum of water to release from upstream reservoirs into the Paithan dam (Jaykwadi project).

This software module will serve as a decision support tool for water resource management, allowing authorities to make informed decisions regarding water release to alleviate drought conditions and ensure optimal utilization of available water resources. MRSAC's expertise in remote sensing and GIS technology will be instrumental in developing this software to effectively address the challenges of drought declaration and water management in Maharashtra.

6. Methodology: Project execution methodology is elaborated below:

1. The precise determination of the storage levels within the command areas of dams situated upstream of Jaykwadi (Paithan Dam) and those within the Jaykwadi project area is conducted annually on the 15th of October using the Pravah App. This process involves utilizing the Pravah App's functionalities to calculate the exact quantum of storage available in these dams, ensuring accurate data retrieval and analysis for effective water management strategies.
2. A Water Resources Department (WRD) officials will be responsible for furnishing the necessary data concerning the kharif utilization of each dam and the requirements for non-irrigation purposes, including drinking and industrial usage, for dams situated upstream of Jaykwadi (Paithan Dam).
3. MRSAC will provide the list of circles under drought with the help of MAHAMADAT software. WRD will provide the utilization data for each circle, based on which MRSAC will calculate exact amount of water need in the Drought declared revenue circles in the command area of dams (upstreams of Jaykwadi (Paithan Dam).
4. MRSAC will provide precise calculations regarding the amount of water to be released, taking into account various factors such as the prevailing drought conditions, the storages in dams i.e., Jaykwadi and upstream dams levels as of October 15th, the utilization of water during the kharif season, and the requirements for non-irrigation purposes, including drinking and industrial usage. Additionally, the irrigation requirements, as determined by the GSG committee, will also be factored into these calculations. This comprehensive approach

ensures effective water management and allocation in accordance with the prevailing conditions and demands.

5. The work will be executed in several phases:
    - Phase I: Collection storage, utilization and drought data
    - Phase II: Preparation of the release water analogy
    - Phase III: Conducting trial runs using historical data from 2015, 2018, and 2023
    - Phase IV: Updating the software module based on the results of the trial runs, if necessary
    - Phase V: Running the software annually and update software as per experiences result & outcome.

6. MRSAC will allocate skilled personnel for GIS activities who will collaborate with MWRD officials to accurately determine the amount of water to be released. This determination will be made after assessing the severity of the drought situation in the command areas of Jaykwadi (Paithan Dam) & Upstream dams of Jaykwadi. MRSAC will develop specialized software that takes into account five key parameters related to drought, as well as the storages of all dams within the study area and the utilization of water for Kharif crops and non-irrigation requirement also irrigation requirement as per prevailing strategy of G.S.G. report.at each dam by October 15th of every year. The software will be designed to operate autonomously, without requiring human intervention, streamlining the process and ensuring accuracy in water release decisions.

This methodology ensures a systematic approach to water management, leveraging technology and collaboration between MRSAC and MWRD to optimize water utilization and mitigate the impacts of drought in the region.

7. **Indenting Party:** Executive Director Godavari Marathwada Irrigation Development Corporation ChhatrapatiSambhaji Nagar, [Hereinafter referred to as the "1st PARTY" which expression shall mean and include its heirs, successors, representatives, officers, etc.]

8. **Executing Party:** Director Maharashtra Remote Sensing Applications Centre (MRSAC) Autonomous Body under Planning Department, Government of Maharashtra VNIT Campus, South Ambazari Road, Nagpur 440 010, Maharashtra, India. [Hereinafter referred to as the "2nd PARTY" which expression shall mean and include its heirs, successors, representatives, officers, etc.]

9. **Authorized Signatories:**

- Er. Mahendra S. Amale, Member secretary, Godavari Study Group & Superintending Engineer, Command Area Development Authority, Nashik On behalf of Executive Director, Godavari Marathwada Irrigation Development Corporation Chhatrapati Sambhaji Nagar. 1st party.
- Dr.Ashok Kumar Joshi, Director, Maharashtra Remote Sensing Application Centre(MRSAC), Nagpur On behalf 2nd party.

10. **Terms & Conditions:**

1. The agreement shall be effective from the date of signing and shall remain in force for a period of 12 months.

2. The agreement shall terminate on the expiry of the period unless extended by both the Parties. The project can continue only if funds are made available by MWRD at proper time intervals

3. During the tenure of the agreement, parties shall have the right to terminate the agreement either for breach of any of the terms and conditions of this agreement or otherwise by giving a one-month notice in writing to the defaulting party. Failure of either party to terminate the agreement on account of breach or default by the other shall not constitute a waiver of the party's right to terminate this agreement.

4. The 1st party shall have the absolute right to terminate the contract or understanding by causing 30 days prior notice. If it is noticed that the performance is not up to the expectations, then the termination of the project and recovery of the fund should be decided jointly by the 1st and 2nd party. It shall be the responsibility of the 2nd party to reimburse such expenditure, failing which the 1st party shall become entitled to recover the same.

5. In the event of termination of the agreement, vide clause 5 (iv), the rights and obligations of the parties thereto shall be settled by mutual discussion; the financial settlement shall take into consideration not only the expenditure incurred but also the expenditure committed by the parties hereto.

6. The agreement arrived at between the parties hereto for the utilization of the intellectual property shall survive the termination of the agreement.

7. The 2nd party undertakes to perform the work to complete the project within the stipulated time framework using reasonable technical skills, care, and diligence and will own up the task to ensure its successful completion and sustenance.

8. The 1st party undertakes to provide the necessary inputs on regular time intervals as per requirement.

9. In the event of any dispute concerning the work done, payment made or payments claimed by the 2nd party or any other disputes, the 1st party or 2nd party shall be entitled to call for a meeting to settle the dispute. Any dispute is to be settled jointly by Executive Director GMIDC Chhatrapati Nagar and Director, MRSAC Nagpur. Any unresolved matter will be settled by MWRD, Secretary (CAD), Government of Maharashtra & will be final & binding on both parties.

10. The 2nd party hereby agrees to indemnify and keep the 1st party harmless against any loss suffered on account of any negligence on the part of the 2nd party or the damage caused to the properties provided by the 1st party to the 2nd party.

11. If any error is observed in the deliverables submitted by the executing agency, within six months of submission of final deliverables, the executing agency will do the corrections and submit the modified deliverables, within the time frame mutually agreed upon.

12. No amendment or modification of this agreement shall be valid unless the same is made in writing by both parties and their otherwise representatives and specifically stating the same to be the amendment of this agreement. The modification/changes shall be effective from the date on which they are made / executed, unless otherwise agreed to.

11.0 Project Monitoring Committee

The Project Monitoring Committee will be constituted to oversee the implementation of the project. The committee will comprise officials from MWRD and will be chaired by the Superintending Engineer. The responsibilities of the committee include:

1. Monitoring, reviewing, and reporting progress of the project.
2. Coordinating and collaborating between various agencies involved in the project to ensure proper and smooth functioning.
3. Providing guidance, support, and resolution of technical issues faced by project team members.
4. Conducting quality checks and accepting all project deliverables.
5. Tracking timelines in comparison to the project plan.
6. Ensuring proper training arrangements for project staff.
7. Supporting MWRD in training and capacity building of its staff.
8. Assisting MWRD in evaluating the project continuously.
9. Conducting regular strategic meetings and issuing Minutes of Meetings (MoM).
10. Holding regular meetings with MRSAC on a quarterly basis to review progress, identify any bottlenecks, and explore ways to expedite work.

This committee will play a crucial role in ensuring the successful implementation of the project by providing oversight, support, and coordination among all stakeholders involved.

12.0 MRSAC project Team: MRSAC project team is structured as follows.

Dr.Prashant Rajankar, Project Manager

Dr.Indal Ramteke, Project Coordinator (Thematic)

Mrs. Sangita Rajankar, Project Coordinator (Software Development)

13.0 Deliverables

MRSAC will provide the exact quantum of water to be released from the upstream of Jaykwadi (Paithan Dam) by considering drought situations, storage levels on 15/10, kharif utilization, and non-irrigation requirements (drinking & industrial).

14.0 Project Schedule

The project is expected to be completed by the end of July 2024 from the signing of the MoU by MWRD (GMIDC)and MRSAC. Any changes in the process flow may affect the target date. The timeframe for database creation depends on coordination with departments/stakeholders. The activities of Phases I to IV will span July 2024. MRSAC will run the software every year at the end of October & give the report regarding necessity to release the water from u/s reservoirs.

15.0 Role & Responsibilities

15.1 Maharashtra Water Resources Department: i. Coordinating with MRSAC by appointing a nodal officer. ii. Providing various inputs and related information to MRSAC. iii. Providing funds for the project and performing ground truth with MRSAC, if required. iv. Providing requisite information/data to MRSAC within the specified time frame. v. Providing spatial/non-spatial data to MRSAC in the

desired format. vi. Providing verification, validation, or approval for resolving any data/map related issues. vii. Identifying appropriate officials for User Acceptance Testing (UAT).

15.2 Maharashtra Remote Sensing Application Centre: i. Developing plugging software to ascertain the quantum of water to be released from the upstream of Jayakwadi Dam. ii. Not held responsible for errors arising from wrong entry of information/data by MWRD field officials. iii. Entitled to full disclaimer and immunity regarding custody and handling of data. iv. Commencing project work after deployment of manpower and receipt of advance payment from MWRD.

16.0 Confidentiality

Both parties shall maintain strict confidentiality of all information and data exchanged/generated during the agreement, for purposes outlined in the agreement

17.0 Intellectual Property Rights

MRSAC and MWRD shall retain absolute rights over any results or procedures discovered during the project

18.0 Force Majeure

Neither party shall be responsible for non-fulfillment of obligations due to unforeseen events, with notice required if such events occur. If force majeure conditions continue beyond six months, the parties shall decide the future course of action.

19.0 Indemnity Bond

MRSAC shall indemnify and keep indemnified MWRD in respect of any loss, damage, or claim arising from breach of contract, statutory duty, or negligence.

18.0 Budget

Budget details are provided in the Annexure-1 as mentioned below, Payment terms and conditions are mentioned inthe Annexure-1

ANNEXURE -1

SN	COMPONENTS	COST (Rs.)
1	Thematic Manpower 1 number for 12 months (@ Rs. 75000/- month)	27,00,000/-
2	Software Manpower 2 numbers for 6 months (@ Rs. 100000/- month)	12,00,000/-
3	Travel, field work, stationary, report generation, seminar, workshop	5,00,000/-
4	System usage / Server / Administrative charges (@39%)	17,16,000/-
	TOTAL COST	61,16,000/-

NOTE:

1. Above estimate is applicable for one year (i.e. for the year 2024-25)
2. For next two years (i.e. 2025-26 and 2026-27) 25% cost will be applicable for operation and maintenance of the portal.
3. Operation and Maintenance cost for 2025-26 will be Rs. 1529000/- and for 2026-27 will be Rs. 15,29,000/-
4. Cost will be revised after third year (i.e. after 2026-27)

FUND RELEASE MILESTONE:

1st Payment: Immediately after signing the MoU (50% of total cost) i.e. Rs. 30,58,000/-

2nd Payment: In the month of Jun 2024 (40% of the total cost) i.e. Rs. 24,46,400/-

3rd Payment: After submission of first year results (10% of total cost) i.e. Rs. 6,11,600/-

19.0 Seal of Parties

In witness whereof the parties hereto have signed this agreement on the day, month and year mentioned hereinbefore.

THE PARTIES HAVE EXECUTED THIS MEMORANDUM OF UNDERSTANDING (MoU) IN DUPLICATE ON THIS DAY .....th, Month ....., Year 2024 IN THE PRESENCE OF WITNESS INDICATED.

First Party

For and on behalf of GMIDC, Chhatrapati Sambhaji Nagar.

Signature_____

Name – Er. Mahendra S. Amale
Member Secretary, Godavari Study Group & Superintending Engineer, Command Area Development Authority, Nashik
Mobile – 9422256593

Email – secadnsk@gmail.com

Seal

Supdt. Engr. C.A.D.A. NASHIK

Witnesses: (Name & Address)

1. Pramod G. Mandade
DG, DTHRS, Nashik

2. Prakash B. Musale
CE, NMR, Nashik

Second Party

For and on behalf of MRSAC, Nagpur

Signature_____

Name - Dr. Ashok Kumar Joshi, Director, MRSAC, VNIT, Campus, Nagpur– 440010

Mobile – 9422184063
Email – director@mrsac.gov.in,

Seal

MAHARASHTRA REMOTE SENSING APPLICATIONS CENTRE * NAGPUR *

Witnesses: (Name & Address)

1. Dr. Prashant Rajankar,
Associate Scientist, MRSAC, Nagpur

2. Dr. Indal Ramteke,
Scientific Associate, MRSAC, Nagpur

महाराष्ट्र शासन
GOVERNMENT OF MAHARASHTRA
पशुसंवर्धन आयुक्तालय, महाराष्ट्र राज्य,
COMMISSIONERATE OF ANIMAL HUSBANDRY
Maharashtra State, Opp. Spicer Memorial College,
Ambedkar Chowk, Pune - 411 063
ISO : 9001 : 2015 Certified

पशु, पीसी/अ-४(१)/१६९-२४३ /२०२४, पसं-१४, पुणे-६७, दिनांक ०८/०४/२०२४

प्रति,

१) प्रादेशिक सहआयुक्त पशुसंवर्धन (सर्व)
२) जिल्हा पशुसंवर्धन उपआयुक्त (सर्व)
३) जिल्हा पशुसंवर्धन अधिकारी, जिल्हा परिषद (सर्व)

विषय :- गावनिहाय वार्षिक चारा आराखडा तयार करणेबाबत..

उपरोक्त विषयाच्या अनुषंगाने, पशुपालन व दुग्धव्यवसाय हा ग्रामीण भागातील अर्थव्यवस्थेतील महत्त्वाचा व्यवसाय असून, ग्रामीण भागात वर्षभर रोजगार आणि नियमित आर्थिक उत्पन्न देणारा व्यवसाय आहे. पशुपालन व दुग्धव्यवसायात चारा, वैरण व पशुखाद्य हा अतिशय महत्त्वाचा घटक असून, पशुपालन व दुग्धव्यवसायातील जवळपास ७० टक्के खर्च हा चारा व पशुखाद्यावर होत असतो.

पशुपालन व दुग्धव्यवसायात चारा, वैरण व पशुखाद्य या घटकांचा पशुधनाच्या खालील बाबींवर परिणाम होतो.

१) पशुधनाची उत्पादकता/क्षमता
२) पशुधनाची प्रजनन क्षमता
३) दुध उत्पादन व दुध उत्पादनातील सातत्य

राज्यातील वार्षिक सरासरी पर्जन्यमान, पर्जन्यमान व हवामानातील अनियमितता, घटत असलेले प्रति कुटुंब धारण क्षेत्र, शेतकऱ्यांचा नगदी पिकांकडे वाढलेला कल इत्यादी कारणामुळे राज्यात पशुधनासाठी आवश्यक असणारा चारा उपलब्ध होत नाही. आजमितीस राज्यात ४३.९८ टक्के हिरव्या वैरणीची व २५.९२ टक्के वाळलेल्या वैरणीची तूट आहे. त्यामुळे चारा टंचाईच्या काळातील पशुधनास आवश्यक असणाऱ्या चाऱ्याच्या उपलब्धता व उपलब्धतेनुसार वार्षिक नियोजन करण्याची आवश्यकता आहे.

कृपया सोबतचे परिपत्रक पहावे..

मागिल पानावरून पुढे..

एका पशुधनास प्रतिदिन किमान खालील प्रमाणे हिरव्या व वाळलेल्या चाऱ्याची आवश्यकता असते.

अ.क्र.	वर्ग	प्रतिदिन प्रति पशुधन आवश्यकता (किलो)	
		हिरवी	वाळलेली
१	लहान पशुधन(गाय व म्हैस वर्ग)	१०	३
२	मोठे पशुधन(गाय व म्हैस वर्ग)	१८	६
३	शेळी	४	१
४	मेंढी	४	१

उपरोक्त नमुद प्रतिदिन आवश्यकतेनुसार एका पशुधनास खालील प्रमाणे वार्षिक हिरव्या व वाळलेल्या चाऱ्याची आवश्यकता असते.

अ.क्र.	वर्ग	किमान प्रतिवर्ष प्रति पशुधन आवश्यकता (मे.टन)	
		हिरवी	वाळलेले
१	लहान पशुधन(गाय व म्हैस वर्ग)	३.५	१.००
२	मोठे पशुधन(गाय व म्हैस वर्ग)	६.५	२.२५
३	शेळी	१.५	०.४
४	मेंढी	१.५	०.४

पशुसंवर्धन विभागामध्ये केंद्र शासनाच्या मार्फत प्रत्येक ५ वर्षाने गायनिहाय पशुगणना करण्यात येते. त्यानुळे गायनिहाय पशुधन संख्या उपलब्ध आहे. वरीलप्रमाणे पशुधनास किमान वार्षिक हिरव्या व वाळलेल्या चाऱ्याची आवश्यकता विचारात घेवून, गायनिहाय चारा पिकांची पेरणी, उत्पादन व उपलब्धता याबाबतचे वार्षिक आराखडे तयार करणेबाबत आपल्या अधिनस्त सर्व संस्थांना आपल्या स्तरावरून लेखी निर्देश निर्गमित करावेत. आणि दिनांक ३१/०५/२०२४ सेवी पर्यंत सर्व गावांचे वार्षिक चारा नियोजन आराखडे जिल्हा कार्यालयास प्राप्त करून द्यावेत.

कृपया पुढील पानावर पहावे..

मासिल पाठवून द्यावे..

तद्नंतर माहे जून २०२४ पासून वार्षिक चारा नियोजन आराखड्यानुसार चारा पिकांची पेरणी करून घेण्याबाबतची कार्यवाही करण्यात यावी. यासाठी आवश्यक बियाण्याचे वितरण जिल्हा वार्षिक योजनेअंतर्गत उपलब्ध असलेल्या निधीमधून करण्यात यावे.

वार्षिक आवश्यकतेप्रमाणे चारा उपलब्धतेकरीता पर्जन्यकाळात (खरीप हंगामात) होणाऱ्या पावसाचा उपयोग करून, चारा पिकांचे उत्पादन घेण्यात यावे. खरीप हंगामात उत्पादित होणाऱ्या हिरव्या एकदल (मका, ज्वारी, बाजरी, संकरीत नेपियर गवत, इ.)चाऱ्याचे मुरघासमध्ये रूपांतर करावे, जेणेकरून, उदरचा मुरघास उन्हाळी हंगामात पशुधनास खाऊ घालण्यासाठी उपयोगात येईल.

गावातील ज्या पशुपालकांकडे स्व: मालकीची जमिन उपलब्ध नाही, अशा पशुधनासाठी गावातील उपलब्ध गायरान (सामाईक) जमिनीमध्ये चारा पिकांची लागवड करावी. तसेच गावातील पडीक जमिन, वनक्षेत्रातील कुरण जमिन, गोशाळा/गोरक्षण संस्था/पांजरपोळ या संस्थांची जमिन आणि गाळपेरा क्षेत्र यामध्येही चारा पिकांच्या लागवडीचे नियोजन करावे. तसेच शेळ्यांकरीता वैरण उपयुक्त वृक्षांची लागवड करण्याचे नियोजन करून कार्यवाही करावी. सोबत वैरण उपयुक्त वृक्षांची यादी जोडण्यात येत आहे.

माहे जुलै २०२४ ते माहे जुलै २०२५ या कालावधीमध्ये पशुधनास आवश्यक असणारा चारा कमी पडणार नाही आणि गावातील पशुधनास आवश्यक असणारा हिरवा व वाळलेला चारा गाव क्षेत्रामध्येच उपलब्ध होईल या पध्दतीने नियोजन करण्यात यावे. यासाठी आवश्यक असल्यास, प्रादेशिक पशुसंवर्धन सहआयुक्त कार्यालयात कार्यरत असलेल्या वैरण विकास अधिकारी यांची मदत घेण्यात यावी.

यासोबत वैरण पिकनिहाय प्रति हेक्टरी पेरणीसाठी आवश्यक बियाणे (सिड रेट) व सरासरी प्रति हेक्टरी हिरव्या वैरणीचे उत्पादन या बाबतचा तपशील जोडण्यात येत आहे.

सहपत्र : वरीलप्रमाणे

८/९/२०२४

उपसंचालक (वैरण विकास)
पशुसंवर्धन आयुक्तालय,
महाराष्ट्र राज्य, औंध, पुणे-६७

प्रत : माहिती व कार्यवाहीस्तव
वैरण विकास अधिकारी, प्रादेशिक पशुसंवर्धन सहआयुक्त (सर्व)

विविध वैरण पिकांच्या सुधारीत प्रजातीच्या सीड रेट व उत्पादनाचा तपशील

अ. क्र.	वैरण पिकाचे नाव व प्रजाती	पेरणीसाठी आवश्यक बियाणे (किलो/हे.)	हिरव्या चा-याचे उत्पादन (मे. टन /हे.)	कापणी संभव
१	हायब्रीड मका (एडीव्ही ७५६)	२०	४५ ते ५५	१
२	हायब्रीड मका (पीएसी ७४०)	२०	४५ ते ५५	१
३	हायब्रीड ज्वारी (जंबो सुपर)	३० ते ३७.५	३० ते ३७	३ ते ४ पहिली कापणी -५५ दिवस दुसरी कापणी - ४५ दिवस
४	हायब्रीड ज्वारी (बीएमआर रॉकेट)	३०	३० ते ३७	३ ते ४ पहिली कापणी -५५ दिवस दुसरी कापणी - ४५ दिवस
५	हायब्रीड ज्वारी (स्पीड फीड)	३० ते ३७.५	३० ते ३७	३ ते ४ पहिली कापणी -५५ दिवस दुसरी कापणी - ४५ दिवस
६	हायब्रीड गोड ज्वारी (मेगास्वीट)	१२.५ ते १५	६२ ते ७०	१ ते २
७	हायब्रीड गोड ज्वारी (शुगरग्रेज)	१२.५ ते १५	६२ ते ७०	१ ते २
८	हायब्रीड बाजरी न्युट्रीफीड	५ ते ७.५	३० ते ३७	३ ते ४ पहिली कापणी- ५५ दिवस दुसरी कापणी - ५० दिवस
९	हायब्रीड बाजरी (न्युट्रीफास्ट)	५ ते ७.५	३० ते ३७	३ ते ४ पहिली कापणी -४५ दिवस दुसरी कापणी -४० दिवस

A)

Water reqd.to produce fodder for animals in 1 Sqkm Area (Mm3 / Sqkm)

Sr.No.	Dist	Area of District (Sq.Km)	Total Animals in the		Animals Per Sqkm		fodder Reqd.for		fodder to be		Area reqd. to produce			Ha /Mcft (duty assumed 150	Water (Mcft) reqd. per Sqkm	water reqd.to produce fodder for (Mm3/Sq.Km)
							Big	Small			Big	Small				
			Big	Small	Big	Small	18 kg /Day	5 kg /Day	Big	Small	(50 M.T. / Ha)		Total			
1	2	3	4	5	6 = (col.4/Col.3)	7= (col.5/Col .3)	8 =COL.6 X18	9 =COL.6 X 5	10 = (col.8 x258 /1000)	11 = (col.9 x258 /1000)	12 = (col.10/ 50)	13 = (col.11/ 50)	14	15	16= (col.14/ col.15)	17 = (col.16 / 35.315)
1	Nashik	15530	1116284	170461	71.88	10.98	1293.83	54.88	333.81	14.16	6.676	0.283	6.959	4.247	1.64	0.05
2	Ahmednagar	17098	1599658	242117	93.56	14.16	1684.05	70.80	434.48	18.27	8.690	0.365	9.055	4.247	2.13	0.06
3	Ch. Sambhaji nagar	10131	633002	61118	62.48	6.03	1124.67	30.16	290.16	7.78	5.803	0.156	5.959	4.247	1.40	0.04
4	Jalna	7694	504048	37391	65.51	4.86	1179.21	24.30	304.24	6.27	6.085	0.125	6.210	4.247	1.46	0.04
5	Parbhani	6214	398356	24327	64.11	3.91	1153.91	19.57	297.71	5.05	5.954	0.101	6.055	4.247	1.43	0.04
6	Beed	10693	754808	70841	70.59	6.62	1270.60	33.12	327.92	8.55	6.556	0.171	6.727	4.247	1.58	0.04

Procedure : -

col.no.

3 Area and Total animals in the District are taken from Maharashtra Govt.Web site www.maharashtra.gov.in (animal husbandary dept.)

4 & 5 Big animals include Cow & Buffelow and small animals include Goat, ship,pig,& pollutry etc.

6 & 7 Animals Per Sqkm = Total Animals (big /Small) / Area of District (Sq.Km)

8 & 9 fodder Reqd.for Animals / Day/sqkm = Animals Per Sqkm X 18

and = Animals Per Sqkm X 5

a. Figures 18 kg /Day for big animals & 5 kg /Day for small animals are taken from commissionerate of animal Husbandary Pune Marathi letter जा.क्र./वैवि/अ.६(१)/१६९-२४३/२०२४ /प.सं-१४,पुणे-६४दि. ०८/४/२०२४

10 & 11 Fodder to be Produced for Animals in 258 days (MT) = [fodder Reqd.for Animals / Day/sqkmX258] / 1000
(258Days= 15 Oct. TO 30June)

12 & 13 Area reqd. to produce fodder (Ha) = fodder to be Produced for Animals in 258 days (MT) / (50 M.T. / Ha)

(50 M.T. / Ha) as per animal husbandry letter dated 8/04/2024 (as mentioned above for col. 8 & 9)

15 Ha /Mcft (duty assumed 150 Ha/Mm3 (as per wrd circular dated 5/12/2003) = 150/35.315 = 4.25 Ha /Mcft

(M. S. Amale)
Superintending Engineer & Administrator
Command Area Development Authority, Nashik

Abstract of Revenue Circle wise Command Area of Various projects in Upper Godavari Sub Basin

Sr No	Project Name	Canal	District	Taluka	Revenue Circle under Command Area (Nos)	Village (Nos)	Command Area under Revenue Circle (Ha)
1	**Mula Complex**						
	Mula	Mula Right Bank Canal	Ahmednagar	4	60	162	91783.66
		Mula Left Bank Canal		1	5	55	15527.35
	Mandelwal	Mandelwal Right Bank Canal		1	2	06	2480.00
2	**Pravara Complex**						
	Bhandardara	Pravara Left & Pravara Right Bank Canal	Ahmednagar	6	28	208	42975.92
	Adhala	Adhala Left & Pravara Right Bank Canal		3	6	22	4794.25
3	**Gangapur Complex**						
	Gangapur	Nashik Left Bank Canal	Nashik	2	6	38	12190.00
		Godavari Left Bank Canal	Ahmednagar Nashik	3	8	36	15560.58
		Godavari Right Bank Canal		5	15	126	23046.00
	Kadava Project	Kadava Right Bank Canal	Nashik	4	11	55	13209.20
5	**Palkhed Complex**						
	Palkhed	Palkhed Left & Pravara Right Bank Canal	Nashik Ahmednagar Chh.Sambhajinagar	5	18	159	63409.62
	Ozarkhed	Ozarkhed Left Bank Canal	Nashik	3	10	52	17135
	Waghad	Waghad Left & Right Bank Canal		1	8	28	9460
	Punegaon	Punegaon Left Bank Canal		2	4	22	4630
	Karanjwan	Karanjwan Left Bank Canal		1	4	21	1546.27
6	**Shivana complex**						
	Ambadi	Ambadi Left & Right Bank Canal	Chhatrapati Sambhajinagar	1	3	3	2147
	Dheku	Dheku Left Bank Canal		1	3	3	2212
	Tembhapuri	Tembhapuri Right Bank Canal		1	1	1	4784
	Kohli	Kohli Left Bank Canal		1	1	1	472
	Narangi	Narangi Left & Right Bank Canal		1	1	1	1000
	Bor	Bor Left & Right Bank Canal		1	1	1	1600
	Shivana Takli	Shivana Takli Left & Right Bank Canal		2	5	35	6389
7	**Jaykwadi complex**						
	Jaykwadi	Jaykwadi Left Canal	Chh.Sambhajinagar Ahmednagar Jalna Parbhani	9	32	298	78431.67
		Jaykwadi Left Canal	Parbhani	6	18	173	95867.00
		Jayakwadi Right Bank Canal	Chh.Sambhajinagar Ahmednagar Beed	4	14	102	41680.00

मुख्य अभियंता, जलविज्ञान व धरण सुरक्षितता सीडीओ बिल्डींगच्या मागे, दिंडोरी रोड , नाशिक - ४२२००४ दूरध्वनी :०२५३-२५३०२२७		महाराष्ट्र शासन जलसंपदा विभाग		**Chief Engineer,** Hydrology & Dam Safety Behind C.D.O. Building, Dindori Road, Nashik – 422004 **Ph.No.** : 0253-2530227
Web: www.mahahp.gov.in **Email:** cehpswnasik@gmail.com / cehp.nashikwrd@maharashtra.gov.in				

By E-mail Only

No. CE H&DS/TS-3/(06/2023)/1106/Year 2024.	Date:-26/07/2024

To,

The Chairman,
Study Group set up to
formulate regulations for integrated
management of reservoirs in the
Godavari Basin & Director
General, DTHRS (MERI),
Nashik.

Sub:- A yield study carried out up to Jayakwadi Dam for the functioning of the Study Group set up to formulate regulations for integrated management of reservoirs in the Godavari Basin.

With reference to above subject, it is submitted that a yield study up to Jayakwadi dam has been carried out by this office and the details are attached herewith for the functioning of the Study Group set up to formulate regulations for integrated management of reservoirs in the Godavari Basin by Government resolution No. Misc-2023/CaseNo.186/2023/I&M(Policy),Dated-26/07/2023.

To carry out the yield study the Rainfall-Runoff co relations established for Upper Godawari (Up to Jayakwadi Dam), Pravara & Mula Sub Basins in Integrated State Water Plan & the weighted rainfall of the catchment area calculated from rainfall data of influencing rain gauge stations (of the project authority & Hydrology project) for the period from 1990 to 2021 are used.

Sr. No.	Sub Basin	Data Period	75%Dependable Gross Yield in Mcum.
1	Upper Godavari (area up to Jayakwadi Dam)	1990 to 2021	3598.29
2	Pravara	1990 to 2021	826.65
3	Mula	1990 to 2021	769.59
4	Total Catchment area up to Jayakwadi Dam	1990 to 2021	5424.21

Note - The year-wise yield series of Upper Godavari, Pravara and Mula Sub Basins for the period 1990 to 2021 has been aggregated for yield calculation of the total area up to Jayakwadi project.

Submitted for information and perusal of the committee.

Document Attached :- As above.

(A.A. Pandit)
Assistant Chief Engineer
Hydrology and Dam Safety
Nashik

O/C Signed By C. E.

Copy with regards to:

1) Chief Engineer & Chief Administrator, CADA, Chhatrapati Sambhajinagar for information.
2) Chief Engineer (WR), Water Resources Department, Chhatrapati Sambhajinagar for information.
3) Chief Engineer, Water Resources Department, North Maharashtra Region, Nashik for information.
4) Additional Commissioner, Water Conservation & Chief Engineer, Soil and Water Conservation Regional area, Chhatrapati Sambhajinagar for information.
5) Member Secretary of Godavari Study Group and Superintending Engineer & Administrator, CADA, Nashik for information and further action.
6) Superintending Engineer, Data Analysis Circle, Nashik for information.

Yield calculations HP study upto Jayakwadi project

Study approach:- A) Catahment area:- For this study the entire catchment is sub divided into three sub basins 1) Upper Godavari sub basin(upto Jayakwadi project on Godavari river) 2) Pravara sub basin 3) Mula sub basin where Pravara and Mula are tributaries of Godavari river

A-1:- **Upper Godavari** sub basin is further sub divided into

1) Palkhed complex and area below upto Niphad GD(on Kadwa river)

2) Darna complex and area below upto Samangaon GD(on Darna river)

3) Gangapur complex and area below upto Nashik GD(on Godavari river)

4) Area below Niphad ,Samanagaon and Nashik GD upto Kopargaon GD

5) Area below Kopergaon GD upto Nagamthan GD

6) Area below Nagamthan GD upto Jayakwadi Project

For yield calculation weighted rainfall of influencing raingauge stations and Rainfall runoff co relations established for hydrological study of Upper Godavari sub basin for Integrated state water plan at Niphad, Samangaon, Nashik, Kopargaon and Nagamthan GD sites are used.

Rainfall runoff co relations for Upper Godavari sub basin

Group no.	Group Titlae	Month	R-R Equations	R^2
Group-1	Niphad	June	R = 0.255P+8.117	0.93
		July	R = 0.723P-70.36	0.67
		August	R = 0.527P-31.26	0.81
		Septeber	R = 0.446P+4.328	0.88
		October	R = 0.508P-2.533	0.86
Group-2	Nashik	June	R = 0.7P+26.54	0.93
		July	R = 0.57P-59.02	0.62
		August	R = 0.819P-170.9	0.86
		Septeber	R = 0.584P-3.194	0.60
		October	R= 0.649P-3.82	0.92
Group-3	Samangaon(B)	June	R = 0.329P-17.31	0.68
		July	R = 0.376P-19.6	0.52
		August	R = 0.554P-17.63	0.90
		Septeber	R = 0.731P-60.28	0.73
		October	R = 0.426P-0.05	0.57

Group no.	Group Titlae	Month	R-R Equations	R^2
Group-4	Kopargaon	June	$R = 0.000 P^2-0.181P +17.41$	0.30
		July	R = 0.20P-0.608	0.67
		August	R = 0.588P-2.589	0.22
		Septeber	R = 0.472P-6.459	0.18
		October	R = 0.449P+7.412	0.11
Group-5	Nagamthan	June	R = 0.353P-9.823	0.26
		July	$R = -0.006P^2+1.03P +74.94$	0.12
		August	R = 0.684P+37.47	0.21
		Septeber	R = 0.79P+43.82	0.19
		October	R = 0.973P+43.43	0.25
Group-6	Jayakwadi	June	R = 0.3053P+7.006	0.53
		July	R = 0. 53P-21.08	0.58
		August	R = 0.479P-14.58	0.54
		Septeber	R = 0.562P-24.65	0.62
		October	R = 0.211P+5.863	0.55

R= Runoff in mm, P=Rainfall in mm

75% dependable Yield of **Upper Godavari** sub basin calculated for rainfall Data period 1990 to 2021 is **3598.29 Mcum** .

A-2:- **Pravara** sub basin is further sub divided into

1) Upto Nilwande dam (Bhandardara dam, area between Nhandara dam to Nilvane dam and area of Bhojapur and Adhala dam

2) Area below Nilwande dam to ozar weir

3) Area below ozar weir upto confluence of Pravara river with Godavari river

For yield calculation weighted rainfall of influencing raingauge stations and Rainfall runoff co relations established for hydrological study of Pravara sub basin for Integrated state water plan are used.

Rainfall runoff co relations for Pravara sub basin

Group no.	Group Titlae	Month	R-R Equations	R^2
a)	Up to Bhandardara	June	Y = 0.909x-113.5	0.947
		July	Y = 0.985x+93.60	0.691
		August	Y = 1.320x-15.63	0.888
		September	Y = 1.153x+15.21	0.597
		October	Y = 2.196x-39.41	0.292

Group no.	Group Titlae	Month	R-R Equations	R^2
b)	Bhandardara dam to Ozar	June	Y = 0.148x-13.834	0.65
		July	Y = 0.334x-14.179	0.65
		August	Y = 0.228x+6.41	0.37
		Septeber	Y = 0.166x+3.33	0.26
		October	Y = 0.131x+1.21	0.38

y= Runoff in mm, x=Rainfall in mm

75% dependable Yield of **Pravara** sub basin calculated for rainfall Data period 1990 to 2021 is **826.65 Mcum** .

A-3:- **Mula** sub basin is further sub divided into

1) Upto Mula dam

2) Area below Mula dam upto confluence of Mula river with Pravara river

For yield calculation weighted rainfall of influencing raingauge stations and Rainfall runoff co relations established for hydrological study of Mula sub basin for integrated state water plan are used.

Rainfall runoff co relations for Mula sub basin

Group no.	Group Titlae	Month	R-R Equations	R^2
	Mula sub basin	June	Y = 0.579x-26.43	0.73
		July	Y = 0.965x-41.69	0.604
		August	Y = 0.733x+17.50	0.616
		Septeber	Y = 0.340x+2.738	0.616
		October	Y = 0.514x-8.686	0.769

y= Runoff in mm, x=Rainfall in mm

75% dependable Yield of **Mula** sub basin calculated for rainfall Data period 1990 to 2021 is **769.59 Mcum** .

A-4 For yield calculation at Jayakwadi project yield series of Upper Godavari,Pravara and Mula series are combined yearwise. And total 75% dependable Yield for common Data period 1990 to 2021 is **5424.21 Mcum**

Detals of previoius studies and now are tabulated below

Figures in Mcum

Sr.No.	Study year	75% dep. vergin yield	Upstream utilisation	75% dep. net yield
1	Project Report 1964	5558.04	3270	2280.04
2	Project report 1985	5566	3270	2565
3	CDO study 2001	4830.04	4150.2	979.8
4	CDO study 2004	4415.5	4074.02	341.48
5	Godavari study group report 2013	-	-	816.53
5	ISWP 2016	5837	4045.29	1791.71
6	HP STUDY 2024 (Considering combined yield of Mula, Pravara & Upper Godavri upto Jayakwadi Subbsins)	5424.21	4060.15 (excluding Jayakwadi use 2618.19 Mcum)	1364.06

for 1 to 4 Net yield includes regenration from upstream projects

Upper Godavari sub basin

Yield in Pravara sub basin								
Sr. No.	Year	Bhandardara	Nilwande free	Adhala	Bhojapur	below Nilwande to Ozar weir	below Ozar weir to Pravara sangam	Pravara sub basin
1	1990	661.21	167.317	22.02	16.61	93.76	170.45	1131.37
2	1991	537.96	145.29	23.96	19.79	75.52	137.30	939.82
3	1992	386.16	109.55	15.56	11.16	62.87	114.30	699.60
4	1993	518.10	140.27	27.20	18.30	97.50	177.26	978.63
5	1994	808.97	227.78	23.91	18.26	53.65	97.53	1230.10
6	1995	339.79	124.04	17.30	14.71	78.05	141.89	715.79
7	1996	388.86	127.98	26.61	22.10	103.27	187.74	856.55
8	1997	880.36	29.33	13.57	10.21	52.16	94.84	1080.47
9	1998	471.44	79.42	24.09	19.58	124.00	225.44	893.98
10	1999	520.62	26.95	19.61	14.93	86.41	157.09	825.82
11	2000	424.04	21.11	10.72	8.49	82.51	150.01	696.89
12	2001	603.30	26.19	15.87	11.85	80.94	147.15	885.30
13	2002	427.73	70.52	9.83	7.24	60.96	110.83	687.12
14	2003	465.57	95.24	23.62	17.60	59.41	108.01	769.45
15	2004	536.85	85.78	18.62	14.62	84.35	153.34	893.55
16	2005	689.81	160.45	18.70	14.90	87.22	158.58	1139.66
17	2006	803.41	199.38	37.47	29.74	136.23	247.66	1453.90
18	2007	575.47	241.29	26.50	21.46	99.28	180.48	1044.47
19	2008	663.00	127.44	23.80	18.79	100.18	182.13	1115.34
20	2009	383.57	82.21	15.54	13.05	83.54	151.87	729.78
21	2010	546.17	77.78	18.18	13.94	130.43	237.32	1023.62
22	2011	622.95	92.54	15.76	11.72	95.41	173.45	1016.84
23	2012	488.50	72.60	16.55	11.32	85.24	154.97	829.17
24	2013	592.55	98.78	15.69	10.57	86.05	156.44	960.08
25	2014	509.39	308.08	19.39	13.36	93.80	170.53	914.55
26	2015	351.21	83.56	13.68	10.04	55.05	100.09	613.63
27	2016	574.41	119.52	29.97	24.44	125.78	228.67	1102.79
28	2017	591.08	142.98	8.13	8.83	91.46	166.28	1008.76
29	2018	616.87	154.97	10.56	8.27	46.52	84.58	921.76
30	2019	883.22	200.70	40.12	32.29	123.38	224.31	1504.04
31	2020	743.05	133.07	18.99	20.39	145.47	264.46	1325.43
32	2021	504.23	113.63	13.16	9.84	122.21	222.17	985.24

Yield in descending order			
Sr. No.	Year	Yield of pravara sub basin in Mcum	75 % dependable Yield in Mcum
1	2019	1504.04	
2	2006	1453.90	
3	2020	1325.43	
4	1994	1230.10	
5	2005	1139.66	
6	1990	1131.37	
7	2008	1115.34	
8	2016	1102.79	
9	1997	1080.47	
10	2007	1044.47	
11	2010	1023.62	
12	2011	1016.84	
13	2017	1008.76	
14	2021	985.24	
15	1993	978.63	
16	2013	960.08	
17	1991	939.82	
18	2018	921.76	
19	2014	914.55	
20	1998	893.98	
21	2004	893.55	
22	2001	885.30	
23	1996	856.55	
24	2012	829.17	826.65
25	1999	825.82	
26	2003	769.45	
27	2009	729.78	
28	1995	715.79	
29	1992	699.60	
30	2000	696.89	
31	2002	687.12	
32	2015	613.63	

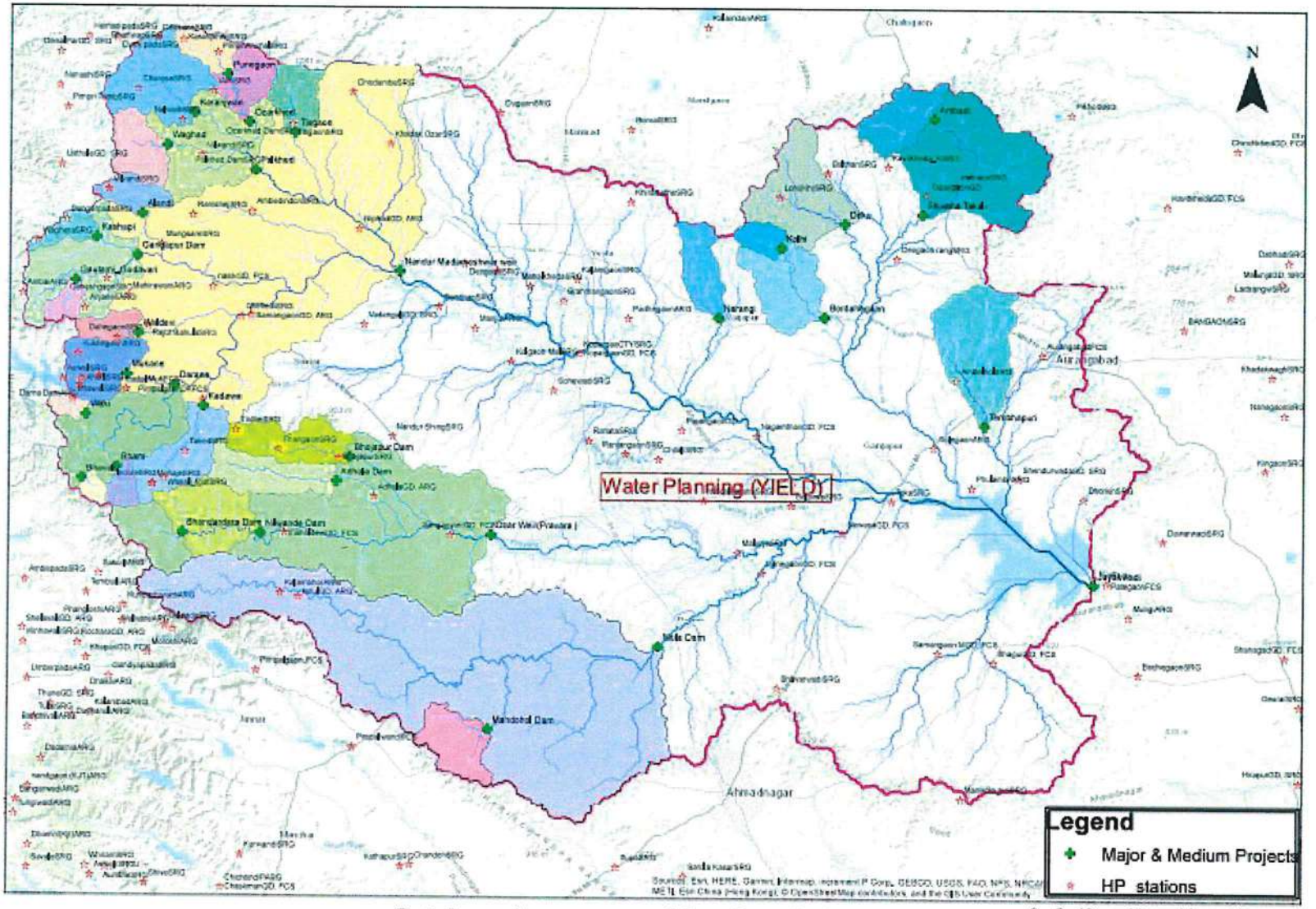
Yield of Mula sub basin				
Sr.No	Year	Upto Mula project	below Mula project upto confluence with Pravara	Total Mula sub basin in Mcum
1	1990	612.76	153.91	766.67
2	1991	1023.37	142.95	1166.32
3	1992	870.80	91.93	962.72
4	1993	1934.01	156.40	2090.41
5	1994	2158.23	63.47	2221.70
6	1995	426.43	110.15	536.58
7	1996	1062.38	186.00	1248.38
8	1997	550.00	63.87	613.93
9	1998	843.23	196.86	1040.09
10	1999	488.23	153.30	691.53
11	2000	614.81	163.55	778.37
12	2001	1248.77	149.43	1398.20
13	2002	499.78	106.01	605.79
14	2003	609.21	50.21	658.43
15	2004	685.13	88.42	901.55
16	2005	1352.99	106.62	1459.61
17	2006	2333.19	136.88	2470.06
18	2007	1236.53	156.48	1393.00
19	2008	1042.47	100.00	1142.47
20	2009	1165.29	128.70	1293.99
21	2010	873.58	198.84	1072.42
22	2011	909.67	128.19	1037.86
23	2012	1058.22	88.26	1146.47
24	2013	1462.98	111.44	1574.41
25	2014	828.36	105.97	934.33
26	2015	666.78	76.50	742.28
27	2016	1924.22	153.57	2077.79
28	2017	1993.23	123.27	2116.50
29	2018	545.99	92.98	638.96
30	2019	1048.52	126.11	1174.63
31	2020	1241.87	264.13	1606.00
32	2021	746.74	225.68	972.42

Yield in descending order			
Sr.No.	Year	Yield of Mula subbasin in Mcum	75 % dependable Yield in Mcum
1	2006	2470.06	
2	1994	2221.70	
3	2017	2116.50	
4	1993	2090.41	
5	2016	2077.79	
6	2020	1606.00	
7	2013	1574.41	
8	2005	1459.61	
9	2001	1398.20	
10	2007	1393.00	
11	2009	1293.99	
12	1996	1248.38	
13	2019	1174.63	
14	1991	1166.32	
15	2012	1146.47	
16	2008	1142.47	
17	2010	1072.42	
18	1998	1040.09	
19	2011	1037.86	
20	2021	972.42	
21	1992	962.72	
22	2014	934.33	
23	2004	901.55	
24	2000	778.37	
25	1990	766.67	769.59
26	2015	742.28	
27	2003	658.43	
28	1999	691.53	
29	2018	638.96	
30	1997	613.93	
31	2002	605.79	
32	1995	536.58	

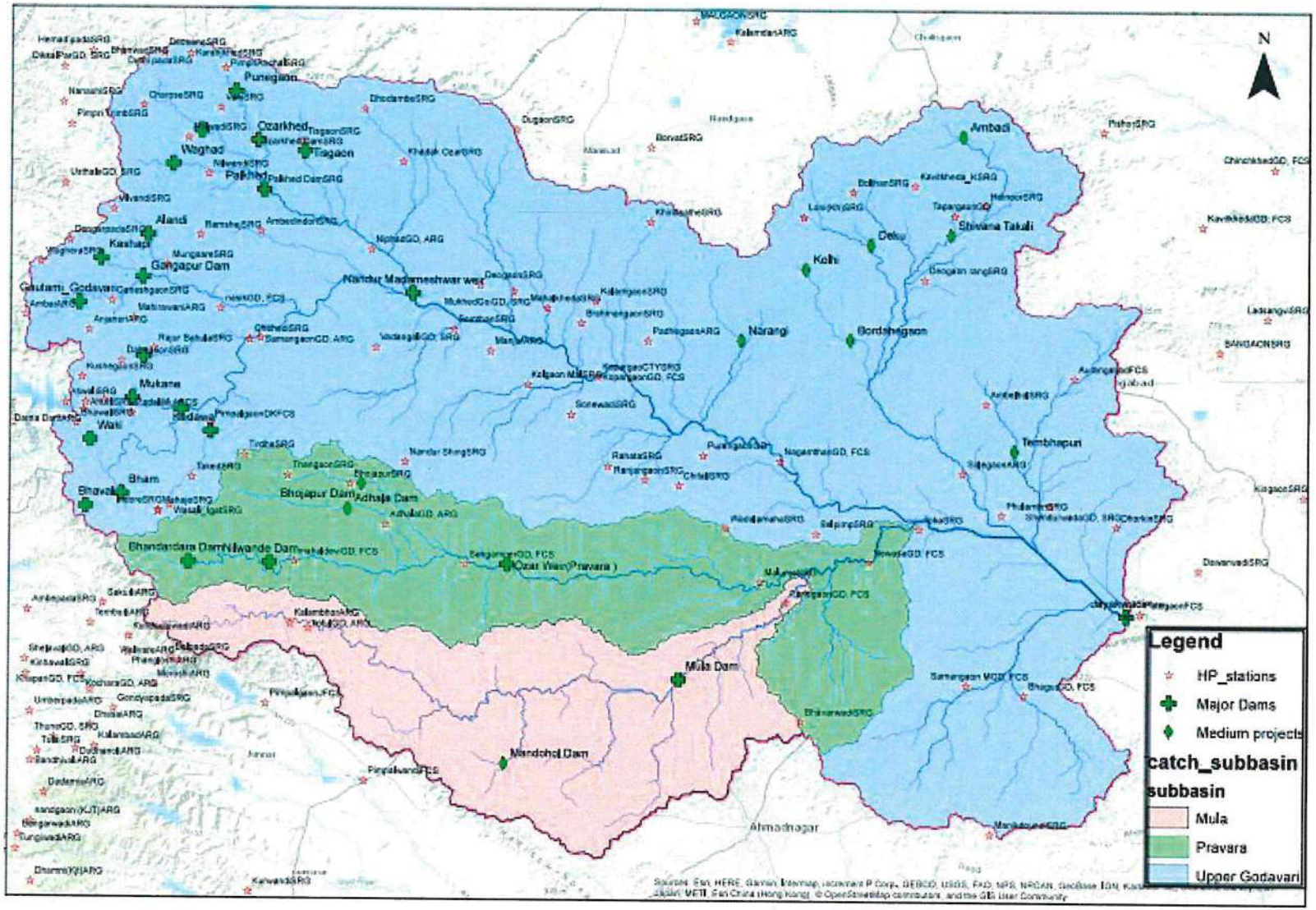
Yields in entire Jayakwadi catchment					
Sr.No.	Year	UG sub Basin	Pravara	Mula	Entire Jayakwadi catchment yield in Mcum
1	1990	4193.33	1131.37	706.87	6031.42
2	1991	3406.37	959.87	1146.47	5512.50
3	1992	3797.01	699.60	962.72	5459.32
4	1993	4761.31	578.64	2090.41	7430.15
5	1994	4197.60	1230.10	2221.70	7649.46
6	1995	3966.86	715.78	168.48	4849.53
7	1996	4792.61	856.55	1218.38	6867.53
8	1997	4662.00	1862.47	651.93	7176.44
9	1998	5435.52	693.98	1070.05	7560.50
10	1999	4486.57	825.82	652.93	5964.67
11	2000	3650.47	696.85	778.37	5155.73
12	2001	5793.22	865.40	1398.20	8077.20
13	2002	5467.70	687.12	605.79	4760.61
14	2003	5525.70	769.25	668.43	4964.59
15	2004	5424.05	893.55	903.55	7222.09
16	2005	4726.22	1134.66	1456.61	7317.49
17	2006	7372.51	1453.05	2470.08	11296.27
18	2007	4757.02	1040.47	1391.00	7188.43
19	2008	5245.81	1115.34	1142.47	7503.63
20	2009	3521.31	728.78	1293.98	5544.88
21	2010	5485.22	1023.62	1072.42	7581.25
22	2011	4407.13	1026.84	1027.86	6461.83
23	2012	3602.60	628.17	1348.47	5578.24
24	2013	4739.79	960.08	1574.41	7254.28
25	2014	4035.88	914.55	934.33	5884.77
26	2015	3155.71	613.63	742.28	4511.63
27	2016	5270.70	1102.75	2077.75	8450.78
28	2017	3101.28	1008.76	2116.50	6225.54
29	2018	2842.02	921.76	638.96	4402.74
30	2019	6526.94	1504.04	1174.62	9205.61
31	2020	6264.63	1325.43	1606.00	9196.06
32	2021	5690.63	585.24	972.42	7648.29

Yields in descending order			
Sr.No.	Year	Entire Jayakwadi catchment yield in Mcum	75% dependable yield in Mcum
1	2006	11296.27	
2	2019	9205.61	
3	2020	9196.06	
4	2016	8450.78	
5	1993	7830.15	
6	1994	7649.46	
7	2021	7648.29	
8	1998	7560.50	
9	2010	7581.26	
10	2008	7503.63	
11	2005	7317.49	
12	2013	7254.28	
13	2004	7222.09	
14	1997	7176.44	
15	1996	6867.53	
16	2011	6461.83	
17	2017	6225.54	
18	1990	6031.42	
19	2001	8077.20	
20	1999	5964.67	
21	2014	5884.77	
22	2012	5578.24	
23	2009	5544.88	
24	1992	5459.32	
25	1991	5512.50	5424.21
26	1995	4849.53	
27	2000	5155.73	
28	2003	4964.59	
29	1995	4849.23	
30	2002	4760.61	
31	2015	4511.63	
32	2018	4402.74	

Drawings



Catchment area map of Jayakwadi dam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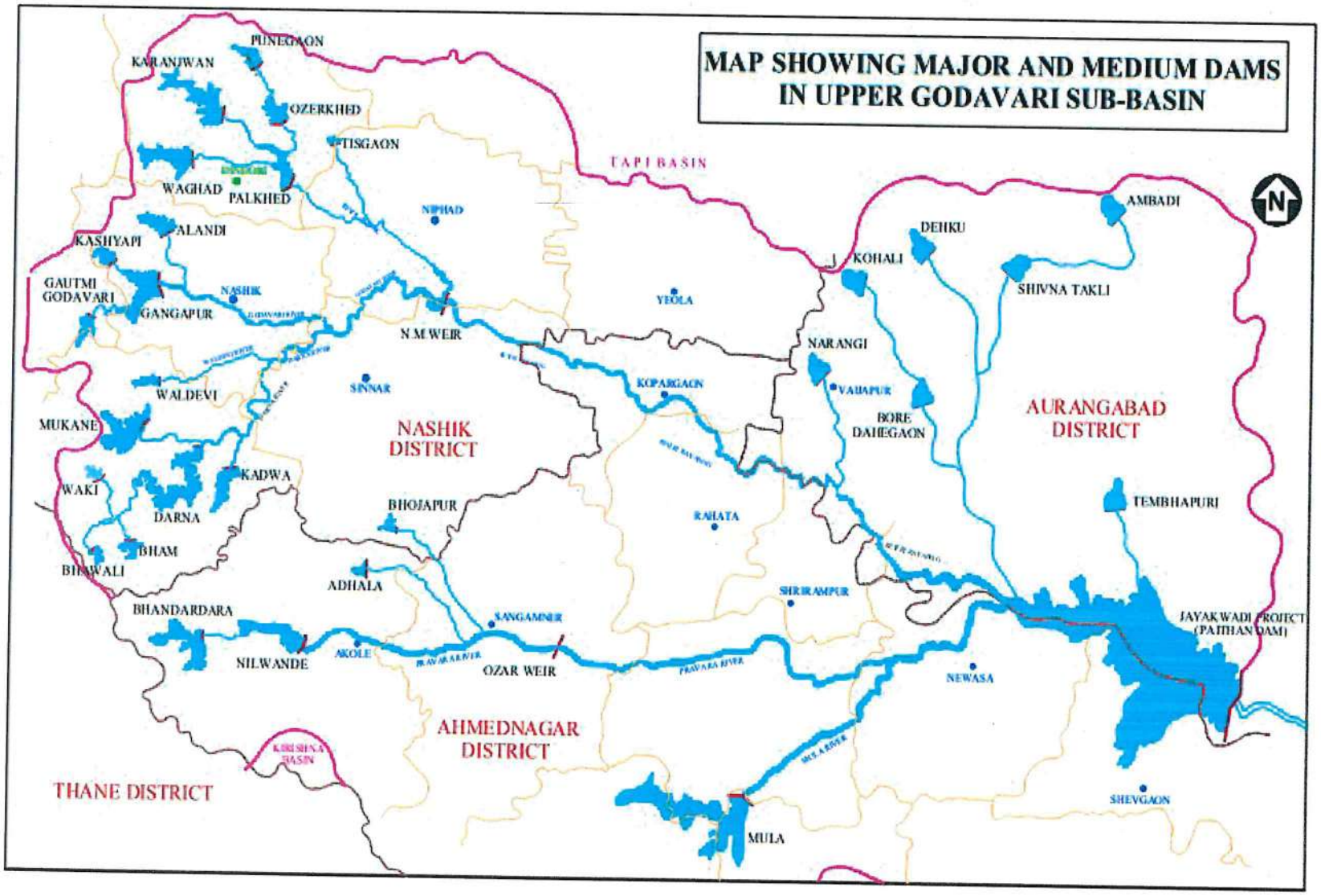
Upper Godavari
Gangapur Dam
Nanchur Madhmeshwar weir
Bhojapur Dam
Adhale Dam
Bhandardara Dam
Nilwande Dam
Mula Dam
Mandohol Dam
Ozar Weir(Pravara)
Ozarkhed
Pimpalgaon
Waghad
Tagaon
Palkhed
Ambadi
Shivana Takali
Kolhi
Deku
Narangi
Gordshegaon
Mukane
Wani
Bham
Bhojve
Tembhapuri
Ahmadnagar


MAP SHOWING MAJOR AND MEDIUM DAMS
IN UPPER GODAVARI SUB-BASIN
PUNEGAON
KARANJWAN
OZERKHED
TISGAON
WAGHAD
PALKHED
NIPHAD
TAPI BASIN
ALANDI
KASHYAPI
GAUTMI
GODAVARI
NASHIK
GANGAPUR
YEOLA
N.M.WEIR
WALDEVI
SINNAR
MUKANE
NASHIK
DISTRICT
KADWA
WAKI
DARNA
BHOJAPUR
BHAM
BHAWALI
ADHALA
BHANDARDARA
SANGAMNER
NILWANDE
AKOLE
OZAR WEIR
AHMEDNAGAR
DISTRICT
KRISHNA
BASIN
THANE DISTRICT
MULA
AMBADI
DEHKU
KOHALI
SHIVNA TAKLI
NARANGI
VAIJAPUR
BORE
DAHEGAON
KOPARGAON
RAHATA
AURANGABAD
DISTRICT
TEMBHAPURI
SHRIRAMPUR
JAYAKWADI PROJECT
(PAITHAN DAM)
NEWASA
SHEVGAON
N