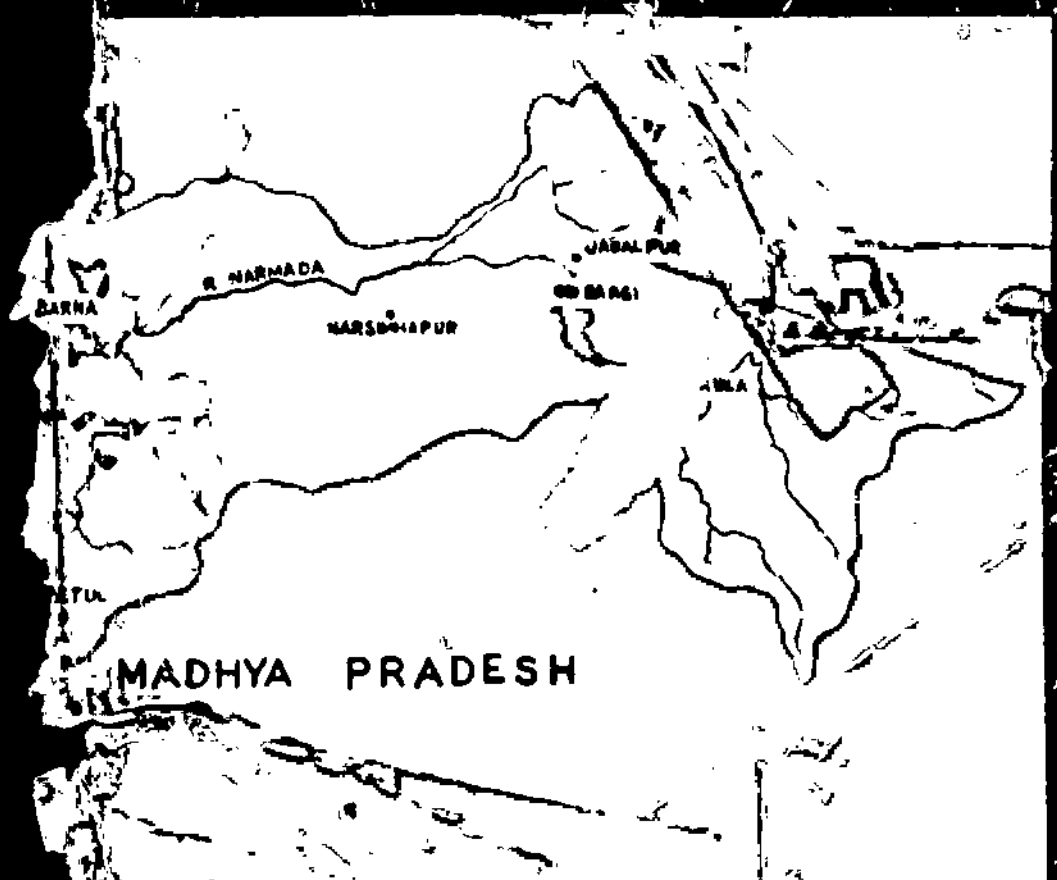
REPORT OF THE
NARMADA WATER DISPUTES TRIBUNAL

VOLUME I



GOVERNMENT OF INDIA
NARMADA WATER DISPUTES TRIBUNAL

THE REPORT OF THE NARMADA WATER DISPUTES TRIBUNAL

WITH

ITS DECISION

IN THE MATTER OF WATER DISPUTES REGARDING THE INTER-STATE RIVER NARMADA AND THE RIVER VALLEY THEREOF BETWEEN

1. *The State of Gujarat*
2. *The State of Madhya Pradesh*
3. *The State of Maharashtra*
4. *The State of Rajasthan*

VOLUME I

NEW DELHI
1979

COMPOSITION OF THE
NARMADA WATER DISPUTES TRIBUNAL

Chairman :

Shri V. Ramaswami

(Judge of the Supreme Court of India upto 29-10-1969)

Members :

Shri A. K. Sinha

(Judge of the Calcutta High Court upto 31-10-1974)

Shri M. R. A. Ansari

(Chief Justice of the J & K High Court upto 14-11-1977)

The following were also Members of the Narmada Water Disputes Tribunal for the period indicated:—

Shri G. C. Mathur

(Judge of the Allahabad High Court)
(from 6-10-69 to 2-5-70)

Shri E. Venkatesam

(Judge of the Andhra Pradesh High Court)
(from 7-5-70 to 29-10-74)

Shri V. P. Gopalan Nambiyar

(Chief Justice of the Kerala High Court)

(from 6-10-69 to 7-11-77)

GOVERNMENT OF INDIA
NARMADA WATER DISPUTES TRIBUNAL
3 MOTILAL NEHRU MARG
NEW DELHI

No. 69/1/78-NWDT *Dated August* 16, 1978.

The Secretary to the Government of India

Ministry of Agriculture and Irrigation

(Department of Irrigation)

NEW DELHI

Sir,

On the 6th October, 1969, the Government of India constituted the Narmada Water Disputes Tribunal by Notification No. S. O. 4054, dated 6th October, 1969. Vacancies in the offices of Members of the Tribunal were filled by fresh appointments made by the Government of India *vide* Notification No. S. O. 1628 dated 2nd May, 1970 issued by the Government of India, Ministry of Irrigation and Power and Notification Nos. S.O. 620 (E) dated 23rd October, 1974 and S.O. 754(E) dated 7th November, 1977 issued by the Government of India, Ministry of Agriculture and Irrigation (Department of Irrigation).

On 6th October, 1969, the Government of India, Ministry of Irrigation and Power referred to the Tribunal for adjudication of the water dispute regarding the inter-State river Narmada and the rivier valley thereof *vide* Reference No. 12/6/69-WD.

On 16th October, 1969, the Government of India, Ministry of Irrigation and Power, made another reference of certain issues raised by the State of Rajasthan under Section 5(1) of the Inter-State Water Disputes Act (Act 33) 1956 by their reference No. 10/1/69-WD.

On 24th November, 1969, Madhya Pradesh filed a demurrer before the Tribunal with regard to the action of the Government of India in issuing Notification No. S.O. 4054 dated 6th October, 1969 and making a reference of the complaints of Gujarat and Rajasthan to the Tribunal by their references No. 12/6/69-WD dated 6th October, 1969 and 10/1/69-WD dated 16th October, 1969 were *ultra vires* of the Inter-State Water Disputes Act, 1956.

In CMP No. 13 of 1971, Maharashtra prayed that certain issues should be tried as preliminary issues. In CMP No. 12 of 1971, Madhya Pradesh made a prayer of a similar character. After hearing the Counsel for all the party States, the Tribunal decided by its Order dated 26th April, 1971 that issues 1(*a*), 1(*b*), 1(A), 2, 3 and 19 should be tried as preliminary issues of law.

The Tribunal heard the arguments of all the party States and also the Attorney General on behalf of the Union of India on these preliminary issues. On 23rd February, 1972, the Tribunal delivered its judgement holding in the main that the Notification of the Central Government No. 10/1/69-WD dated 16th October, 1969 referring the matter raised by Rajasthan by its complaint was *ultra vires* of the Inter State Water Disputes Act, 1956. The Tribunal further held that the action of the Central Government constituting the Tribunal by its Notification No. S.O. 4054 dated 6th October, 1969 and making a reference of the water dispute raised by the complaint of Gujarat by Notification No. 12/6/69-WD dated 6th October, 1969 were not *ultra vires* of the 1956 Act and the Tribunal had jurisdiction to decide the dispute referred to it at the instance of Gujarat.

Against the judgment of the Tribunal on the preliminary issues dated 23rd February, 1972, Madhya Pradesh and Rajasthan appealed to the Supreme Court by special leave and also obtained a stay of the proceedings before the Tribunal to a limited extent. The Supreme Court directed that the proceedings before the Tribunal should be stayed but discovery, inspection and other miscellaneous proceedings before the Tribunal might go on. The Supreme Court also permitted the State of Rajasthan to participate in the interlocutory proceedings. The Orders of the Supreme Court granting special leave to Rajasthan and Madhya Pradesh are dated Ist May, 1972 and 6th June, 1972.

On 22nd July, 1972, there was an agreement between the Chief Ministers of Madhya Pradesh, Maharashtra, Gujarat and Rajasthan that the matters in dispute should be compromised with the assistance of the Prime Minister of India. On 31st July,1972, all the party States and the Union of India prayed for adjournment of proceedings of the Tribunal on this ground. The prayer for adjournments was granted by the Tribunal on that date and on further subsequent dates on the same ground as prayed for by the party States.

In CMP No. 8 of 1974, Gujarat stated that the Chief Ministers of Madhya Pradesh, Maharashtra and Rajasthan and the Adviser to the Governor of Gujarat had reached an agreement on a number of issues on 12th July, 1974. A copy of the Agreement is Annexure A to CMP No. 8 of 1974. Clause 1 of the Agreement stated that the water dispute referred to the Narmada Water Disputes Tribunal should be determined by the Tribunal on the basis of the Agreement reached between the States of Madhya Pradesh, Maharashtra, Gujarat and Rajasthan and the Tribunal may give appropriate necessary directions to the concerned party States.

In CMP No. 55 of 1974, Rajasthan stated that it had applied to the Supreme Court for withdrawal of Civil Appeal No. 1129 of 1972 against the judgement of the Tribunal on preliminary issues and the Supreme Court had made an Order on Ist August 1974 allowing Rajasthan to withdraw the said appeal.

In CMP No. 56 of 1974, Madhya Pradesh similarly stated that it has applied to the Supreme Court for withdrawing Civil Appeal No. 1742 against the judgement of the Tribunal on the preliminary issues and that on Ist August 1974, the Supreme Court had passed an Order permitting Madhya Pradesh to withdraw the said appeal.

After hearing the Counsel of the party States, the Tribunal gave its decision on 8th October, 1974, and recorded the compromise of the party States on various matters referred to in the Agreement of 12th July, 1974.

As we have already stated, there were two Orders of the Supreme Court dated 1st May, 1972 and 6th June, 1972 that the proceedings before the Tribunal should be stayed pending the hearing of the appeals of Rajasthan and Madhya Pradesh. These stay orders were vacated by Supreme Court on Ist August, 1974 when it permitted Madhya Pradesh and Rajasthan to withdraw their respective appeals.

Thereafter, Gujarat opened its case before the Tribunal on 12th December, 1974 and concluded its arguments on 14th August, 1975. Madhya Pradesh commenced on 14th August, 1975 and concluded on 6th October, 1976. Maharashtra opened its case on 7th October, 1976 and concluded on 23rd February, 1977. Rajasthan opened its case on 24th February, 1977 and concluded on 22nd April, 1977. Gujarat argued in reply from 23rd April, 1977 to 7th October 1977.

Madhya Pradesh commenced its arguments on the whole case on 7th October. 1977 and concluded on 21st November, 1977, Maharashtra, similarly, argued from 14th November, 1977 to 18th November 1977 and Rajasthan from 21st November, 1977 to 23rd November, 1977. Gujarat argued and replied on the whole case from 23rd November, 1977 to 15th February, 1978. As desired by Shri M. R. A. Ansari, all the party States addressed further arguments before the Tribunal in order to clarify certain points raised by him from the 13th March, 1978 to 15th March, 1978.

Accordingly this Tribunal has investigated the matters referred to it by the Central Government and prepared its Report setting out the facts found by it and giving it Decision on the matter referred to it under Section 5(2) of the Inter-State Water Disputes Act (Act 33) of 1956. In Chapters I to XIX of the Report (Volumes I and II), the Chairman of the Tribunal, Shri V. Ramaswami and Member, Shri M. R. A. Ansari have expressed their opinion on all the important issues arising in the reference. Shri A. K. Sinha, another Member of the Tribunal, has expressed on certain issues a somewhat different opinion which is reproduced in Volume IV of the Report. In accordance with the majority opinion, the Tribunal has given its Decision in Chapter XX of Volume II of the Report under Section5(2) of the Inter-State Water Disputes Act, 1956 read with Section 5(4) of the same Act.

The Report of the Tribunal in five Volumes is forwarded herewith.

Yours faithfully,

Sd/- V. RAMASWAMI
Chairman

Sd/- A. K. SINHA
Member

Sd/- M.R.A. ANSARI
Member

Enclosures :

Report (Volumes I—V)

BEFORE THE NARMADA WATER DISPUTES TRIBUNAL

I. Assessors :

1. Dr. M. R. Chopra,
   Retired Chairman, Central Water & Power Commission
   & former Vice-Chancellor of Roorkee University
   (Whole-time).

2. Shri C. S. Padmanabha Aiyar,
   Retired Chief Engineer,
   Government of Kerala (Part-time).

3. Shri Balwant Singh Nag,
   Retired Adviser, Planning Commission,
   Government of India, New Delhi (Whole-time).

4. Dr. Ambika Singh,
   Assistant Director-General,
   Indian Council of Agricultural Research (Part-time).

5. Dr. H. B. Hukkeri,
   Assistant Director-General,
   Indian Council of Agricultural Research (Part-time).

Representatives of the State Governments

II. For the State of Gujarat :

Advocates—

1. Shri J. M. Thakore, Advocate General

2. Shri S. B. Vakil, Advocate, and

3. Shri M. G. Doshit, Advocate.

The following Advocates also appeared as indicated below :—

4. Shri C. K. Daphtary, Senior Advocate, at the preliminary hearing.

5. Shri J. L. Hathi, Senior Advocate, at the preliminary hearing and in the initial stages of the main hearing.

Other Representatives—

1. Shri C. C. Patel, Chief Engineer (IP) & Special Secy.

2. Shri P. A. Raj, Special Secretary & Chief Engineer (IP)

3. Shri I. M. Shah, Superintending Engineer

4. Shri N. Ramaswamy, Superintending Engineer

5. Shri M. M. Shah, Superintending Engineer

6. Shri N. B. Desai, Superintending Engineer

7. Shri B. J. Shah, Executive Engineer

8. Shri P. W. Parwani, Executive Engineer.

III. For the State of Madhya Pradesh :

Advocates—

1. Dr. Y. S. Chitale, Senior Advocate
2. Shri M. S. Ganesh, Advocate
3. Shri Shekar Bhargava, Advocate (in the later stages of the main hearing).

The following Advocates also appeared as indicated below :—

4. Shri N. A. Palkhiwala, Senior Advocate
5. Shri K. A. Chitale, Senior Advocate
6. Shri U. N. Bachawat, Advocate
7. Shri Ram Panjwani, Senior Advocate, appeared at the initial stages of the main hearing.

Other Representatives—

1. Shri K. L. Handa, Irrigation Adviser
2. Shri R. L. Gupta, Chief Engineer (Investigation)
3. Shri V. M. Chitale, Deputy Secretary
4. Shri M. S. Billore, Superintending Engineer (Narmada)
5. Shri L. K. Wagh, Executive Engineer
6. Shri D. V. Sahasrabudhe, Executive Engineer
7. Shri S. C. Bhatnagar, Executive Engineer.

IV. For the State of Maharashtra :

Advocates—

1. Shri F. S. Nariman, Senior Advocate
2. Shri B. R. Zaiwalla, Advocate.

Other Representatives—

1. Shri K. K. Framji, Technical Consultant
2. Shri V. R. Deuskar, Secretary, Irrigation Deptt.
3. Shri S. K. Guha, Special Commissioner
4. Shri M. G. Padhye, Chief Engineer (WR) & Joint Secy.
5. Shri B. S. Kapre, Chief Engineer & Joint Secy.
6. Shri S. C. Sakhalkar, Officer On Special Duty
7. Shri N. M. Jog, Deputy Secretary & OSD
8. Shri G. E. Dadape, Under Secretary
9. Shri R. D. Saraph, Under Secretary.

The following officers also attended :—

10. Shri E. C. Saldanha, Chief Engineer & Joint Secy.
11. Shri A. K. Shenolikar, Officer On Special Duty
12. Shri M. V. Deshmukh, Under Secretary.

V. For the State of Rajasthan :

Advocates—

1. Shri K. K. Jain, Advocate
2. Shri B. D. Sharma, Advocate.

The following Advocates also appeared as indicated below :—

3. Shri A. K. Sen, Senior Advocate
4. Shri G. C. Kasliwal, Advocate-General
   (The above Counsel appeared at the preliminary hearing)
5. Dr. L. M. Singhvi, Advocate-General, appeared in the initial stages of the main hearing.

Other Representatives—

1. Shri Moti Ram, Hony. Advisier & Technical Consultant
2. Shri Manohar Lal, Chief Engineer
3. Shri D. M. Singhvi, Superintending Engineer
4. Shri C. G. Mathur, Executive Engineer.

VI. For the Union of India :

Advocates—

1. Shri Niren De, Attorney-General
2. Shri O. P. Malhotra, Senior Advocate
3. Shri Satpal, Advocate
4. Miss S. Chakravorty, Advocate
   (The above Counsel appeared at the preliminary hearing).
5. Mrs. Shyamla Pappu, Senior Advocate
6. Shri V. P. Nanda, Advocate
   (The above Counsel appeared for some miscellaneous matters).

P.148 Explanation for allotment of 18.25 MAF for M.P.
and 9 MAF for Gujarat out of 27.25 MAF
after deducting 0.5 MAF for Rajasthan
and 0.25 MAF for Maharashtra (28 − 0.5 − 0.25
= 27.25 MAF)

THE REPORT OF THE NARMADA WATER DISPUTES TRIBUNAL WITH ITS DECISION

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CHAPTER I

SECTION A

CONSTITUTION OF THE TRIBUNAL—REFERENCES OF COMPLAITS MADE BY THE CENTRAL GOVERNMENT AND LUBSEQUENT PROCEEDINGS

COMPLAINT OF GUJARAT

1.1.1 On the 6th July, 1968, the State of Gujarat made a complaint to the Government of India under Section 3 of the Inter-State Water Disputes Act (Act 33 of 1956) stating that a water dispute had arisen between the State of Gujarat and the Respondent States of Madhya Pradesh and Maharashtra over the use, distribution and control of the waters of the Inter-State River Narmada. The substance of the allegation was that executive action had been taken by Maharashtra and Madhya Pradesh which had prejudicially affected the State of Gujarat and the inhabitants of the State of Gujarat. The State of Madhya Pradesh had proposed to construct Maheshwar and Harinphal Dams over the river Narmada in its lower reach and Madhya Pradesh had also entered into an agreement with the State of Maharashtra to jointly construct the Jalsindhi dam over Narmada in its course between these two States. The State of Gujarat objected to the proposals of the States of Madhya Pradesh and Maharashtra on various grounds, the principal ground being that implementation of these projects would prejudicially affect the rights and interests of Gujarat State by compelling the Gujarat State to restrict the height of the dam it proposed to construct across the river at Navagam to FRL 210 or less. It was said that this would mean the permanent detriment of irrigation and power benefits that would be available to the inhabitants of Gujarat and this would also make it impossible for Gujarat to reclaim the desert area in the Ranns of Kutch. It was alleged that limitation of FRL would drastically reduce the irrigation potential of Navagam dam to 12 lakh acres or even less and the equitable share of Gujarat in Narmada waters would be denuded to the permanent prejudice of the rights and interests of Gujarat and its inhabitants. According to the State of Gujarat, the principal matters in disputes are—

(i) the right of the State of Gujarat to control and use the waters of the Narmada river on well-accepted principles applicable to the use of waters of inter-State rivers;

(ii) the right of the State of Gujarat to object to the arrangement between the State of Madhya Pradesh and the State of Maharashtra for the development of Jalsindhi dam;

(iii) the right of the State of Gujarat to raise the Navagam dam to an aptimum height commensurate with the efficient use of Narmada waters including its control for providing requisite cushion for flood control; and

(iv) the consequential right of submergence of area in the States of Madhya Pradesh and Maharashtra and areas in the Gujarat State.

1.1.2 *Notification by Central Government Constituting the Tribunal*

P.20

Acting under Section 4 of the Inter-State Water Disputes Act, 1956 (hereinafter referred to as the 1956 Act) the Government of India constituted this Tribunal for adjudication of the said water dispute by Notification No. S.O. 4054 dated 6th October, 1969.

1.1.3 *Reference by the Central Government dated 6th October* 1969

On the same date, the Government made a reference of the water dispute to this Tribunal by their Reference No. 12/6/69-WD which states:

> "In exercise of the powers conferred by subsection (1) of section 5 of the Inter-State Water Disputes Act, 1956 (33 of 1956), the Central Government hereby refers to the Narmada Water Disputes Tribunal for adjudication of the water dispute regarding the inter-State river, Narmada, and the river valley thereof, emerging from letter No. MIP-5565/C-10527-K dated the 6th July, 1968, from the Government of Gujarat".

1.1.4 *Reference of the Central Government dated 16th October* 1969

On 16th October 1969, the Government of India made another reference of certain issues raised by

the State of Rajasthan under Section 5(1) of the 1956 Act by Reference No. 10/1/69-WD dated the 16th October, 1969, which states:

> "WHEREAS by Notification of the Government of India in the Ministry of Irrigation & Power No. S.O. 4054 dated the 6th October, 1969, the Central Government has constituted the Narmada Water Disputes Tribunal for the adjudication of the water dispute regarding the inter-State river, Narmada, and the river valley thereof;
>
> "AND WHEREAS the water dispute regarding the inter-State river, Narmada, and the river valley thereof emerging from the Government of Gujarat's letter No. MIP-5565/C-10527-K dated the 6th July, 1968, has been referred to the said Tribunal;
>
> "AND WHEREAS certain matters connected with and relevant to the said water dispute have been raised by the Government of Rajasthan in their letter No. F. 9(1)Irrg/69 dated the 20th September, 1969;
>
> "NOW THEREFORE, in exercise of the powers conferred by sub-section (1) of Section 5 of the Inter-State Water Disputes Act 1956 (33 of 1956), the Central Government hereby refers the said matters also to the said Tribunal for adjudication".

1.1.5 *Demurrer by Madhya Pradesh*

On 24th November, 1969, the State of Madhya Pradesh filed a Demurrer before the Tribunal that the action of the Government of India in constituting the Tribunal by Notification No. S.O. 4054 dated 6th October, 1969, and in making a reference of the complaints of Gujarat and Rajasthan by their References No. 12/6/69-WD dated the 6th October 1969, and No. 10/1/69-WD dated the 16th October 1969, were *ultra vires* of the 1956 Act. The contention of Madhya Pradesh was that there was no "water dispute" within the meaning of Section 2(c) read with Section 3 of the 1956 Act and also that the Government of India had no material for forming the opinion that the water dispute could not be settled by negotiation within the meaning of Section 4 of the 1956 Act. It was alleged that Maheshwar, Harinphal and Jalsindhi projects were purely power projects and would not diminish the flow of water prejudicially affecting the interests of Gujarat or of its inhabitants. It was said that implementation of these projects would not reduce the irrigation potential to 12 lakh acres or less as alleged by Gujarat. Madhya Pradesh also objected that Gujarat had no right to construct the Navagam Dam above FRL 210. It was asserted that the claim of Gujarat to construct Navagam Dam at FRL 530 was beyond its competence as the construction of such a dam will submerge the territories of Maharashtra and Madhya Pradesh and three important projects of Madhya Pradesh at Jalsindhi, Harinphal and Maheshwar would be submerged. It was also contended that the State of Rajasthan not being a coriparian State had no legal right to set in motion the machinery of the Inter-State Water Disputes Act. It was claimed that Rajasthan not being a Basin State had no right to share the waters of the river Narmada. The problem had also not been discussed between Rajasthan and Madhya Pradesh and the conditions precedent laid down in Sections 3 and 5 of the Act have not been satisfied.

1.1.6 *Framing of Issues*

After the party States had filed their respective statements of case and their respective rejoinders to each other's statement, the Tribunal framed 24 issues in the first instance at their seventh meeting held on 28th January, 1971. The issues were amended on 26th April, 1971. The issues as finally settled were as follows:—

1. Is the action of Central Government constituting this Tribunal by the Notification No. S.O. 4054 dated 6-10-1969 or in making a reference of complaint of Gujarat by Notification No. 12/6/69--WD dated the 6-10-1969 under the Inter-State Water Disputes Act (Act No. 33 of 1956) *ultra vires* for the alleged reasons:

(a) that there was no "water dispute" within the meaning of Section 2(c) read with Section 3 of the Act and/or

(b) that the Central Government had no material for forming the opinion that the water dispute "could not be settled by negotiations" within the meaning of Section 4 of the Act.

1A. Has this Tribunal jurisdiction to entertain or decide the question as to whether the action of the Central Government in constituting this Tribunal under Notification No. S.O. 4054 dated 6-10-1969 and in referring the complaints of Gujarat and Rajasthan by Notifications No. 12/6/69-WD dated 6th October, 1969, and No. 10/1/69-WD dated 16th October, 1969, *ultra vires* of the Inter-State Water Disputes Act, 1956?

2. Is the Notification of the Central Government No. 10/1/69-WD dated 16-10-1969 in referring the

complaint of Rajasthan to this Tribunal for adjudication under Section 5 of the Act *ultra vires* for the reasons:

(a) that the complaint of Rajasthan is not a matter connected with or relevant to the water dispute between Madhya Pradesh, Maharashtra and Gujarat already referred to the Tribunal by the Central Government by its previous Notification dated 6-10-1969, and

(b) that no part of the territory of Rajasthan is located within the Narmada basin or its valley?

3. Is the State of Rajasthan not entitled to any portion of the waters of the Narmada river on the ground that the State of Rajasthan is not a coriparian State or that no portion of its territory is situated in the basin of the river Narmada?

4. Has the State of Madhya Pradesh no right to execute and complete the projects for hydroelectric development at Maheshwar I and II, Harinphal and Jalsindhi? Do any or all these projects prejudicially affect the interests of the Gujarat State or its inhabitants?

5. In Maharashtra estopped and bound by the representation of the former Bombay State in its letter dated 16-1-1959 to CWPC dropping the investigation regarding the power project at Keli Dam site?

6. Is Gujarat entitled to construct:—

(a) a high dam with FRL 530/MWL 540 or thereabouts or less FRL/MWL at Navagam across the Narmada river; and

(b) a canal with FSL 300 or thereabouts or less at its offtake adequate discharge carrying capacity from the Navagam Dam?

7. What is the utilisable quantum of waters of Narmada at Navagam dam site on the basis of 75 per cent or other dependability and how should this quantum be apportioned among the States of Gujarat, Maharashtra, Madhya Pradesh and Rajasthan?

(a) On what basis should the available waters be determined?

(b) How and on what basis should equitable apportionment of the available waters of Narmada be made between the different States? What should be the allocation of each State?

(c) Should diversion of waters outside the Narmada drainage basin be permitted? If so, to what extent and subject to what safeguards for the concerned States?

(d) Should any preference or priority be given to irrigation over production of power?

(e) Has any State any alternative means of satisfying its needs? If so, what is the effect?

(f) What are the 'existing uses' or appropriation of Narmada waters by each party State and to what extent should they be recognised and protected?

8. Is Rajasthan entitled to allocation of sufficient quantity of water to irrigate 7½ lakh acres or less of culturable command area with minimum intensity of 110 per cent or less through a direct canal from Navagam? If not, how much?

9. What directions, if any should be given for the equitable apportionment of the waters including excess waters of Narmada river and of its basin?

9A. What directions, if any are required to be given regarding the sharing of distress among the concerned States in the event of the waters of the Narmada falling short of the allocated quantum?

10. Is Gujarat entitled to any injunction restraining Madhya Pradesh from constructing the proposed dams at Jalsindhi, Harinphal and Maheshwar I and II?

11. Should a declaration be given that Maharashtra is not entitled to implement the Jalsindhi Agreement or join in the construction of the proposed dam at Jalsindhi?

12. Is Gujarat entitled to a declaration that it may use 23.49 million acre feet (inclusive of evaporation losses at Navagam Dam) or less of Narmada waters every year?

13. Should any directions be given:

(a) for releases of adequate water by Madhya Pradesh below Narmada Sagar for the setting up and operation of Navagam Dam FRL 530/MWL 540 or thereabouts or less FRL/MWL;

(b) for specification of FRL and MWL of the storage at Navagam Dam and the FSL of Navagam canal so as not to prejudicially affect the interests of Madhya Pradesh, Maharashtra or the other concerned States;

(c) for releases by the State of Madhya Pradesh below Narmada Sagar for the benefits of the States of Gujarat and Maharashtra;

(d) for the releases by the State of Madhya Pradesh below Narmada Sagar for the benefits of the State of Rajasthan.

14. What machinery, if any, should be set up to make available and regulate the allocation of waters to the States concerned or otherwise to implement the decision of the Tribunal?

15. Should the apportionment of the waters of Narmada be made amongst the concerned States so as to be binding on them for all times or whether any and if so, what period should be fixed for which such apportionment shall remain binding?

16. What directions, if any, are required to be given for timely releases of the Narmada waters from the upstream reservoirs to meet effectively the requirements at and from Navagam on the basis of the allocation of waters made by the Tribunal?

17. Whether the costs and benefits of the Navagam project of Gujarat are required to be shared amongst the concerned States. If so, in what manner and on what terms and conditions? If not, whether Gujarat is liable to pay any, and if so, what compensation to Maharashtra and/or Madhya Pradesh for loss of power?

18. Whether the Navagam project is liable to pay any compensation to any upstream project or projects in consideration of receiving regulated releases of the Narmada waters therefrom? If so, how much and on what terms and conditions?

19(i) Whether the proposed execution of the Navagam project with FRL 530 or thereabouts or less involving consequent submergence of a portion of the territories of Maharashtra and/or Madhya Pradesh can form the subject mater of a "water dispute" within the meaning of Section 2(c) of the Inter-State Water Disputes Act (Act 33 of 1956).

19(ii) If the answer to 19(i) is in the affirmative, whether the Tribunal has jurisdiction:

(a) to give appropriate direction to Madhya Pradesh and/or Maharashtra to take steps by way of acquisition or otherwise for making the submerged land available to Gujarat in order to enable it to execute the Navagam project with FRL 530 or thereabouts or less;

(b) to give consequent directions to Gujarat on other party State regarding payment of compensation to Maharashtra and/or Madhya Pradesh and/or share in the beneficial uses of Navagam Dam; and

(c) for rehabilitation of displaced persons.

20. Whether Gujarat is entitled to the declarations and injunctions sought in sub-paragraphs (xi), (xii), (xiii), (xiv), (xv) and (xvi) of paragraph 87.1 of its Statement of the Case?

21. To what reliefs and directions, if any, are the parties entitled?

22. How are the costs of the present proceedings and costs incidental thereto to be apportioned among the party States?

SECTION B

TRIAL OF PRELIMINARY ISSUES AND JUDGEMENT OF THE TRIBUNAL DATED 23RD FEBRUARY 1972

Trial of Preliminary Issues of Law

1.2.1 In CMP 13 of 1971, Maharashtra prayed that out of the issues settled by the Tribunal, the following issues should be tried as preliminary issues:—

"1. Is the action of Central Government constituting this Tribunal by the Notification No. S.O. 4054 dated 6-10-1969 or in making a reference of complaint of Gujarat by Reference No. 12/6/69-WD dated 6-10-1969 under the Inter-State Water Disputes Act (Act No. 33 of 1956) *ultra vires* for the alleged reasons:

(a) that there was no "water dispute" within the meaning of Section 2(c) read with Section 3 of the Act and/or

(b) that the Central Government had no material for forming the opinion that the water dispute "could not be settled by negotiations" within the meaning of Section 4 of the Act.

"1A. Has this Tribunal jurisdiction to entertain or decide the question as to whether the action of the Central Government in constituting this Tribunal under Notification No. S.O. 4054 daed 6-10-1969 and in referring the complaints of Gujarat and Rajasthan by References No. 12/6/69-WD dated 6th October, 1969 and No.10/1/69-WD dated the 16th October, 1969 *ultra vires* of the Inter-State Water Disputes Act, 1956?

"2. Is the Reference of the Central Government No. 10/1/69-WD dated 16-10-1969 in referring the complaint of Rajasthan to this Tribunal for adjudication under Section 5 of the Act *ultra vires* for the reasons:

(a) that the complaint of Rajasthan is not a matter connected with or relevant to the water dispute between Madhya Pradesh, Maharashtra and Gujarat already referred to the Tribunal by the Central Government by its previous Reference dated 6-10-1969; and

(b) that no part of the territory of Rajasthan is located within the Narmada basin or its valley?

"3. Is the State of Rajasthan not entitled to any portion of the waters of the Narmada basin on the ground that the State of Rajasthan is not a co-riparian State or that no portion of its territory is situated in the basin of the river Narmada?

"19(i) Whether the proposed execution of the Navagam project with FRL 530 or thereabouts or less involving consequent submergence of a portion of the territories of Maharashtra and/or Madhya Pradesh can form the subject matter of a "water dispute" within the meaning of Section 2(c) of the Inter-State Water Disputes Act (Act No. 33 of 1956).

"19(ii) If the answer to 19(i) is in the affirmative, whether the Tribunal has jurisdiction

(a) to give appropriate directions to Madhya Pradesh and/or Maharashtra to take steps by way of acquisition or otherwise for making the submerged land available to Gujarat in order to enable it to execute the Navagam project with FRL 530 or thereabouts or less;

(b) to give consequent directions to Gujarat or other party States regarding payment of compensation to Maharashtra and/or Madhya Pradesh and/or giving them a share in the beneficial uses of Navagam dam; and

(c) for rehabilitation of displaced persons.

It was contended by Maharashtra that these issues were issues of pure law and an answer in the affirmative would preclude any further enquiry or

investigation in respect of the complaint of Gujarat or the complaint of Rajasthan. It was stated that under Order 14, Rule 2 Civil Procedure Code read with Section 141 of Civil Procedure Code, the Tribunal was competent to try the issues as preliminary issues of law and give its decision thereon.

In CMP 12 of 1971, Madhya Pradesh also made a prayer of similar character. Madhya Pradesh stated that in addition to the issues contained in CMP 13 of 1971, the following issues should also be tried as preliminary issues:—

> "1. Is the action of Central Government constituting this Tribunal by the Notification No. S.O. 4054 dated 6-10-1969 or in making a reference of the complaint of Gujarat by the Notification No. 12/6/69-WD dated 6-10-1969 under the Inter-State Water Disputes Act (Act No. 33 of 1956) *ultra vires* for the alleged reasons:
>
> (a) that there was no "water dispute" within the meaning of Section 2(c) read with Section 3 of the Act and/or.
>
> (b) that the Central Government had no material for forming the opinion that the water dispute "could not be settled by negotiations" within the meaning of Section 4 of the Act.
>
> "4. Has the State of Madhya Pradesh no right to execute and complete the projects for hydroelectric development at Maheshwar I and II, Harinphal and Jalsindhi? Do any or all these projects prejudicially affect the interests of the Gujarat State or its inhabitants?"

In the course of argument, Madhya Pradesh, however, conceded that issue No. 4 may not be tried as preliminary issue.

1.2.2 After hearing the Counsel for all the party States, the Tribunal decided by its order dated 26th April, 1971, that issues 1(a), 1(b), 1(A), 2, 3 and 19 should be tried as preliminary issues of law. In reaching this decision, the Tribunal applied the principle of Order 14, rule 2 of the Civil Procedure Code and of the decision of the Bombay High Court in J. Sowkabai Pandharinath v. Tukojirao Holkar A.I.R. 1932 Bombay 128.

Judgement of the Tribunal on the Preliminary Issues

1.2.3 The Tribunal heard elaborate arguments from learned Counsel of the party States and the Attorney General on behalf of the Union of India on these preliminary issues. On 23rd February, 1972, the Tribunal delivered its judgement. The judgement of the Tribunal is reproduced in Volume III of this Report.

The Tribunal held in the first place that the Notification of Central Government No. 10/1/69-WD dated 16th October, 1969, referring the matters raised by Rajasthan by its complaint was *ultra vires* of the 1956 Act. The Tribunal further held that the action of the Central Government constituting the Tribunal by its Notification No. S.O. 4054 dated 6th October, 1969, and making a reference of the water dispute regarding the Inter-State river Narmada and the river valley thereof emerging from the complaint of Gujarat by Notification No. 12/1/69-WD dated 6th October, 1969, was not *ultra vires* of the Act and the Tribunal had jurisdiction to decide the dispute referred to it at the instance of Gujarat. With regard to the issues 19(i) and 19(ii), the Tribunal further held that the proposed construction of the Navagam project involving consequent submergence of portions of the territories of Maharashtra and Madhya Pradesh can form the subject matter of a "water dispute" within the meaning of Section 2(c) of the 1956 Act. The Tribunal also found that it had jurisdiction to give appropriate direction to Madhya Pradesh and Maharashtra to take steps by way of acquisition or otherwise for making submerged land available to Gujarat in order to enable it to execute the Navagam Project and to give consequent directions to Gujarat and other party States regarding payment of compensation to Maharashtra and Madhya Pradesh, for giving them a share in the beneficial use of Navagam dam, and for rehabilitation of displaced persons.

Appeal to the Supreme Court by Madhya Pradesh & Rajasthan against the order of the Tribunal on Preliminary Issues by Special Leave

1.2.4 Against the judgement of the Tribunal on the preliminary issues dated 23rd February, 1972, Madhya Pradesh and Rapasthan preferred appeals to the Supreme Court by special leave and also obtained a stay of the proceedings before this Tribunal to a limited extent. The Supreme Court directed that the proceedings before the Tribunal should be stayed but discovery, inspection and other miscellaneous proceedings before the Tribunal may go on. The Supreme Court also permitted the State of Rajasthan to participate in these

interlocutory proceedings. The Orders of Supreme Court granting special leave to Rajasthan and Madhya Pradesh are dated 1st May, 1972, and 6th June, 1972.

Agreement of Chief Ministers of Madhya Pradesh, Maharashtra, Gujarat and Rajasthan dated 22nd July, 1972

1.2.5 On 31st July, 1972, while the Tribunal was in session engaged in the work of discovery and inspection of documents, it was represented to us by the Counsel of all the party States and the Union of India that the Chief Ministers of Madhya Pradesh, Maharashtra, Gujarat and Rajasthan had entered into an agreement to compromise the matters in dispute with the assistance of the Prime Minister of India. The party States and the Union of India, therefore, prayed for adjournment of proceedings of the Tribunal on that date and on further subsequent dates on the same ground. The prayer for adjournment was granted by the Tribunal on the relevant dates.

SECTION C

AGREEMENT OF PARTY STATES DATED 12-7-74 AND SUBSEQUENT PROCEEDINGS

Agreement of the Chief Ministers of Madhya Pradesh, Maharashtra & Rajasthan and the Advisor to the Governor of Gujarat dated 12th July, 1974

1.3.1 In CMP 8 of 1974, Gujarat stated that the Chief Ministers of Madhya Pradesh, Maharashtra and Rajasthan and the Advisor to the Governor of Gujarat had arrived at an agreement on a number of issues on 12th July, 1974. A copy of the Agreement (Annexure A to the application) is reproduced below:—

"IT IS AGREED:

(1) that the water dispute referred to the Narmada Water Disputes Tribunal be determined by the Tribunal on the basis of this agreement between the States of Madhya Pradesh, Maharashtra, Gujarat and Rajasthan (hereinafter referred to as 'Madhya Pradesh', 'Maharashtra', 'Gujarat' and 'Rajasthan' respectively);

(2) that development of Narmada should no longer be delayed in the best regional and national interests;

(3) that the quantity of water in Narmada available for 75 per cent of the year be assessed at 28 million acre feet and that the Tribunal in determining the disputes referred to it do proceed on the basis of that assessment;

(4) that the requirements of Maharashtra and Rajasthan for use in their territories are 0.25 and 0.5 million acre feet respectively and that the Tribunal in determining the disputes referred to it do proceed on the basis that the requirements of Maharashtra for use in its territories are 0.25 million acre feet and that Rajasthan will get for use in its territories 0.5 million acre feet without prejudice to the height of the canal;

(5) that the net available quantity of water for use in Madhya Pradesh and Gujarat is 27.25 million acre feet and that the Tribunal in determining the disputes referred to it do proceed on the basis that the net available quantity of water for use in Madhya Pradesh and Gujarat is 27.25 million acre feet;

(6) that the Tribunal do allocate this balance of water, namely, 27.25 million acre feet, between Madhya Pradesh and Gujarat after taking into consideration various contentions and submissions of the parties hereto;

(7) that the height of Navagam Dam be fixed by the Tribunal after taking into consideration various contentions and submissions of the parties hereto;

(8) that the level of the canal be fixed by the Tribunal after taking into consideration various contentions and submissions of the parties hereto;

(9) that in the light of this agreement, issues 4, 5, 7, 7(a), 7(c), 7(d), 7(e), 7(f), 8, 10, 11, 12 and 20 framed by the Tribunal on the 28th January, 1971, may be deleted and that issues 6, 7(b), 13 and 17 may be suitably modified as in the annexure to this agreement. All other issues may be determined by the Tribunal after taking into consideration the various contentions and submissions of the parties hereto;

(10) that for the limited purpose of effectuating the terms of this agreement, Madhya Pradesh do withdraw the proceedings filed by it before the Hon'ble Supreme Court and arising out of the decision of the Tribunal dated 23rd February, 1972, on the preliminary issues of law;

(11) that for the limited purpose of effectuating the terms of this agreement, Rajasthan do withdraw the proceedings filed by it before the Hon'ble Supreme Court and arising out of the decision of the Tribunal dated 23rd February, 1972 on the preliminary issues of law; and

(12) that Rajasthan shall be a party to the further proceedings before the Tribunal, without prejudice to the legal position regarding the rights of a non-riparian State."

1.3.2 In CMP 8 of 1974, Gujarat had made a prayer that the Tribunal may be pleased to determine the dispute on the basis of this agreement and give appropriate direction to Madhya Pradesh, Maharashtra, Gujarat and Rajasthan, so as to enable it to determine the disputes referred to it on that basis.

1.3.3 In CMP 23 of 1974, Rajasthan had also annexed a copy of the agreement dated 12th July, 1974, and had made prayers to a similar effect.

1.3.4 In CMPs 27 and 47 of 1974, Maharashtra and Madhya Pradesh had also annexed copies of the agreement dated 12th July, 1974 and had made prayers to the Tribunal to an identical effect.

1.3.5 On 1st August, 1974, a joint petition by the four Counsel appearing for Madhya Pradesh and the other three party States was filed before the Tribunal saying that the party States have arrived at an agreement dated 12th July, 1974, signed by the Chief Ministers of Madhya Pradesh, Maharashtra, Rajasthan and the Advisor to the Governor of Gujarat and praying that the Tribunal may determine the disputes on the basis of that agreement and give appropriate and necessary directions to the concerned party States (*vide* CMP 57 of 1974).

Withdrawal of Appeal to the Supreme Court by Madhya Pradesh & Rajasthan

1.3.6 In CMP 55 of 1974, Rajasthan had stated that it has applied to the Supreme Court for withdrawal of Civil Appeal No. 1129 of 1972 against the judgement of the Tribunal on the preliminary issues and the Supreme Court had made an order allowing Rajasthan to withdraw the said appeal.

1.3.7 In CMP 56 of 1974, Madhya Pradesh similarly stated that it had applied to the Supreme Court for withdrawing Civil Appeal No. 1742 of 1972 against the judgement of the Tribunal on the preliminary issues and that on 1st August, 1974, the Supreme Court has passed orders permitting Madhya Pradesh to withdraw the said appeal.

1.3.8 The orders of the Supreme Court permitting Rajasthan and Madhya Pradesh to withdraw their respective appeals are dated 1st August, 1974. The result is that the decision of the Tribunal on the preliminary issues dated 23-2-1972 has become final.

Order and Decision of the Tribunal dated 8th October 1974

1.3.9 After hearing the Counsel of the various States, the Tribunal gave its decision on 8th October, 1974, with regard to CMP 8 of 1974 and other connected CMPs concerning the agreement of the Chief Ministers of Madhya Pradesh, Maharashtra and Rajasthan and the Advisor to the Governor of Gujarat dated 12th July, 1974.

The decision and order of the Tribunal is reproduced in Volume III of this Report.

1.3.10 In the first instance, the Tribunal dealt with paragraphs 3, 4 and 12 of the agreement of the 12th July, 1974, wherein the party States have reached a compromise on certain matters of dispute.

Issue No. 7 with regard to Utilisable Quantum of Waters of Narmada at Navagram Dam Site on the basis of 75 per cent Dependability

1.3.11 There has been a serious controversy between the party States as to what is the utilisable quantum of waters in Narmada at Navagam Dam Site on the basis of 75 per cent dependability. This was made the subject matter of Issue No. 7 before the Tribunal. The parties have now agreed that the net available quantum of Narmada waters for use with 75 per cent dependability should be assessed at 28 million acre feet. It is true that the Inter-State Water Disputes Act does not contain any provision specifically authorising the Tribunal to record a compromise or to make an award in terms thereof corresponding to the provisions of Order 23, rule 3 of Civil Procedure Code, but the Tribunal took the view that nothing in the Act precludes it from accepting the agreement of the parties on any particular issues and giving a decision in terms of that agreement and from incorporating it in the report of the Tribunal forwarded to the Central Government under Section 5(2) of the 1956 Act. In expressing this view, the Tribunal relied upon the principle of the decision of the Supreme Court in the State of Bihar v. D. N. Ganguly & Others 1959 SCR 1191 at 1202 and 1203. The Tribunal accordingly accepted the agreement between the party States on Issue No. 7 and gave its decision that the utilisable quantum of waters in Narmada at Navagam Dam Site on the basis of 75 per cent dependability should be assessed at 28 million acre feet.

What are the Shares of Narmada Waters to which Rajasthan & Maharashtra are entitled?

1.3.12 In paragraph 4 of the agreement, the party States say that the requirements of Maharashtra and Rajasthan are 0.25 MAF and 0.5 MAF respectively and the Tribunal in determining the disputes referred to it may proceed on the basis that Maharashtra may be allotted 0.25 MAF and Rajasthan may be allotted 0.5 MAF for use in their respective territories without prejudice to the level of the Navagam Canal. As regards the allotment of share to Rajasthan, there has been a serious dispute between the party States and the Central Government had to make a reference of the dispute to the Tribunal under Section 5(1) of the 1956 Act *vide* Reference No. 10/1/69-WD dated 16th October, 1969. The case of Madhya Pradesh and Maharashtra was that Rajasthan had no right to a share of Narmada waters as it was a non-riparian State. In its preliminary decision given by the Tribunal on 23rd February, 1972, it was held by it as a matter of law that Rajasthan being a non-riparian State was not entitled to a share of the waters of the inter-State river Narmada. Against the decision of the Tribunal, Rajasthan had taken an appeal to the Supreme Court. This appeal has since been withdrawn by Rajasthan. The result is that the decision of the Tribunal dated 23rd February, 1972, has become final. But the legal position has changed as a result of the subsequent agreement between the party States dated 12th July, 1974. As a result of this agreement. Rajasthan has now become entitled to a share of the Narmada waters to the extent of 0.5 MAF. The right of Rajasthan to a share of the Narmada waters is at present based on the agreement between the party States and not on the general law as set out in the decision of the Tribunal dated 23rd February, 1972. As the Indus Commission has pointed out in its report, the most satisfactory settlement of dispute of waters of inter-State rivers is by agreement and once there is such an agreement, that itself furnishes the law governing the rights of the several party States until a new agreement is concluded *vide* page 10 paragraph 14 of the Indus Commission Report, Volume I. The same principle is enunciated in the judgement of the International Court of Justice, 1937, in the Meuse Dispute between Holland and Belgium (Diversion of water from the Meuse—P.C.I.J. Series A/B No. 70, 1937).

1.3.13 In the setting and background of this principle, the Tribunal accepted the agreement of the party States with regard to allotment of share to Rajasthan and gave its decision that Rajasthan is entitled to a share of 0.5 MAF of Narmada waters on the basis of the agreement of the party States dated 12th July, 1974. In other words, that was the decision of the Tribunal on Issue No. 8 and Issue No. 7 so far as it concerns Rajasthan.

1.3.14 As regards Maharashtra also, the Tribunal accepted the agreement and gave its decision that Maharashtra was entitled to 0.25 MAF as its rightful share of the utilisable quantum of Narmada waters. In other words, that was the decision of the Tribunal on Issue No. 7 so far as it concerns Maharashtra.

1.3.15 In clause 12 of the agreement, the party States have agreed that Rajasthan shall be a party to the further proceedings before the Tribunal without prejudice to the legal position regarding the rights of a non-riparian State. The Tribunal accepted this clause of the agreement also and gave a decision that Rajasthan shall be a party to the further proceedings before the Tribunal in terms of the agreement

Direction on Modification of Issues No. 6, 7(b), 13 and 17

1.3.16 In clause 9 of the agreement, the party States prayed that issues Nos. 6 7(b), 13 and 17 may be suitably modified as follows:

Issue No.

6. What should be the height of the dam at Navagam across the Narmada water and what should be the level of the canal at its offtake with adequate discharge carrying capacity from the Navagam dam?

7(b) How and on what basis should equitable apportionment of the 27.25 MAF of water be made between the States of Madhya Pradesh and Gujarat? What should be the allocation to either State?

13. Should any directions be given:

(a) for releases of adequate water by Madhya Pradesh below Narmada Sagar for the setting up and operation of Navagam Dam;

(b) for specification of FRL and MWL of the storage at Navagam Dam and the FSL of Navagam Canal so as not to prejudically affect the interests of Madhya Pradesh, Maharashtra or the other concerned States;

(c) for releases by the State of Madhya Pradesh below Narmada Sagar for the benefits of the States of Gujarat and Maharashtra;

(d) for the releases by the State of Madhya Pradesh below Narmada Sagar for the benefits of the State of Rajasthan.

17. Whether the costs and benefits of the Navagam Project of Gujarat are required to be shared amongst the concerned States. If so, in what manner and on what terms and conditions? If not, whether Gujarat is liable to pay any, and if so, what compensation to Maharashtra and/or Madhya Pradesh for loss of power? Whether Maharashtra and/or Madhya Pradesh are entitled to any share of power because of their proposed projects, namely, Jalsindhi, Harinphal and Maheshwar.

After hearing the Counsel of the party States, the Tribunal allowed their unanimous request and directed that issues 6, 7(b), 13 and 17 may be modified as prayed for.

Clause 9 of the agreement with regard to the Deletion of Issues No. 4, 5, 7, 7(a), 7(c), 7(d), 7(e), 7(f), 8, 10, 11, 12 and 20

1.3.17 As regards issues 4 and 5, it was stated by the Counsel for Gujarat and Madhya Pradesh that though they have applied for the deletion of these issues, the intention of the agreement was that it would be open to party States to argue the subject matter covered by these issues when issue 6 was taken up for consideration. In other words, the contention of the party States was that the deletion of the issues does not mean that these issues are given up but they will be argued under another head, namely, issue 6. The Tribunal accepted the prayer of the party States and directed that issues 4 and 5 may be deleted subject to the reservation that it would be open to the party States to argue the subject matter covered by these under modified issue 6.

Issues 7(c), 7(d), 7(e) and 7(f)

1.3.18 It was pointed out by the Tribunal to the learned Counsel for the party States during argument that it was essential that the matters covered by issues 7(c), 7(d), 7(e) and 7(f) should, as a matter of law, be taken into account in determining the equitable apportionment of the available waters of Narmada between different States under the modified issue 7(b). In this context, the Tribunal referred to Article V of the Helsinki Rules setting out the relevant factors which are to be considered while determining the reasonable equitable share of each basin State in the beneficial use of the waters of an inter-State river. The learned Counsel for all the party States agreed with this legal proposition and prayed that these issues may be deleted as prayed for but it should be made clear in our order that it would be open to the party States to argue the subject matter covered by issues 7(c), 7(d), 7(e) and 7(f) while dealing with issue 7(b). The submission of all the four party States was that deletion of issues 7(c), 7(d), 7(e) and 7(f) did not mean that these issues are given up but the deletion was only made for compression of the language and for bringing about a numerical reduction of issues. The Tribunal accepted the prayer of the party States and ordered that issues 7(c), 7(d), 7(e) and 7(f) may be deleted but subject to the qualification that it will be open to the party States to argue the subject matter covered by the issues 7(c), 7(d), 7(e) and 7(f) while arguing issue 7(b).

Issues No. 7 and 7(a)

1.3.19 With regard to these issues, the Tribunal directed that they may be deleted as prayed for by the party States. The Tribunal observed that with regard to this issue, it has already given its decision that the utilisable quantum of Narmada waters at Navagam Dam Site with 75 per cent dependability was 28 MAF on the basis of the agreement of the parties. So far as the allocation of this quantity of water among the party States is concerned, the Tribunal has already given its decision that Rajasthan is entitled to 0.5 million acre feet and Maharashtra is entitled to 0.25 million acre feet as their rightful shares in view of the agreement between the party States dated 12th July, 1974.

Issue No. 8

1.3.20 The Tribunal directed that this issue may be deleted as prayed for. The Tribunal has already given its decision that Rajasthan was entitled to 0.5 MAF of the utilisable quantum of Narmada waters at 75 per cent dependability as stipulated in clause 4 of the agreement.

1.3.21 A question was raised during the hearing of the case whether this Tribunal could give a decision on the subject of an issue which the parties have applied for deletion in these CMPs. The Tribunal expressed its opinion that it was empowered under Section 5(2) of the 1956 Act to adjudicate and give a decision or finding on any matters referred to it irrespective of the presence or absence of a formal issue in that matter and incorporate its decision or finding in its report to the Central Gov-

ernment under Section 5(2) of the 1956 Act. The learned Counsel for Madhya Pradesh, Gujarat, Maharashtra and Rajasthan have all agreed that this view represents the correct position in law.

Issues Nos. 10, 11, 12 *and* 20

1.3.22 Gujarat prayed that these issue may be deleted but submitted that it should be made clear that it would be open to Gujarat to argue the subject matter of all these issues under issues 6, 7(b) and 21. Madhya Pradesh, Maharashtra and Rajasthan also said that these issues may be deleted but it should be open to them also to argue these issues under any other issue. The Tribunal accepted the prayer of the party States and ordered that issues 10, 11, 12 and 20 may be deleted subject to the qualification that it would be open to Gujarat, Madhya Pradesh, Maharashtra and Rajasthan to argue the subject matter of these issues under issues 6, 7(b) 21 or any other issue.

Exhibits and Documents

1.4.1 The party States filed numerous exhibits. On behalf of Gujarat, there were 128 exhibited documents including studies, plans, project reports etc. For Madhya Pradesh, there was 1198 exhibited documents and for Maharashtra and Rajasthan, there were 156 and 308 exhibited documents. In addition, Gujarat filed 53 statements during the course of argument. Madhya Pradesh similarly filed 141 statements and Maharashtra filed 16 statements. Gujarat put in 649 CMPs. Madhya Pradesh 737 CMPs. Maharashtra 229 CMPs and Rajasthan 192 CMPs. All the party States also filed written submission in support of their respective stand points. Gujarat filed 104 volumes, Madhya Pradesh 48 volumes, Maharashtra 64 volumes and Rajasthan 25 volumes (total number of pages in 241 volumes is 16,301).

The respective States also carried out special investigations and surveys whenever the Tribunal considered it necessary for a proper decision of any issue arising in the case.

Tours

1.4.2 The Tribunal inspected the proposed dam sites on the river Narmada in Madhya Pradesh and Gujarat. The Tribunal also visited the command areas and submergence areas of the various irrigation projects. The Tribunal toured various other places in Madhya Pradesh, Gujarat, Rajasthan and Maharashtra to study the local conditions and needs. Particulars of these tours are given in Annexure 1.1 of the Report.

Assessors

1.4.3 The following Assessors were appointed under Section 4(3) of the Inter-State Water Disputes Act (Act 33) 1956 to advise the Tribunal in the proceedings:—

Name	Date of appointment
(1) Dr. M.R. Chopra, Retired Chairman, Central Water & Power Commission & formerly Vice Chancellor. Rorkee University (whole-time)	19-2-1972
(2) Shri C.S. Padmanabha Aiyar, Retired Chief Engineer, Government of Kerala (part-time)	1-4-1972
(3) Dr. Ambika Singh, Assistant Director General, Indian Council of Agricultural Research (part-time)	28-10-1974
(4) Dr. S.B. Hukkeri, Senior Agronomist, Indian Institute of Agricultural Research (part-time)	9-8-1976
(5) Shri B. S. Nag, Retired Adviser, (Irrigation & Power) Planning Commission (whole-time)	25-10-1976

Order of stay of the Supreme Court of further proceedings between 1-5-1972 *and* 1-8-1974

1.5.0 As we have already stated in paragraph 1.2.4, there were two orders of the Supreme Court dated 1-5-1972 and 6-6-1972 that the proceedings before the Tribunal should be stayed pending the hearing of appeals of Rajasthan and Madhya Pradesh filed before that Court. The stay orders were vacated by the Supreme Court on 1-8-1974 when it permitted Madhya Pradesh and Rajasthan to withdraw their respective appeals.

During this period, all the four party States had also from time to time applied for adjournment of the hearings before the Tribunal on the ground that they had entered into an agreement to compromise the matters in dispute with the assistance of the Prime Minister of India (*See paragraph* 1.2.5).

Hearing of Agreements

1.5.1. (a) *Opening of Case*:

Gujarat opened its case on 12th December, 1974, and concluded on 14th August, 1976. Madhya Pradesh commenced its opening on 14th August, 1975, and concluded on 6th October, 1976. Maharashtra opened on 7th October, 1976, and concluded on 23rd February, 1977. Rajasthan opened its case on 24th February, 1977 and concluded on 22nd April, 1977.

Gujarat argued in reply from 23rd April, 1977 to 7th October, 1977.

(b) *Evidence*:

Gujarat, Madhya Pradesh, Maharashtra and Rajasthan have all stated that they would not offer any oral evidence in this case.

(c) *Arguments on the Whole Case*:

Madhya Pradesh commenced arguments on the whole case on 7-10-77 and concluded on 21-11-77. Maharashtra commenced arguments on the whole case on 14-11-77 and concluded on 18-11-77. Rajasthan argued upon the whole case on 21-11-77 and concluded on 23-11-77. Gujarat commenced its reply to the arguments on the whole case from 23-11-77 and concluded on 15-2-1978.

ANNEXURE I.I

Particulars of visits by the Narmada Water Disputes Tribunal to Various Areas and Sites in the States of Gujarat, Madhya Pradesh, Maharashtra and Rajasthan

		Distance Travelled (By Road) km	
October, 1975			
20th	Indore to Ujjain	72	Assembled at Indore and proceeded to Ujjain.
21st	Ujjain to Mandu	215	General inspection of areas in Narmada Valley
22nd	Mandu to Maheshwar	250	Visit to some farms en route.
			Inspection of some of the areas of Barwani liable for submergence by the proposed high Sardar Sarovar Dam.
			Inspection of areas proposed to be commanded by Omkareshwar Project and Narmadasagar Project.
23rd	Maheshwar to Khandwa	218	Inspection of ghats and temples likely to be affected by the proposed Sardar Sarovar reservoir.
			Inspection of Maheshwar dam site.
			En route inspection of Omkareshwar dam site and Narmadasagar dam site, visit to Indore Water Supply Scheme and visit to some farms.
24th	Khandwa to Hoshangabad	164	En route inspection of areas coming under submergence of Narmadasagar Project and inspection of land consolidation work in Sawalkheda Farm.
25th	Local visits at Hoshangabad	138	Inspection of flood protection works of Hoshangabad town. Visit to Government Farms at Powerkheda and Raisalpur and some other farms.
			Inspection of Tawa Project works.
26th	Hoshangabad to Bhopal	160	En route inspection of Barna Project works.
27th ;	Bhopal to Itarsi	90	Journey.
	Itarsi to Pipariya		Journey by train.
	Local visits at Pipariya	16	Visit to Farms at Silari and Khaparkheda.
	Pipariya to Pachmarhi	60	Halt overnight.
28th	Pachmarhi to Pipariya	60	Journey.
	Pipariya to Jabalpur		Journey by train.
	Local visits at Jabalpur	40	Visit to Government Farm at Khamaria and some other farms.
29th	Local visits at Jabalpur	94	Inspection of Bargi Project works.
			Visit to Jawaharlal Nehru University farms.
30th	Local visit at Jabalpur	40	Inspection of Narmada river at Bhedaghat.
31st	Jabalpur to Amarkantak	380	En route inspection of the procedure for observing the gauge and discharge at Jamtara Gauging Station and visit to some farms.
November, 1975			
1st	Amarkantak to Rewa	321	Visit to Narmada Mandir at Amarkantak, the traditional source of the river Narmada.
			En route inspection of areas proposed to be commanded by diverting waters from the Bargi dam to the neighbouring valley.

		Distance Travelled (By Road) km	
November, 1975			
2nd	Rewa to Khajuraho	170	En route inspection of areas proposed to be commanded by diverting waters from the Bargi dam to the neighbouring valley.
	Khajuraho to Delhi		
			Assembled at Baroda.
6th	Baroda to Kevadia	98	En route visit to relief model of Gujarat at Baroda Irrigation Circle and visit to some farms.
7th	Local visits at Kevadia	55	Visit to dam sites No. 1 & 3, canal power house site and sites for other appurtenant works etc. of the proposed Sardar Sarovar Project. Visit to Laboratory, Museum and the record room.
			Inspection of River Gauging site at Garudeshwar.
8th	Kevadia to Baroda	180	En route inspection of flood damages in the road length between Ankleshwar and Broach and in areas near about Broach.
			Visit to some farms.
9th	Baroda to Ahmedabad	272	En route visit to Amul Dairy at Anand, Government Farm at Thasra and some other farms.
			Inspection of Irrigation both flow and lift from Mahi Right Bank Canal and visit to Wanakbori weir.
	Ahmedabad to Bhachau		Night journey by train.
10th	Bhachau to Bhuj	80	Journey.
	Bhuj to Khavda and back	153	En route inspection of reclamation experiments at Pilot Plot between Bhuj and Khavda.
	Bhuj to Jamnagar		Journey by air.
	Jamnagar to Mithapur	159	Journey.
11th	Local visits at Mithapur	103	Visit to Mithapur Industrial Complex.
	Mithapur to Porbandar	147	Inspection of agricultural development in Saurashtra.
12th	Porbandar to Veraval	261	Inspection of agricultural development in Saurashtra.
13th	Veraval to Rajkot	214	Journey.
14th	Rajkot to Ahmedabad	235	En route inspection of areas proposed to be benefited by the proposed Sardar Sarovar Canal system and visit to some farms.
15th	Ahmedabad to Radhanpur & back	364	Inspection of areas proposed to be benefited by the proposed Sardar Sarovar Canal system and visit to some farms.
16th	Ahmedabad to Delhi		
February, 1976			
23rd			Assembled at Jaipur. Visit to Agricultural Research Institute, Durgapura.
23rd	Jaipur to Ajmer	132	Journey.
24th	Ajmer to Jodhpur	228	En route inspection of Jaswant Sagar Project.
25th	Jodhpur to Mount Abu	302	En route inspection of medium irrigation tank works at Hemawas and Jawai Dam works.
26th	Halt at Mount Abu		
27th	Mount Abu to Barmer	145	En route visit to Raniwara dairy and some farms and inspection of areas commandable by the proposed Narmada Canal system.
28th	Barmer to Jaisalmer	140	En route inspection of water points.
29th	Jaisalmer to Bikaner	290	En route inspection of tubewells, dairy farm at Chandan and Kolayut Tank.

		Distance Travelled (By Road) km	
March, 1976			
1st	Bikaner to Suratgarh	240	En route inspection of Rajasthan Canal under construction and development of irrigation from the completed portion of Rajasthan Canal.
2nd	Suratgarh to Ganganagar	110	En route visit to Suratgarh farm.
			Inspection of areas served by Bhakra Canal System and Gang Canal System and visit to areas commanded by Gang Canal upto Indo-Pakistan border.
	Sri Ganganagar to Delhi		
7th	Indore to Alirajpur	200	Assembled at Indore and proceeded to Alirajpur.
8th	Alirajpur to Jalsindhi and back	*50	Inspection of Jalsindhi Dam site.
	Local visits at Alirajpur	50	Visit to the Narmada basin areas in Kathiawara.
9th	Alirajpur to Barwani	75	Visit to some farm en route.
	Barwani to Harinphal and back	*70	Visit to Harinphal dam site and inspection of Dharamrai site from air.
	Barwani to Indore	163	En route visit to some farms.
10th	Indore to Bombay		Journey by air.
	Bombay to Poona	175	En route visit to Tata Hydel works.
11th	Local visits at Poona	50	Visit to Central Water and Power Research Station.
	Poona to Koynanagar	200	Journey.
12th	Local visits at Koynanagar	53	Inspection of Koyna Hydro-Electric Project Works.
	Koynanagar to Mahableshwar	140	Journey.
13th	Halt at Mahableshwar		
14th	Mahableshwar to Bombay	330	Inspection of Bhatgarh Project works en route.
15th	Halt at Bombay		General Review of the tour.
16th	Bombay to Delhi		
February 1977			
4th			Assembled at Aurangabad.
5th			Halt at Aurangabad.
6th		45	Visit to Jayakwadi Project. Inspection of the Dam, Canal and some farms in the areas commanded by the Project. Visit to a village set up to resettle the oustees from the Project.
7th			Aurangabad to Delhi.

*Nautical Miles.

CHAPTER II

A HISTORICAL REVIEW OF THE DISPUTE

2.1 *Earlier Investigations, Surveys and Planning*

2.1.1 In 1946, the then Government of Central Provinces and Berar and the then Government of Bombay requested the Central Waterways, Irrigation and Navigation Commission (CWINC) to take up investigations on the Narmada river system for basin-wise development of the river with flood control, irrigation, power and extension of navigation as the general objectives in view.

2.1.2 Accordingly, the topography and the hydrology of the basin were taken up for study in the CWINC in 1947. The study revealed excellent storage sites on the main river and some of its tributaries. Most of the sites were inspected by engineers and geologists and as a result of the preliminary reconnaissance, detailed investigation for seven projects including the Broach weir scheme was recommended.

2.1.3 In 1948, the Central Ministry of Works, Mines & Power appointed an Ad-hoc Committee consisting of Shri A. N. Khosla, Chairman, CWINC, Dr. J. L. Savage and Shri M. Narasimhaiya to scrutinise the estimates prepared for investigations of the above projects and to recommend priorities. The Ad-hoc Committee recommended as an initial step detailed investigations for the following projects keeping in view the availability of men, materials and resources:—

1. Bargi Project.
2. Tawa Project near Hoshangabad,
3. Punasa Project and
4. Broach Project.

Based on the recommendations of the Ad-hoc Committee, estimates for investigations of the Bargi, Tawa, Punasa (Narmadasagar) and Broach Projects were sanctioned by the Government of India on or about 19th March, 1949 *vide* letter No. 18/47 dated 19th March, 1949 of Ministry of Works, Mines & Power.

2.1.4 The CWINC took up investigations of these projects in the year 1949. Investigations of three projects (except Bargi) were completed and the project reports were prepared.

2.1.5 In the year 1955, the Central Waterways, Irrigation and Navigation Commission was renamed as Central Water & Power Commission. The work of investigation of Bargi project which had been suspended for want of funds was started again by the CWPC in November 1960 and the project report prepared in November, 1963.

2.1.6 The CWPC carried out a study of the hydroelectric potential of the Narmada basin in the year 1955. The report on this study pointed out that, with adequate regulation, it would be possible to generate power of the order of about 1.3 million KW at the following 16 sites:—

1. Rosra.
2. Basania.
3. Bargi.
4. Chinki.
5. Hoshangabad.
6. Punasa.
7. Barwaha.
8. Harinphal.
9. Keli.
10. Gora.
11. Burhner.
12. Sitarewa.
13. Tawa.
14. Kolar.
15. } On irrigation canal from Bargi.
16. }

2.1.7 At a meeting held on 24th September, 1957 at New Delhi attended by the representatives of Madhya Pradesh and Bombay to consider the question of comprehensive development of Narmada valley, the Chairman, CWPC pointed out:—

> "Some investigation work for the Punasa Hydro-electric Scheme was conducted by CW&PC sometime ago, and a report prepared. Further studies of the power potential of the entire Narmada Valley have revealed that, apart from Punasa Dam, sites for construction of pick up dams are available where generation of power would be feasible after con-

struction of the Punasa Dam. There is scope also for utilisation of the water of the river for irrigation, and the Broach Scheme is currently under investigation for the purpose. Therefore, it was desirable that investigations should be carried out at the three other sites between Punasa and Broach to assess the optimum potentialities of irrigation and power. Minor modifications which may be necessary for the Punasa Project after detailed investigations as well as its repercussions on the Broach Scheme would have to be taken into consideration for finalising the Punasa and Broach Projects."

2.1.8 As a result of the discussions at the above meeting, it was decided that detailed investigations should be carried out by the CWPC at three intermediate sites between Punasa and Broach, namely, at Barwaha, Harinphal and Keli and the cost of such investigations should be shared equally by Madhya Pradesh and the then Bombay State.

2.1.9 After carrying out preliminary geological as well as topographical surveys of all the possible sites along the river reach between Dhirkhadi and Gora, a site near Gora was first proposed by the CWPC for construction of a weir with pond level 160 in the first stage, envisaging an annual irrigation of 4.44 lakh hectares (10.97 lakh acres) with a gross commanded area of 5.38 lakh hectares (13.3 lakh acres) through a right bank canal. The project report was first prepared in the beginning of 1956.

2.1.10 In 1956, the erstwhile States of Sourashtra and Kutch were merged in the then Bombay State.

2.1.11 While the Broach project was under examination in CWPC the Gora site was inspected by the Member (Designs and Research) CWPC in February, 1957. During the course of his inspection he found that investigations in a certain portion of the river at Gora site were not complete. He therefore, suggested further investigations for the Gora site and also at Navagam, 1½ miles upstream of Gora site, where there was exposed rock in the bed and which afforded high abutments to enable raising the dam height. After investigations, the matter was examined in the CWPC and the Navagam site was finally decided upon in consultation with the erstwhile Government of Bombay which also concurred with its selection.

The project was modified by the CWPC in accordance with the suggestion made above and forwarded to the then Government of Bombay for comments in the year 1959. The implementation was contemplated in two stages. In Stage I, the FRL was restricted to 160 with provision for wider foundations to enable raising of the dam to FRL 300 in Stage II. A high level canal was envisaged in Stage II. The estimated cost of the Stage I of the Project then was Rs. 3,286 lakhs.

2.1.12 In 1959, the then Government of Bombay informed the CWPC that as Navagam dam was planned to be raised in the second stage to FRL 300, there could be no occasion for the construction of the dam at Keli in between Harinphal and Navagam. In January 1959, the Government of the then Bombay State in their letter No. MIP-5559-J191249 dated the 16th January, 1959 addressed to the Chairman, CWPC pointed out:—

> "The Central Water & Power Commission is aware of the fact that the Navagam Dam is likely to be raised in the second stage to RL 300 approximately and in that event there would be no occasion for the construction of the dam at Keli in between Harinphal and Navagam. In view of this, though provision has been made in the estimate for investigation of the Keli dam, the same, it is presumed, would not be operated upon."

The above presumption was confirmed by the CWPC in their letter No. 7(1)/58-FFI dated the 5th February, 1959 to the Government of Bombay under intimation to the Government of Madhya Pradesh.

2.1.13 The revised Broach Irrigation Project was referred to the erstwhile Government of Bombay for its observations in the year 1959. The main modification suggested by the erstwhile Bombay Government related to the raising of the FRL of the dam from RL 300 to FRL 320 in Stage II and provision of a power house in the river bed and a power house at the head of the low level canal. The estimates were also reviewed and modified in accordance with the revised Kakrapara and Mahi projects in Gujarat area. The CWPC generally agreed with the comments made by the erstwhile Government of Bombay.

In January 1959, a panel of Consultants was appointed by the Ministry of Irrigation and Power to review to Broach Irrigation Project. The Consultants inspected the site and the command area as envisaged in Stage I and forwarded their report on the Broach Irrigation Project in April, 1960. The Consultants made an important suggestion that the two stages of the Navagam dam as proposed should

be combined into one and the dam be constructed to its final FRL 320 in one stage only. The Consultants also stated that there was scope for extending irrigation from the high level canal towards the Rann of Kutch.

2.1.14 By the Bombay Reorganisation Act, 1960 (Central Act, No. XI of 1960), the erstwhile State of Bombay was bifurcated into two States from 1st May, 1960, and the State of Maharashtra and the State of Gujarat were formed on that date.

2.1.15 Consequent upon the said reorganisation and upon the Navagam site having fallen within the territories of Gujarat, the project planning and works stood transferred to the State of Gujarat. Stage I of the Broach Irrigation Project was accepted in August, 1960 by the Planning Commission for implementation *vide* Planning Commission's letter dated 5th August, 1960 from the Secretary, Planning Commission to the Secretary, Planning and Development Department, Government of Gujarat. The Narmada Project as accepted by the Planning Commission envisaged Navagam Dam to be constructed in Stage I to FRL 162 with a low level canal taking off therefrom for irrigation of 3.89 lakh hectares (9.63 lakh acres). The Project estimates as well as the planning and layout of the FRL 162 dam, however, included obligatory works required for raising of the dam to FRL 320 in Stage II. These works provided (1) wider foundations for masonry dam, (2) additional length of masonry dam to be provided in Stage I with the sole object of accommodating river bed power house in Stage II and (3) building of the earth dam to full cross-section on water side corresponding to the dam having FRL 320. The cost of these arrangements was included in the estimates of the Narmada Project Stage I accepted by the Planning Commission.

Stage I also provided for construction of an ungated weir with FRL 162 for diverting water into a low level canal to command 5.38 lakh hectares (13.30 lakh acres) gross in the Broach and Baroda districts Annual irrigation of 3.89 lakh hectares (9.63 lakh acres) was contemplated. The anticipated releases from the Tawa Project in Madhya Pradesh were also taken into account while planning irrigation benefits.

Stage II envisaged the raising of the dam to afford FRL 320. Irrigation was proposed to be extended to an additional area of at least 3.64 lakh hectares (9 lakh acres) pending investigations as recommended by the Consultants for extending irrigation in North Gujarat including the Little Rann of Kutch by means of a high level canal offtaking with full supply level (FSL) 295. Power to the extent of 625 MW at 60 per cent load factor (LF) was also envisaged after Punasa and other upstream storages were constructed and after meeting the then anticipated irrigation needs of Madhya Pradesh. The Government of Gujarat accorded administrative approval to Stage I of the Narmada Project in February 1961. The project was inaugurated by the late Pandit Jawahar Lal Nehru on 5th April, 1961. The preliminary works such as approach roads and bridges, colonies, staff buildings and remaining investigations for dam foundations were soon taken up.

2.1.16 While the above preliminary works for the project were under execution, a study was made by the Gujarat Government about utilising the flow in Narmada in the free catchment below Punasa. Navagam being the terminal reservoir had necessarily to provide for storage of the available flow particularly from the intervening free catchment. The survey work relating to submergence area of the reservoir and the probable commanded area of the high level canal was entrusted to the Survey of India in 1960. The Gujarat Government undertook surveys for the high level canal in 1961. The submergence area survey of the reservoir enabled assessment of the storage capability of the Navagam reservoir, if its height should be raised beyond FRL 320. This assessment showed that very large storage could be provided at Navagam reservoir if its height was raised to that of Harinphal which was planned immediately upstream of Navagam. The command area and canal surveys as they progressed indicated larger potentiality for irrigation under the proposed high level canal. A careful check of the water planning and the extent of benefits that could be had by reshaping of the project was also made by the Government of Gujarat. The studies indicated that a reservoir with FRL+460 would enable realisation of optimum benefits by utilising the untapped flow below Punasa and would make it possible to extend irrigation to a further area of over 20 lakh acres. Accordingly, explorations for locating a more suitable site in the narrower gorge portion were also taken in hand. Site No. 2 was selected in the first instance and geological investigations for this site were taken up in April 1963. In November 1963, Site No. 3 about 610 m (2000') upstream of site No. 2 was examined, since geological conditions at this site appeared more favourable. Accordingly, detailed investigations and explora

tion were taken up for the Navagam Site No. 3 together with prospecting, investigations, quality and quantity surveys etc. for the construction materials required for building a high Navagam Dam. Eventually Site No. 3 was found suitable on the basis of recommendations of the Geological Survey of India and also on the basis of exploration and investigations with regard to the foundation as well as construction materials available in the vicinity of the dam site.

2.2 *Agreement between Madhya Pradesh and Gujarat regarding the Height of the Navagam Dam (Bhopal Agreement)*

2.2.1 In November, 1963 the Union Minister of Irrigation & Power held a meeting with the Chief Minister of Gujarat and Madhya Pradesh at Bhopal. As a result of the discussions and exchange of views, an agreement (Bhopal Agreement) was arrived at the salient features of which were:—

(a) that the Navagam Dam should be built to FRL 425 by the Government of Gujarat and its entire benefits were to be enjoyed by the State of Gujarat.

(b) Punasa dam (Madhya Pradesh) should be built to FRL 850. The costs and power benefits of Punasa Power Project shall be shared in the ratio 1:2 between the Governments of Gujarat and Madhya Pradesh. Out of the power available to Madhya Pradesh half of the quantum was to be given to the State Maharashtra for a period of 25 years for which the State of Maharashtra was to provide a loan to the extent of one-third the cost of Punasa Dam. The loan to be given by the State of Maharashtra was to be returned within a period of 25 years.

(c) Bargi Project was to be implemented by the State of Madhya Pradesh, Bargi Dam was to be built to FRL 1365 in Stage I and FRL 1390 in Stage II and the Governments of Gujarat and Maharashtra were to give a total loan assistance of Rs. 10 crores for the same.

2.2.2 In pursuance of the Bhopal Agreement, the Government of Gujarat prepared a brief project report envisaging the Navagam Dam FRL 425 and submitted the same to the CWPC under Gujarat Government's letter dated 14th February, 1964. Madhya Pradesh, however, did not ratify the Bhopal Agreement *vide* D.O. letter dated November 28, 1963 from Shri D. P. Mishra, Chief Minister, Madhya Pradesh to Dr. K. L. Rao, Minister for Irrigation and Power, Government of India (Annexure 5 of the Statement of Case of Madhya Pradesh). On the other hand, Gujarat ratified the agreement on 30th November, 1963 *vide* their letter No. MIP-5563-K, dated 30th November, 1963 to the Government of India. Madhya Pradesh raised strong objections to the Bhopal Agreement contending that Navagam Dam should not be constructed to a greater height than FRL 162 because that was the river bed level at Madhya Pradesh border.

2.3 *Constitution of Narmada Water Resources Development Committee*

2.3.1 In order to overcome the stalemate following the rejection of the Bhopal Agreement by Madhya Pradesh, a High Level Committee of eminent engineers headed by Dr. A. N. Khosla, Governor of Orissa was, constituted on 5th September, 1964 by the Government of India. The appointment of the Chairman and other Members of the Committee and also the terms of reference were decided by the Government of India in consultation wtih the three States of Madhya Pradesh, Maharashtra and Gujarat. The terms of reference required:—

(i) drawing up of a Master Plan for the optimum and integrated development of the Narmada water resources;

(ii) the phasing of its implementation for maximum development of the resources and other benefits;

(iii) the examination, in particular, of Navagam and alternative projects if any, and determining the optimum reservoir level or levels;

(iv) making recommendations of any other anciliary matters.

Jalsindhi Agreement between Madhya Pradesh and Maharashtra

2.3.2 While the deliberations of the Khosla Committee were in progress, the States of Madhya Pradesh and Maharashtra entered into an agreement known as the Jalsindhi Agreement contemplating the construction of a dam at Jalsindhi for power generation. The Jalsindhi site is situated between the Harinphal and Navagam sites.

2.3.3 The terms of the Jalsindhi Agreement are reproduced below:—

"The Government of Madhya Pradesh and Maharashtra have agreed to co-operate in the development of hydro-electric power at Jalsindhi on the Narmada river and for this purpose have agreed as follows:—

(1) The Government of Maharashtra will carry out the necessary investigations and surveys and prepare a project estimate for the constructions of Jalsindhi dam and power house, in accordance with the Master Plan (March 1965) prepared by Madhya Pradesh. This estimate will be considered by the two Governments and, after it has been approved by both the Governments with such modifications as may be necessary, the Government of Maharashtra will undertake the construction of the dam; power house and ancillary work at Jalsindhi in the Fourth Plan.

(2) The Government of Madhya Pradesh will give all due assistance in the acquisition of land required in Madhya Pradesh for the Jalsindhi project and such other facilities as may be necessary for the execution of the Project.

(3) The costs of the works at Jalsindhi will be shared between Madhya Pradesh and Maharashtra in the ratio of a+b/2:b/2 where a is equal to the fall in the river between Harinphal and the point where one bank of the river enters Maharashtra and b is equal to the fall in the river in the portion where it runs along the boundary between the two States.

(4) The net benefits from the Jalsindhi project (i.e. excluding such credits as have to be afforded to the upstream projects for the regulated supplies received at Jalsindhi from these projects and including such credits as would be afforded by downstream projects for the regulated supplies delivered from Jalsindhi) will be shared between the two States in the same proportion as the costs.

(5) If, at any stage, during investigation, project making or construction of the project, either Government considers that a change is desirable in the scope or design, etc. of the project, the two Governments would meet and after discussion agree on such changes as may be necessary in the interest of economic development.

(6) The two Governments will work out in due course and agree upon arrangements for financing the project, for the association of the two Governments in the control of expenditure on the construction, maintenance and operation of the Jalsindhi project and of its operation in the best interests of both the Governments.

(7) Apart from the provision of paragraph 5 above, by mutual agreement, the two Governments may, at any stage, make such modifications in the terms of this agreement as may appear to be desirable and necessary."

2.3.4 On 1st September, 1965, the Narmada Water Resources Development Committee submitted their unanimous report to the Government of India. In this report, the Committee recommended a Master Plan of the Narmada water development. The Master Plan envisages 12 major projects to be taken up in Madhya Pradesh and one, *viz* Navagam in Gujarat. So far as Navagam Dam is concerned, the Committee recommended as follows:—

1. the terminal dam should be located at Navagam.

2. the optimum FRL of the Navagam worked out to RL 500.

3. the FSL of the Navagam canal at off-take should be RL 300.

4. the installed capacity at the river bed power station and canal power station should be 1000 mw and 240 mw respectively with one stand by unit in each power station (in other words the total installed capacity at Navagam would be 1400 mw).

The projects together with the benefits contemplated in the Master Plan are given in the following

table:—

Sl. No.	Name of Project	Benefits from Narmada waters: Irrigation area in lakh hectares (lakh acres)	Power, MW at 60% LF: Mean-year of development of irrigation	Power, MW at 60% LF: On full development of irrigation
1	2	3	4	5
1.	Madhya Pradesh			
	(a) Major Projects			
1.	Rosra	XX	52	52
2.	Basania	XX	60	60
3.	Burpner	XX	28	28
4.	Bargi	2.15 (5.32)	100	74
5.	Chinki	XX	55	40
6.	Sitarewa	XX	11	11
7.	Barna	0.67 (1.64)	XX	XX
8.	Hoshangabad	XX	50	37
9.	Tawa	3.04 (7.50)	20	20
10.	Kolar	0.50 (1.23)	XX	XX
11.	Narmadasagar	2.43 (6.00)	446	333
12.	Omkareshwar (Barwaha)	1.21 (3.00)	241	133
	Total	10.00 (24.69)	1,063	793
	(b) Medium & Minor Works in Madhya Pradesh	16.30 (40.31)	XX	XX
	Total	26.30 (65.00)	1,063	793
2.	Gujarat			
1.	Navagam Dam FRL 500	18.95* (46.80)	951**	511**

*Including 0.40 (1·0) of Rajasthan & 2·64(6·4)under Mahi.
**To be shared by Madhya Pradesh, Maharashtra & Gujarat States in the ratio of 2.5:1:1 respectively.

The Statewise benefits as envisaged by the Khosla Committee are given in the table below:—

Sl. No.	Name of State	Irrigation in lakh hectares (lakh acres)	Power generation in mean year in MW@60% LF
1.	Madhya Pradesh	26.30 (65.00)	1,592
2.	Maharashtra	0.04 (0.1)	211
3.	Gujarat (excluding Mahi)	15.80* (39.24)	211
4.	Rajasthan	0.40* (1.0)	

*In addition Rajasthan can irrigate 3·04 lakh hectares (7.5 lakh acres) and Gujarat about 1.6 to 2.0 lakh hectares (4 to lakh acres) approximately from the Mahi waters which can be diverted on full development at higher level after Narmada canal (+300) feeds the existing Mahi canal system.

The demands of the States as compared with the allocation of waters given by the Khosla Committee for consumptive use are given below:—

Name of State	Demand: Irrigation in lakh hectares (lakh acres)	Demand: Demand in MAFT	Allocation by the Khosla Committee: Irrigation in lakh hectares (lakh acres)	Allocation by the Khosla Committee: Allocated waters (MAFT)
Madhya Pradesh	31·35 (77·50)	23·75	26·30 (65·00)	15·60
Maharashtra	0·04 (0·10)	0·10	0·04 (10·0)	0·10
Gujarat (including Magu)	18·55** (45·81)	17·55	18·55 (45·81)	10·65@
Rajasthan	3·50 (8·50)	..	0·40 (1·00)	0·25

**with corresponding annual irrigation of 23·92 lakh hectares (59·07 lakh acres)
@Includes reservoir evaporation losses.

2.3.5 The benefits of the Navagam Dam as assessed by the Khosla Committee are as follows:—

(1) Irrigation of 15.80 lakh hectares (39.4 lakh acres) in Gujarat and 0.4 lakh hectares (1.00 lakh acres) in Rajasthan. In addition, the Narmada waters when fed into the existing Mahi canal system would release Mahi water to be diverted on higher contours enabling additional irrigation of 1.6 to 2.0 lakh hectares (4 to 5 lakh acres) approximately in Gujarat and 3.04 lakh hectares (7.5 lakh acres) in Rajasthan.

(2) Hydro-power generation of 951 MW at 60 per cent LF in the mean year of development and 511 MW on ultimate development of irrigation in Gujarat, Madhya Pradesh, Maharashtra and Rajasthan.

2.3.6 The Khosla Committee stressed an important point in favour of high Navagam Dam, namely, additional storage. They emphasized that this additional storage will permit greater carryover capacity, increased power production and assured optimum irrigation and flood control and would minimise the wastage of water to the sea. The Khosla Committee also observed that instead of higher Navagam Dam as proposed, if Harinphal or Jalsindhi dams were raised to the same FRL as at Navagam, the submergence would continue to remain about the same because the cultivated and

inhabited areas lie mostly above Harinphal while in the intervening 113 km (70 mile) gorge between Harinphal and Navagam, there is very little habitation or cultivated areas.

2.3.7 The Khosla Committee rejected the proposal of the Maharashtra Government that the Narmada canal should take off at +185/190 from Navagam dam FRL 210 on the ground that it would be wasteful to use power for lifting water when flow irrigation can easily be provided with the canal off taking at +300.

Guidelines adopted by the Khosla Committee

2.3.8 In Chapter XI of their report, the Khosla Committee outlined their approach to the plan of Narmada development. An extract from this chapter is reproduced below:—

> "11.1 In their meeting from 14th to 18th December 1964 at which the State representatives were also present, the Committee laid down the following basic guidelines in darwing up the Master Plan for the optimum and integrated development of the Narmada water resources:—
>
> 1. National interest should have over-riding priority. The plan should therefore provide for maximum benefits in respect of irrigation, power generation, flood control, navigation etc. irrespective of State boundaries;
> 2. Rights and interests of State concerned should be fully safeguarded subject to (1) above;
> 3. Requirements of irrigation should have priority over those of power;
>
> Subject to the provision that suitable apportionment of water between irrigation and power may have to be considered, should it be found that with full development of irrigation, power production is unduly affected;
>
> 4. Irrigation should be extended to the maximum area within physical limits of command, irrespective of State boundaries, subject to availability of water; and in particular, to the arid areas along the international border with Pakistan both in Gujarat and/Rajasthan to encourage sturdy peasants to settle in these border areas (later events have confirmed the imperative need for this); and
> 5. All available water should be utilised to the maximum extent possible for irrigation and power generation and, when no irrigation is possible, for power generation. The quantity going waste to the sea without doing irrigation or generating power should be kept to the un-avoidable minimum."

Comments by States on the Khosla Committee Report

2.4.1 While the Government of Gujarat broadly endorsed the recommendations of the Khosla Committee, the Governments of Maharashtra and Madhya Pradesh rejected them. The disagreement mainly related to the proposal for the development of the lower Narmada reach and the allocation of water amongst different States which could be irrigated with the Narmada waters. Madhya Pradesh also claimed absolute right over the hydro-electric power which would be generated in its territory. Regarding compensation or loss of power, Madhya Pradesh stated in its comments as follows:—

> "In all fairness, if for some sound reason Navagam Dam must be built to such a height as would submerge one or more power houses proposed in Madhya Pradesh, the latter is entitled to receive from the power to be developed at Navagam and on the Navagam Canal, the full quantum of power that Madhya Pradesh would have generated in its own territory. Further, this power must be delivered to Madhya Pradesh at sites of generation in Madhya Pradesh and at a cost no higher than that at which it would have generated this power in its own territory; in other words, the full quantum of power should be transmitted to those sites in Madhya Pradesh at no cost to Madhya Pradesh."

2.4.2 Madhya Pradesh claimed most of the water originating in its territory. It, however, indicated that it would be prepared to guarantee to Gujarat one-fifth of the net utilisable supply at Navagam by providing regulated releases as may be necessary on payment towards the cost of necessary storages in Madhya Pradesh. Madhya Pradesh questioned the necessity of a high Navagam Dam with a high level canal from Navagam site. Madhya Pradesh also claimed that the Khosla Committee's assessment of availability of water at different sites were on the higher side. Madhya Pradesh said that it had since found it possible to divert the Narmada waters to Tons Valley (Ganga Basin) and to Maha-

nadi basin for irrigation. According to Madhya Pradesh, an area of 8 lakh hectares in Satna and Rewa in Tons basin which was subject to scarcity and famine conditions could be developed with the waters from the Narmada.

2.4.3. Maharashtra advocated restriction of the FRL of the Navagam Dam to 210 with a canal with FSL 185/190 to be taken therefrom for irrigation in Gujarat. In effect, the views of Madhya Pradesh and Maharashtra supported the Jalsindhi agreement referred to earlier.

Official Level Discussions

2.5 With a view to bringing about an amicable settlement, the Union Minister of Irrigation and Power held discussions with the Chief Ministers of Madhya Pradesh, Gujarat and Maharashtra at their respective State capitals in May and June, 1966. Thereafter, in July and August, 1966, prolonged official level discussions were held in Delhi to discuss a number of technical issues arising out of the differences between the States over the scheme of development of the Narmada waters in the lower reach. During these discussions, agreement was reached on minor points such as quantum of utilisable flow at Navagam and its dependability and the load factor to be adopted for hydro-electric projects; but wide differences over sharing of the waters, the areas to be irrigated in each State, the level of the Navagam Dam and of the canal persisted as before.

Meetings of Chief Ministers

2.6 On 22nd August, 1966 a meeting of the Chief Ministers of the four States, namely, Gujarat, Rajasthan, Maharashtra and Madhya Pradesh was convened by the Union Minister for Irrigation and Power at New Delhi. At that meeting it was decided that the Chief Ministers of Gujarat and Madhya Pradesh should meet as early as possible to resolve the dispute amicably. In pursuance thereof the Chief Ministers of Madhya Pradesh and Gujarat held discussions at Pachmarhi on 23rd May, 1967 and in New Delhi on 22nd June, 1967. Thereafter, a meeting of the Union Minister of Irrigation & Power and the Chief Ministers of Madhya Pradesh, Maharashtra, Gujarat and Rajasthan took place at New Delhi on 18th December, 1967. This meeting also proved infructuous.

Appointment of the Narmada Water Disputes Tribunal

2.7 In spite therefore of the earnest efforts on the part of the Government of India for about six years to persuade the contending States to settle the water dispute by negotiations, it was not found possible to arrive at a mutually agreed settlement in regard to the distribution, control and use of the Narmada waters and the height of the Navagam Dam. The differences on the other hand widened. In this state of facts the Government of Gujarat submitted a complaint to the Government of India *vide* its letter dated 6th July, 1968 for appointment of a Tribunal under the Inter-State Water Disputes Act, 1956. Acting under Section 4 of that Act, the Government of India constituted this Tribunal for adjudication of the dispute about Narmada waters by Notification No. S.O. 4054 dated 6th October, 1969. On the same date, by reference No. 12/6/69-WD, the Government of India made a reference of the water dispute to this Tribunal. On 16th October, 1969, the Government of India made another reference of certain issues raised by Rajasthan under Section 5(1) of the Inter-State Water Disputes Act, 1956 allegedly because these issues were relevant to and connected with the same water dispute. This reference is 10/1/69-WD dated 16th October, 1969.

CHAPTER III

NARMADA RIVER SYSTEM

THE RIVER

3.1.1 The Narmada, the largest west-flowing river of the peninsula rises near Amarkantak, in the Shahdol district of Madhya Pradesh, at an elevation of about 900 m at north latitude 22° 40′ and east longitude 81° 45′ in the Maikala range. The river has a number of falls in its head reaches. At 8 km from its source, the river drops 21 to 24 m at Kapildhara falls 0.4 km further downstream, it drops by about 4.6 m at the Dudhara falls. Its first major tributary, the Burhner joints the Narmada from the left, at the 248th km of its run. Flowing in a generally south-westerly direction in a narrow and deep valley, the river takes pin-head turns at places. At the 286th km from the source, it turns northwards and hardly a km further downstream it receives the Banjar, another major tributary from the left, and flows past Mandla town in a number of channels called Sahasradhara. Close to Jabalpur, 404 km from the source, the river drops nearly 15 m at the Dhaundhara falls, after which it flows through a narrow channel carved through the famous marble rocks.

3.1.2 Emerging from the marble rocks, the Narmada enters the upper fertile plains and at the 464th km of its run, receives the Hiran, a major right bank tributary. Continuing to flow in a westerly direction through the upper plains, the river receives several tributaries like the Sher, Shakkar, Dudhi, Tawa, Gangal from the left and the Tendoni, Barna, Kolar from the right.

3.1.3 Flowing further west, it enters the middle plains near Panghat in East Nimar district. At Nandhar, 806 km from the source and at Dhardi, 47 km further downstream, the river drops over falls of 12 m at each place. At the 966th km from the source, nearly 6.4 km downstream of Maheshwar, the Narmada again drops by about 6.7 m at the Sahasradhara falls. During its journey through the middle plains, it receives the Chhota Tawa, the Kundi from the left and the Man from the right.

Flowing further west, the river enters the lower hilly regions and flows through a gorge, receiving the Goi from the left and the Uri, the Hatni from the right. The 113 km long gorge is formed by the converging of the Vindhyas from the north and the Satpuras from the south towards the river.

3.1.4 Emerging from the gorge, the river enters the lower plains and meanders in broad curves till it reaches Broach. The Karjan from the left and the Orsang from the right are the important tributaries joining the river in this reach. Beyond Broach the valley widens into an estuary. Finally, the river enters the Gulf of Gambay.

3.1.5 The total length of the river from the head to its outfall into the sea is 1,312 km. The first 1077 km are in Madhya Pradesh. In the next length of 35 km, the river forms the boundary between the States of Madhya Pradesh and Maharashtra. Again, in the next length of 39 km, it forms the boundary between Maharashtra and Gujarat. The last length of 161 km lies in Gujarat.

3.1.6 The river has 41 tributaries of which 22 are on the left bank and 19 on the right. The important tributaries of the Narmada are the Burhner, Banjar, Sher, Tawa, Chhota Tawa, Kundi, Hiran and Orsang which are briefly described in the following paragraphs.

3.1.7 The Burhner rises in the Maikala range, south-east of Gwara village in Mandla district of Madhya Pradesh at an elevation of about 900 m, at north latitude 22° 32′ and east longitude 81° 22′ and flows in a generally westerly direction for a total length of 177 km to join the Narmada near Manot. The Burhner drains a total area of 4,118 sq. km.

The Banjar rises in the Satpura range in the Drug direct of Madhya Pradesh near Rampur village at an elevation of 600 m at north latitude 21° 42′ and east longitude 80° 50′ and flows in a generally north-westerly direction for a total length of 184 km to join the Narmada from the left near Mandla at the 287th km of its run. The Banjar drains a total area of 3,626 sq. km.

The Sher rises in the Satpura range near Patan in the Seoni district of Madhya Pradesh at an elevation of 600 m at north latitude 22° 31′ and east longitude 79° 25′ and flows in a generally north-westerly direction for a total length of 129 km to its confluence

with the Narmada from the left near Brahmand. The Sher drains a total area of 2,901 sq km.

The Shakkar also rises in the Satpura range in the Chhindwara district of Madhya Pradesh, east of Chhindi village, at an elevation of 600 m at north latitude 20° 23′ and east longitude 78° 52′ and flows in a generally north-westerly direction for a total length of 161 km to join the Narmada from the left, north-west of Paloha. The Shakkar drains a total area of 2,292 sq. km.

The Dudhi rises in the Mahadeo hills of the Satpura in the Chhindwara district of Madhya Pradesh west of Chhindi village at an elevation of 900 m at north latitude 22° 23′ and east longitude 78° 45′ and flows first in a north-westerly direction up to Sainkheda and then in a westerly direction for a total length of 129 km to join the Narmada from the left, north-west of Nibhora. The Dudhi drains a total area of 1,541 sq. km.

The Tawa, the biggest left bank tributary, rises in the Mahadeo hills of the Satpura range in the Chhindwara district of Madhya Pradesh near Cherkathari village at an elevation of 900 m at north latitude 22° 13′ and east longitude 78° 23′ and flows in a generally north-westerly direction for a total length of 172 km to join the Narmada from the left, north-east of Hoshangabad. The Denwa is its important tributary. The Tawa drains a total area of 6,333 sq. km.

The Ganjal rises in the Satpura range in the Betul district of Madhya Pradesh, north of Bhimpur village at an elevation of 800 m at north latitude 22° 0′ and east longitude 77° 30′ and flows for a total length of 89 km in a north-westerly direction to join the Narmada from the left near Chhipaner village. The Ganjal drains a total area of 1,930 sq. km.

The Chhota Tawa rises in the Satpura range in the West Nimar district of Madhya Pradesh near Kakora village at an elevation of 600 m at north latitude 21° 30′ and east longitude 75° 50′ and flows for a total length of 169 km in a northerly direction to join the Narmada from the left, north of Purni village. The Chhota Tawa is next in size to the Tawa among the left bank tributaries and drains a total area of 5,051 sq. km.

The Kundi rises in the Satpura range in West Nimar district of Madhya Pradesh, near Tinshemali village at an elevation of 600 m at north latitude 21° 25′ and east longitude 75° 45′ and flows for a total distance of 121 km in a northerly direction to join the Narmada from the left near Mandleshwar. The Kundi drains a total area of 3,820 sq. km.

The Goi rises in the Satpura range in West Nimar district of Madhya Pradesh near village Dhavdi at an elevation of 600 m at north latitude 21° 40′ and east longitude 75° 23′ and flows for a total length of 129 km in a north-westerly direction to join the Narmada from the left, west of Barwani village. It drains a total area of 1,891 sq. km.

The Karjan rises in the Satpura range in Surat district of Gujarat, south of Nana village at an elevation of 300 m at north latitude 21° 23′ and east longitude 73° 35′ and flows for a total length of 93 km in a north-westerly direction to join the Narmada from the left, east of Sinor village. It drains a total area of 1,498 sq. km.

The Hiran rises in the Bhanrer range in the Jabalpur district of Madhya Pradesh near Kundam village at an elevation of 600 m at north-latitude 23° 12′ and east longitude 80° 27′ and flows in a generally south-westerly direction for a total length of 188 km to join the Narmada from the right near Sankal village. The Hiran, the biggest right bank tributary of the Narmada, drains a total area of 4,792 sq. km.

The Tendoni rises in the Vindhya range in the Raisen district of Madhya Pradesh; east of Sodarpur village at an elevation of 600 m at north latitude 23° 22′ and east longitude 78° 33′ and flows for a total length of 118 km in a south-westerly direction to join the Narmada from the right, near Bhatgaon village. It drains a total area of 1,632 sq. km.

The Barna rises in the Vindhya range in the Raisen district of Madhya Pradesh, east of Barkhera village, at an elevation of 450 m at north latitude 22° 55′ and east longitude 77° 44′ and flows for a total length of 105 km. in a south-easterly direction to join the Narmada from the right near Dimaria village. It drains a total area of 1,787 sq. km.

The Kolar rises in the Vindhya range in the Sehore district of Madhya Pradesh, near Bilquisganj village at an elevation of 450 m at north latitude 23° 7′ and east longitude 77° 17′ and flows for a total length of 101 km in a south-westerly direction to join the Narmada from the right, south of Nasrullahganj. The Kolar drains a total area of 1,347 sq. km.

The Man rises in the Virdhya range in the Dhar district of Madhya Pradesh near Dhar town at an elevation of 500 m at north latitude 22° 33′ and east longitude 75° 18′ and flows for a total length

of 89 km in a southerly direction to join the Narmada from the right, north of Talwara Deb village. It drains a total area of 1,528 sq. km.

The Uri rises in the Vindhya range in the Jhabua district of Madhya Pradesh, near Kalmore at an elevation of 450 m at north latitude 22° 36′ and east longitude 75° 18′ and flows for a total length of 89 km in a southerly direction to join the Narmada from the right near Nisarpur. It drains a total area of 1,813 sq. km.

The Hatni rises in the Vindhya range in the Jhabua district of Madhya Pradesh, east of Kanas at an elevation of 450 m, at north latitude 22° 32′ and east longitude 74° 40′ and flows for a total length of 81 km in a southerly direction to join the Narmada from the right, near Kakrana. It drains a total area of 1,943 sq. km.

The Orsang rises in the Vindhya range of the Jhabua district of Madhya Pradesh, near Bhabra village at an elevation of 300 m, at north latitude 22° 30′ and east longitude 74° 18′ and flows for a total length of 101 km in a south-westerly direction to join the Narmada from the right, near Chandod. It drains a total area of 4,079 sq. km and is next size to the Hiran, amongst the right bank tributaries.

3.1.8 Table 3.1 indicates the district-wise distribution of the catchment area of the Narmada Basin in the three States *viz.* Madhya Pradesh, Maharashtra and Gujarat and Table 3.2 gives the list of major tributaries of the Narmada, their lengths, catchment areas, etc.

TABLE 3.1

District-wise Distribution Of Catchment area Of Narmada Basin

Sl. No.	Name of State	Name of District	Catchment area in sq. miles	Remarks
1	2	3	4	5
1.	Madhya Pradesh	Shahadol	252	
		Mandla	4,370	
		Durg	276	
		Balaghat	992	
		Seoni	1,002	
		Jabalpur	2,280	
		Narsinghpur	1,923	
		Sagar	268	
		Damoh	172	
		Chhindwara	1,420	
		Hoshangabad	3,845	
		Betul	1,490	Total C,A,
		Raisen	1,873	in M.P.,=
		Sehore	1,409	33,150 sq.
		East Nimar	2,780	miles.
		West Nimar	4,637	
		Dewas	1,447	
		Indore	441	
		Dhar	1,890	
		Jhabua	383	
2.	Maharashtra	West Khandesh	594	Total C.A in Maha rashtra= 594 sq. miles
3.	Gujarat	Baroda	2,270	Total C.A. in Gujarat
		Broach	2021	=4,401 sq.
		Surat	80	miles.
		Panchamahal	30	
			38,145	sq. miles.

TABLE 3.2

List of Major Tributaries of the Narmada

Sl. No.	Name of Tributary	Distance of confluence with Narmada from source (in miles)	Length of Tributary (in miles)	Catchment area in sq. miles
1	2	3	4	5
	Right Bank			
1.	Hiran	288	117	1,850
2.	Tendoni	374	73	630
3.	Barna	376	65	690
4.	Kolar	646	63	520
5.	Man	620	55	590
6.	Uri	643	46	700
7.	Hatni	668	50	750
8.	Orsang	740	63	1,575
	Left Bank			
1.	Burhner	154	110	1,590
2.	Banjar	178	114	1,400
3.	Sher	309	80	1,120
4.	Shakkar	339	100	885
5.	Dudhi	357	80	595
6.	Tawa	420	107	2,445
6.	Ganjal	470	55	745
8.	Chhota-Tawa	515	105	1,950
9.	Kundi	586	75	1,475
10.	Goi	645	80	730
11.	Karjan	745	58	575

The Narmada Basin

3.2.1 The Narmada Basin extends over an area of 98,796 sq km and lies between east longitudes

72° 32′ to 81° 45′ and north latitudes 21° 20′ to 23° 45′. Lying in the northen extremity of the Deccan plateau, the basin covers large areas in the States of Madhya Pradesh and Gujarat and a comparatively smaller area in Maharashtra. The state-wise distribution of the drainage area is as under:

TABLE 3.3

Drainage Area—State-wise @

Name of State	Drainage Area
Madhya Pradesh. . .	85,859 sq. km.
Maharashtra . . .	1,538 sq. km.
Gujarat . . .	11,399 sq. km.
Total . . .	98,796 sq. km.

@Report of the Irrigation Commission 1972 Vol. III, Part I, Page 323.

The Narmada Basin is bounded on the north by the Vindhyas, on the east the Maikala range, on the south by the Satpuras and on the west by the Arabian Sea. The basin has an elongated shape with a maximum length of 953 km from east to west and a maximum width of 234 km from north south. The basin has five well defined physiographic zones. They are—(i) the upper hilly areas covering the districts of Shahdol, Mandla, Durg, Balaghat, and Seoni, (ii) the upper plains covering the districts of Jabalpur, Narsimhapur, Sagar, Damoh, Chhindwara, Hoshangabad, Betul, Raisen and Schore, (iii) the middle plains covering the districts of East Nimar, part of West Nimar, Dewas, Indore and Dhar, (iv) the lower hilly areas covering part of the West Nimar, Jhabua, Dhulia and parts of Baroda and (v) the lower covering mainly the districts of Broach and parts of Baroda. The hilly regions are well forested. The upper, middle and lower plains are broad and fertile areas well suited for cultivation.

CLIMATE

3.2.2 The Tropic of Cancer crosses the Narmada basin in the upper plains area and a major part of the basin lies just below this line. The climate of the basin is humid and tropical, although at places extremes of heat and cold are often encountered. In the year, four distinct seasons occur in the basin. They are (i) cold weather, (ii) hot weather, (iii) south-west monsoon and (iv) post-monsoon.

3.2.3 In the cold weather, the mean annual temperature varies from 17.5°C to 20°C and in the hot weather from 30° C to 32.5°C. In the south-west monsoon, the temperature ranges from 275°C to 30°C. In the post-monsoon season, temperatures between 25°C to 27.5°C are experienced. The maximum and minimum temperatures for a few representative towns in the Narmada basin are given below, which clearly indicate the extent of variations:—

TABLE 3. 4

Maximum and Minimum Temperature (2)

Sl. No.	Station	Jan.—March		April—June	
		Max.	Min.	Max.	Min.
1.	Mandla . . .	34·9	9·0	40·2	19·6
2.	Jabalpur . .	36·2	10·1	42·1	21·0
3.	Hoshangabad . .	37·4	11·6	41·6	24·5
4.	Khandwa . .	38·0	11·8	41·5	24·3
5.	Punasa . . .	38·8	11·9	42·9	24·2

		July—Sep.		Oct.—Dec.	
		Max.	Min.	Max.	Min.
1.	Mandla . .	29·1	21·7	29·4	6·8
2.	Jabalpur . . .	30·6	23·1	30·5	7·7
3.	Hoshangabad . .	30·5	23·0	30·1	11·0
4.	Khandwa . .	30·5	22·6	31·3	11·1
5.	Punasa . .	31·1	22·9	33·1*	12·0*

(2) Report of the Irrigation Commission 1972 Vol. III, Part I, page 330.

*Figures for 1960.

RAINFALL

3.3.1 According to the Indian Meteorological Department, there were ten rain-gauges in 1867 in the entire Narmada basin. The number rose to 21 rain-gauges in the year 1891, the year from which published rainfall data are available. Thereafter, there has been a steady growth of the rain-guage net-work in the basin. In 1965, the number of reporting rain-gauges above Garudeshwar was 69.

3.3.2 The normal annual rainfall for the basin works out to 1,178 mm. Nearly 90 per cent of this rainfall is received during the five monsoon months from June to October. About 60 per cent is received in the two months of July and August. The monthly distribution of normal rainfall over the entire basin has been broadly calculated as below:

TABLE 3.5

Monthly Distribution of Normal Rainfall

Month	Rainfall (mm)	Percentage of annual rainfall
June	152·4	12·97
July	392·4	32·84
August	314·8	26·93
September	199·7	16·77
October	40·6	3·49
Dry months	78·1	7·00

3.3.3 The rainfall is heavy in the upper hilly and upper plains areas of the basin. It gradually decreases towards the lower plains and the lower hilly areas and again increases towards the coast and south-western portions of the basin. The monthly and annual normals of rainfall in the districts lying in the basin are shown in Table 3.6.

3.3.4 In the upper hilly areas, the annual rainfall is, in general, more than 1400 mm (55 inches) but it goes up to 1650 mm (65 inches) in some parts. In the upper plains from near Jabalpur to near Punasa Dam site, the annual rainfall decreases from 1400 mm (55 inches) to less than 1000 mm (40 inches) with a high rainfall zone around Pachmarhi where the annual rainfall exceeds 1800 mm (70 inches). In the lower plains the annual rainfall decreases rapidly from 1000 mm (40 inches) at the eastern end to less than 650 mm (25 inches) around Barwani, and this area represents the most arid part of the Narmada basin. In the lower hilly areas, the annual rainfall again increases to a little over 750 mm (30 inches).

TABLE 3.6

Monthly and Annual Normal Rainfall in the Narmada Basin

Sl. No.	State/District	Month-wise Normal Rainfall in mm.												Annual normal in mm.
		Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.	Oct.	Nov.		
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
	Madhya Pradesh													
1.	Shahdol	39·9	35·7	24·2	18·8	15·1	185·3	387·3	393·6	217·5	54·5	17·5	7.4	1,396·8
2.	Mandla	27·8	34·7	24·5	17·2	16·4	196·2	492·7	447·8	226·5	59·7	18·4	7·7	1,569·6
3.	Durg	13·5	27·5	16·6	18·3	16·4	200·5	355·5	333·3	206·9	63·7	13·5	4.4	1,270·1
4.	Balaghat	17·8	29·6	18·5	16·2	11·8	211·7	557·9	445·2	232·6	62·7	13·3	5·9	1,623·2
5.	Seoni	24·2	32·5	24·4	18·9	16·7	195·0	429·2	350·2	204·7	58·6	19·8	10·3	1,384,5
6.	Jabalpur	26·4	23·3	13·2	6·2	6·9	135·7	424·2	380.0	190·8	42·7	15·7	9·0	1,274·1
7.	Narsimhapur	15·9	17·3	12·1	6·5	10·9	148·3	421·2	385.0	216·5	40·8	17·6	8·7	1,300·8
8.	Sagar	23·9	14·6	10.6	5·3	8·1	130·8	421·5	371·0	189·5	29·8	21·0	8·9	1,235·0
9.	Damoh	20.4	13·8	11·8	5·8	8.5	124·2	400·0	382.3	196·7	36.1	16·3	8·6	1,224·5
10.	Chhindwara	20·2	28·3	20·8	14·8	16·4	187·1	418·7	326.3	200·6	60·9	20.3	·6	1,324·0
11.	Hoshangabad	14·1	9·4	7·2	2·5	9·9	156·2	439·5	361·7	230·3	34·0	21·3	8·4	1,294·5
12.	Betul	17·7	17·1	15·6	8·0	13·1	154·7	336·4	258·7	175·5	50·5	28.5	8·1	1,083·9
13.	Raisen	22·4	11·1	8·5	3·3	7·9	159·2	473·3	371.1	214·1	29·9	21·6	8.o	1,330.4
14.	Sehore	14·1	5·1	5·3	1·9	9·9	150·8	462·1	331·9	208·1	30.4	18·1	7·1	1,244·8
15.	East Nimar	8·8	5·3	4·0	1·5	9·3	138·2	282·6	196·6	168·7	33·9	23.0	8·1	880·0
16.	West Nimar	2·5	1·7	2·9	1·7	8·4	133·1	265·3	183·8	170·5	37·1	19·4	5·1	831.5
17.	Dewas	9·2	3·7	3·2	2·4	12·4	150·7	362·2	291·5	190·6	27·1	25·0	5·1	1,083·2
18.	Indore	5·6	2·2	2·5	2·0	12·1	149·3	311·9	23·5	191·9	36.3	20·8	5·9	980·0
19.	Dhar	4·0	0·9	1·1	1·4	9·8	127·4	255·5	204·0	176.1	31·3	17·9	3·7	833.1
20.	Jhabua	4·5	1·9	1·5	0·7	9·1	116·3	383·3	211·5	162.3	25·5	9·5	1·9	828·0
	Maharashtra													
21.	Dhulia	6·1	2·0	1·9	2·0	8·5	120·4	211·2	133·3	131·1	34·7	17·3	5·5	674·0
	Gujarat													
22.	Baroda	2·0	2·5	0·8	3·2	4·8	123·3	389·6	233·8	170·1	28·2	9·1	1·4	968·8
23.	Broach	3·2	1·6	0·8	3·5	4·2	137·6	368·4	209·5	176·5	32·5	10·6	1·3	949·7
24.	Gurat	3·2	2·0	0·9	2·5	6·7	240·9	634·1	344·8	229·6	42·4	12·3	1·8	1,521·2
25.	Panchamahals ..	2·9	2.0	1·7	1·7	8·2	123·2	377·5	266·7	175·1	20·3	7·3	1·4	988·0

Source : Memoirs of the India Meteorological Department, Vol. XXXI, Part III.

Variability of Rainfall

3.4.1 For the study of variability of rainfall, the co-efficient of variation (CV) defined as Standard Deviation x 100 has been calculated for all the stations in the catchment. For the purpose of this paragraph, the basin has been divided into five zones. The zones are:

Zone 1: From sources to Bargi Dam site.

Zone 2: Between Bargi and Punasa Dam sites.

Zone 3: Between Punasa and Barwaha Dam sites.

Zone 4: Between Barwaha and Harinphal Dam sites.

Zone 5: Between Harinphal and Navagam Dam sites upto the mouth of the river Narmada.

3.4.2 Annual and seasonal values of CV are stated in the following table[3]:

TABLE 3.7

Co-efficient of Variation of Rainfall (%) for such Stations of Narmada Basin which have Data for 50 Years.

	Jan—Feb.	Mar—May	June—Sept.	Oct—Dec.	Annual
ZONE I					
Dindori	80	88	25	88	24
Baihar	85	90	20	84	20
Mandla	81	92	21	85	21
Narayanganj	84	89	29	90	29
Lakhadon	75	87	19	78	19
ZONE II					
Sihora	96	101	23	86	21
Jabalpur (Obsy)	101	105	21	96	20
Narsimhapur	120	55	22	60	19
Mohpani	115	109	22	99	22
Gadarwara	111	108	17	113	18
Pachmarhi (Obsy)	97	96	22	91	21
Sohagpur	116	115	22	97	23
Betul	108	99	26	91	26
Shahpur	208	105	23	96	24
Chicholi	134	126	27	106	27
Hoshangabad (Obsy)	105	99	24	101	23
Seoni	89	78	18	78	19
Harda	135	135	28	105	27
ZONE III					
Harsud	164	124	31	117	30
Khandwa (Obsy)	142	98	33	113	32
ZONE IV					
Manpur	275	131	26	106	25
Dhar	228	163	29	108	30
ZONE V					
Barwani	307	129	27	113	27
Alirajpur	235	179	32	131	32
Chhota Udepur	205	168	30	151	30
Jambugoda	290	186	35	178	34
Rajpipla	268	218	38	138	37
Ankleshwar	296	276	32	163	31
Broach	313	302	38	169	37

Annual Rainfall

3.4.3 Rainfall decreases from more than 150 cm in the east to 75 cm in the west. Rainfall over the eastern half of the basin is more than 100 cm. The eastern most Zone I receives the heaviest rainfall with a normal of 155 cm. A good portion of the zone gets more than 150 cm, a small area receiving 170 to 175 cm. The area of least rainfall is Zone IV and rainfall in this zone varies from 70 to 100 cm. Considering stations with normals based on data of 50 years, Barwani in Zone V, just on the western outer firinge of Zone IV, has the lowest normal of 64 cm in the basin. The average for the different zones ranges from 86 to 155 cm. The average for the entire basin is 123 cm.

Seasonal Rainfall

3.4.4 A principal feature is that more than 90 per cent of the total annual rainfall occurs during the south-west monsoon: June to September, July is the rainiest month with a third of the annal, closely followed by 27 per cent in August. Together, July and August account for 60 per cent of the annual. June receive 13 per cent and September 17 per cent. The eastern half and most of Zone V gets more than 100 cm in the south-west monsoon season. Over the rest of the basin, the normal is generally less than 75 cm.

The highest average rainfall in the south-west monsoon season is for Zone I with 135 cm, the next being Zone II with 121 cm. The lowest is Zone IV with 77 cm. Considering the individual months, rainfall in June increases from 10 cm near Broach to 20 cm. in the extreme south-east. July is the rainiest month and the values range from less than 20 cm south of Harinphal Dam site area to

(3) See the Bulletin on Rainfall and Variability of Narmada issued by the India Meteorological Department (October 1970).

over 60 cm near Mandla in Zone I. The pattern in August is nearly similar but the amounts are less ranging from 15 to 50 cm. Rainfall diminishes considerably in September varying between 13 and 30 cm.

October—December—Though the percentage is small, October to December rainfall is significant and contributes about 5 per cent of the annual total in the different parts of the basin. The amounts range between 3 and 10 cm.

January-February—It is interesting to observe that winter rainfall during January and February accounts for 4 per cent of the annual in the eastern portion (Zone I) with an average of 6 cm. Over most of the remainder of the basin it is negligible, being less than 1 cm in the western half of the basin.

March—May—Rainfall during this season is generally neglibile, except in Zone I, which receives 5 cm. The basin average is only 2.7 cm.

Variability

3.4.5 *January-February*—CV is everywhere high ranging between 75 to 100% of longitude 77° E covering Zone I and adjoining areas of Zone II. CV is over 100 % in the rest of the basin. Although some significant rain occurs in the eastern zones, the variability is high and rainfall very undependable.

March—May—Rainfall in this season is less and variability mostly over 100%.

June—CV ranges from 60 to 100% extreme west CV is 100%.

July—CV is between 30 to 40% in the eastern zone (I) and varies upto 60% near Broach.

August—The pattern is similar to July.

September—CV is 60 to 80%.

June to September (Season)—Except in Zone V. CV is everywhere less than 30%. In the eastern portions of Zone I and adjoning areas. CV is between 20 to 25% only. Even in Zone V which is the extreme western portion of the basin, CV is between 30 to 40% only. Thus, for the season as a whole, the rainfall pattern is less variable as compared to individual months.

October—December—CV is 80 to 100% in Zone I and eastern part of Zone II, it is beyond 100 per cent in the rest of the area.

Annual—Over most of the basin, CV varies between 20 to 30%. The eastern half is less variable, CV being 20 to 25% only. CV of the extreme western portion is 30 to 40%.

Arid and Semi-Arid Regions

3.5.1 Using Thornthwaite's method of classification and utilising normals of not only meteorological observatories under the national net work but also the considerable number of raingauge stations maintained by States, the arid and semi-arid zones of India have been delineated (Thornthwaite, 1948(1)). On the basis of this classification, the total areas of arid and semi-arid zones in the country work out to be 317,090 sq. km and 956,750 sq. km respectively excluding the cold desert of Jammu and Kashmir State which contains 70300 sq. km of arid and 13780 sq km of semi-arid areas. The statewise areas of arid and semi-arid zones and their percentage coverage are shown in Table 3.8 below:—

TABLE 3.8

State-wise Area of Arid and Semi-Arid Zones of India

State	Area in sq. km		Percentage of area under each State		Remarks
	Arid	Semi arid	Arid	Semi-arid	
Jammu & Kashmir	70300	13780			Cold desert
Rajasthan . .	196150	121020	.61	13	
Gujarat . .	62180	90520	20	9	
Punjab . .	14510	31770	5	3	
Haryana . .	12840	26880	4	3	
Uttar Pradesh .	..	64230	..	7	
Madhya Pradesh .	..	59470	..	6	
Maharashtra .	1290	18580	0·4	19	
Mysore . .	8570	139360	..	15	
Andhra Pradesh .	21550	138670	7	15	
Madras . .	..	95250	..	10	
Total excluding Jammu & Kashmir	317090	956750	..	..	

3.5.2. The Drought Research Unit of the IMD at Poona, has tried to evolve a drought index on the basis of rainfall departures, monthly rainfall deciles, water period etc. Employing Thornthwaite's water balance technique, and using potential evapotranspiration values computed for 300 stations from Penman formula, areas of arid and semi-arid climatic zones were again demarcated[2].

[1]Some Aspects of Water Management for crop production in Arid and Semi-arid Zones in India—A. Krishna of Central Arid Zone Research Institute (R/39).

[2]Rao. K.N., C.J. George and K.S. Ramasastry, 1972 Agro-Climate Classification of India, Meteorological Monograph, Agrimet No. 4 India Meteorological Department, Poona.

3.5.3. The relevant parameters and the complete (West), Madhya Pradesh (East), Gujarat Region and classification of the stations for Madhya Pradesh Saurashtra and Kutch are given below:—

TABLE 3.9

Station	PE	Summer concentration	Precipitation	Water surplus	Water deficiency	1h	1a	1m	Climatic type
1	2	3	4	5	6	7	8	9	10
Madhya Pradesh West									
Gwalior	1503·1	40·6	900·2	147·3	749·6	9·8	49·8	—40·0	DA 'da'
Sheopur	1499·5	40·2	926·3	221·7	794·0	14·7	52·9	—38·1	DA 'da'
Nowgong	1428·3	39·6	1043·9	297·7	681·7	20·8	47·7	—26·8	CA 'as'
Guna	1512·0	40·5	1219·8	473·7	765·3	31.3	50·6	—19·2	C_1A 'sa'
Neemuch	1600·7	39·8	895·4	205·2	910·0	12·8	56·8	—44·0	DA 'da'
Sagar	1543·1	38·3	1393·9	642·9	791·9	41·6	51·3	—9·6	C_1A 's_2a'
Ratlam	1519·4	37·7	975·6	331·4	874·7	21·8	57·5	—35·7	DA 'sa'
Bhopal	1553·5	39·3	1208·9	479·8	823.7	30·8	53·0	—22·1	C_1A 'sa'
Hoshangabad	1433·3	37·2	1382·8	668.4	718.3	46·6	50.1	—3·4	C_1A 's_2a'
Indore	1813·2	41·0	1053·4	277·5	1036·8	15·3	57·1	—41·8	DA 'da'
Chhindwara	1428·2	37·4	1094·1	275·6	609·3	19·3	42·6	—23·3	C_1A 'sa'
Seoni	1419·6	36·4	1445·9	576.5	549·7	40·6	38·7	1·8	C_2A 'w_2a'
Betual	1372·1	37·2	1128·7	380·6	623·5	27·7	45·4	—17·7	C_2A 'sa'
Khandwa	1728·5	39·3	960·7	192·2	959·4	11·1	55·5	—44·3	DA 'da'
Madhya Pradesh East									
Satna	1452·7	39·8	1137·1	312·7	627·8	21·5	43·2	—21·6	C_1A 'sa'
Umaria	1343·0	39·0	1351·9	595·9	586·3	44·3	43·6	0·7	C_2A 'w_2a'
Jabalpur	1401·3	38·6	1447·5	656·5	609·8	46·8	43·5	3·3	C_2A 'w_2a'
Ambikapur	1471·9	38·6	1404·8	699·2	765·6	47·5	52·0	—4·5	C_1A 's_2a'
Pendra	1408·4	38·1	1461·7	689·4	635·6	48·9	45·1	3·8	C_2A 'w_2a'
Mandla	1301·8	38·2	1420·6	622·1	502·7	47·7	38·6	9·1	C_2A 'w_2a'
Champa	1475·4	36·7	1429·1	748·5	794·4	50·7	53·8	—3·1	C_1A 's_2a'
Raigarh	1492·4	36·9	1627·0	937·5	802·4	62·8	53·7	9·0	C_2A'W_2a'
Raipur	1597.0	37·8	1388·2	640·4	848·7	40·1	53·1	—13·0	C_1A 's_2a'
Kanker	1452·2	36·6	1394·8	625·8	682·6	43·0	47·0	—3·9	C_1A 's_2a'
Jagdalpur	1392·4	34.7	1534·1	731·3	589·1	52·5	42·3	10·2	C_2A 'w_2a'
Gujarat Region									
Rádhanpur	1750·5	38·1	574·5	62·3	1237·8	3·5	70·7	—67·1	EA 'da'
Ahmedabad	1676·8	37·2	823·1	161·0	1014·1	9·6	60·4	—50·8	DA 'da'
Baroda	1574·9	37·6	985·4	81·2	1233·1	4·1	63·5	—59·3	DA 'da'
Baroda (aerodrome)	1731·9	36·8	935·0	235·9	1032·3	13·6	59·6	—45·9	DA 'da'
Broach	1727·8	35·8	1001·9	187·9	913·1	10·8	52·8	—41·9	DA 'da'
Surat	1606·3	34·2	1203·5	495·7	897·9	30·8	55·9	—25·0	C_1A 'sa'
Saurashtra and Kutch									
Bhuj	1897·1	37·0	348.7	0·0	1547·8	0.0	81·5	—81·5	EA 'da'
Jamnagar	1714·1	35·3	490·3	0·0	1223·2	0·0	71·3	—71·3	EA 'da'
Dwarka	1773.9	31·0	418·9	4·0	1358·4	0·2	76·5	—76·3	EA 'da'
Rajkot	2144·6	36·9	673·8	0·0	1470·1	0·0	68·5	—68·5	EA 'da'
Bhaunagar	1815·2	36·1	600·8	40·2	1253·8	2·2	69·0	—66·8	EA 'da'
Veraval	1685·6	31·6	702·4	138·1	1120·7	8·1	66·4	—58·2	DA 'da'

TABLE 3.10

Moisture Regions and their Limits in Thornthwaite Classification—(1955)

Climatic type	Symbol	Moisture Index Range
Per humid	A	100 and above
Humid	B_4	80 to 100
Humid	B_3	60 to 80
Humid	B_2	40 to 60
Humid	B_1	20 to 40
Moist sub-humid	C_2	0 to 20
Dyr-sub-humid	C_1	—33·3 to 0
Semi-arid	D	—66·7 to —33·3
Arid	E	—100 to —66·7

TABLE 3.11

Seasonal Variation of Evective Moisture

(a) *Moist climates (A, B C 2)*	*Symbol*	*(Aridity Index)*
Little or no water deficiency	r	0—10
Moderate summer water deficiency	a	10—20
Moderate winter water deficieny	w	10.—20
Large summer water deficiency	s_2	20 and abo ve
Large winter water deficiency	w_2	20 and above
(d) Dry Cilmate (C DE)		*Humidity In ex*
Little or no water-surplus	d	0—16·7
Moderate summer water surplus	s	16·7—33·3
Moderate winter water surplus	w	16.7—33·3
Large summer water surplus	s_2	33·3 and above
Large winter water surplus	w_2	33·3 and above

Scarcity Areas

3.6.1 The Irrigation Commission (1972)[6] observed that arid regions are areas where rainfall meets one-third or less of evapo-transpiration needs and semi-arid regions are areas where rainfall meets one-third to two-thirds of evapo-transpiration needs.

3.6.2 The Irrigation Commission (1901)[7] said that a rainfall deficiency of 25 per cent would be likely to cause some injury and deficiency of 40 per cent would generally cause severe injury, and that the former cannot be called a dry year and the latter a year of severe drought.

3.6.3 The Irrigation Commission (1972)[8] observed—

> "We had also requested the Indian Meteorological Department to assist us in laying down criteria for the identification of drought areas. The Department has defined drought as a situation occurring in any area when the annual rainfall is less than 75% of the normal. It has defined 'moderate drought' as obtaining where the rainfall deficit is between 25 to 50 per cent and 'severe drought' where the deficiency is above 50 per cent. Areas where drought has occurred, as defined above, in 20 per cent of the years examined, are considered 'drought areas', and where it has occurred in more than 40 per cent of years, as 'Chronic drought areas'.

3.6.4 Accepting the definition of drought given by the India Meteorological Department, the Irrigation Commission (1972) concluded that the drought areas were areas having 20% probability of rainfall departures of more than (—) 25% from the normal and chronically drought affected areas were areas having 40% probability of ranifall departure of more than (—) 25% from the normal. On this basis, the Irrigation Commission (1972)[8] identified the following taluks as drought-affected areas in Gujarat:—

(i) Banaskantha District.
  (1) Santhalpur
  (2) Radhanpur
  (3) Wao
  (4) Tharad
  (5) Dhanera

[6]Réport of the Indian Irrigation Commission 1972 (Vol. I) pp163—165 and Fig. 8. 2, Map prepared by the Central Arid Zone Research Institute, Jodhpur.

[7]Report of the Indian Irrigation Commission 1901—1903 part I, p. 4.

[8]Report of the Indian Irrigation Commission 1972, p. 160 para 8·14.

[9]Appendix 8·1 Volume I of Irrigation Commission Report (1972), These areas comprise about 36% of the area of Gujarat and 27% of its population (1961 Census).

(ii) Mehsana District.
(6) Harij Mahal
(7) Sami
(8) Chanasma
(9) Patan
(10) Kadi
(11) Kalol

(iii) Ahmedabad District
(12) Virangam
(13) Dhandhuka
(14) Dholka
(15) Sanand

(iv) Kaira District
(16) Cambay
(17) Matar
(18) Mehmedabad

(v) Broach District
(19) Jambusar
(20) Waghra
(21) Hansot

(vi) Kutch District
(22) Anjar
(23) Nakhtrana
(24) Abdasa
(25) Lakhpat
(26) Rahpur
(27) Khavda
(28) Khadir
(29) Mundra
(30) Bhachau
(31) Mandvi
(32) Bhuj

(vii) Surendranagar District
(33) Dasada
(34) Wadhvan
(35) Muli
(36) Dhrangadhra
(37) Halvad
(38) Limbdi
(39) Lakhtar
(40) Sayla

(viii) Jamnagar District
(41) Okhamandal
(42) Kalyanpur
(43) Jodia
(44) Kalavad

(ix) Rajkot District
(45) Malia
(46) Morvi
(47) Wankaner

(x) Bhavnagar District
(48) Bhavnagar
(49) Gadhada
(50) Vallabhipur
(51) Botad
(52) Gariadhar
(53) Kundla

(xi) Amreli District
(54) Amreli
(55) Khamba
(56) Jafrabad
(57) Rajula
(58) Babra
(59) Lilia
(60) Lathi

3.6.5 The Irrigation Commission (1972) also made the following statement about the drought affected areas of Gujarat:—

"4.23 Gujarat has suffered famine and scarcity in 23 of the 71 year of the present century. The countrywide drought of 1965-66 and 1966-67 affected five to six thousand villages in the State and conditions in 1,500—2,500 villages were particularly bad. In the 1968-69 drought, 8.8 million people in 10,000 villages were affected; in 6,000 villages the situation was acute".

"The extreme unreliability of the rainfall, particularly in north Gujarat, Saurashtra and Kutch is the main cause of drought."

"A fact finding committee set up in 1958 by the erstwhile Government of Bombay had identified parts of Banaskantha, Panchmahal, Mehsana, Kutch, Kaira, Jamnagar, Bhavnagar, Amreli, Surendranagar, Broach and Ahmedabad district as chronically drought affected. In reply to our questionnaire, the State Government has included some more areas in Kutch under the drought affected category. In all, about 40% of the land area is considered to be susceptible to drought."

"The most serious problem in the drought-affected areas of Gujarat is the lack of drinking water. Most of the villages in the scarcity areas have no permanent source of drinking water. In the course of our tour, we came across a number of villages, particularly in Kutch, where the only sources of drinking water for the people and cattle are surface tanks and shallow dug-wells. This water is

highly unhygienic. The problem of providing potable drinking water is, therefore, of the highest importance."

3.6.6 So far as Madhya Pradesh is concerned, the Irrigation Commission identified the following tehsils as drought affected:—

(i) Jhabua District
  (1) Jhabua
  (2) Thandla
  (3) Patlawad
  (4) Jobat
  (5) Alirajpur

(ii) Dhar District
  (6) Dhar
  (7) Radnawar
  (8) Sardarpur
  (9) Kukshi
  (10) Munawar
  (11) Tappa (Dharampuri)

(iii) Dewas District
  (12) Bagli
  (13) Khategaon

(iv) Ujjain District
  (14) Khachrod
  (15) Ujjain
  (16) Tarna

(v) Khargaon District
  (17) Rajpur
  (18) Harwani

(vi) Khandwa District
  (19) Khandwa
  (20) Harsood

(vii) Datia District
  (21) Datia

(viii) Shajapur District
  (22) Shajapur

(ix) Betul District
  (23) Betul
  (24) Bhainsadehi

3.6.7 The state-wise position of taluk/tehsil area and population subject to drought is indicated by the Irrigation Commission in the following table:—

TABLE 3.12

Area and Population affected by Drought

State	Number of districts	Number of tehsils talukas	Geographical area (000 hectares)	Population (000 persons)[10]
Gujarat	11	60	7,070	5,480
Madhya Pradesh	9	24	4,090	3,070

3.6.8 Madhya Pradesh has, however, adopted the view of the Maharashtra Fact Finding Committee 1960 (MR-34, Volume I, page 9) and considered the following factors for determining the areas affected by scarcity:—

(a) Rainfall.

(b) Annavari and Land Revenue Suspension data.

(c) Declaration of scarcity in the past.

On this basis the extent of scarcity areas worked out by Madhya Pradesh is shown below:

TABLE 3.13

Extent of Scarcity Areas

State	As per criteria followed by the Fact Finding Committee 1960 (Lakh acres)	As per criteria recommended by the Irrigation Commission 1972 (Page 166 Vol. I) Lakh acres
Madhya Pradesh	460·32 (MP/574 p. 20)	101·02
Gujarat	161 (MR/34 vol I p. 77 to 81)	174

In our opinion, this method of estimating of scarcity areas cannot be accepted as reliable. We agree with the criticism of the Irrigation Commission at page 161, Volume I of its Report as below:—

"8.18 Annawari is the system of estimating the condition of crops by visual assessment. It is assessed in terms of annas in the rupee.* In the south, a twelve anna crop is considered to be a normal crop. Where the crop is four annas or less the recovery of land revenue is suspended in full. Where it is between four annas and six annas, one-half of the land revenue is remitted. The frequency of the suspensions of

[10]1961 Census

*(anna = 1/16th of a rupee)

land revenue over a period of time can provide an indication of the frequency of drought.

8.19 The Krishna-Godavari Commission had examined 'Annawari' as a criterion for determining areas susceptible to drought. It found, however, that the rules and regulations relating to the suspension or remission of land revenue differed from State to State, and even from district to district in the same State. In some cases, the commission found that the revenue suspended or remitted in a year exceeded the total amount of the dry assessment. Also, in the jagir areas, no data was made available. That Commission also found that land revenue had been suspended or remitted in circumstances which were not governed by the general rules, and that the amount suspended or remitted had risen steadily over the years, which could not be attributed to adverse weather conditions alone. For example, during the decade 1941—1950, the amount suspended or remitted was three times the amount remitted in the decade 1931—1940. In subsequent years, the amount remitted was five times more than during the decade 1931—1940."

3.6.9 The Maharashtra Government in its preliminary memorandum to the Irrigation Commission had observed that the subjective element in the assessment of annawari by village officers was so large as to vitiate any identification of drought based upon annawari.

3.6.10 In 1973 the Second Maharashtra Fact Finding Committee also found that the annawari method of estimating scarcity areas should be rejected as arbitrary and unreliable (see para 4.4.4, page 35 of its Report-MR/114 Vol I).

3.6.11 In our opinion the view taken by the Irrigation Commission is correct and the definition of drought given by the India Meteorological Department should be accepted for the purposes of the present case.

Some Features of Narmada Basin

3.7.1 *Soils*—No systematic soil survey of the entire Narmada basin has been carried out so far. Reconnaissance soil surveys have been made by the Central Water and Power Commission in connection with the investigation of the Bargi, Punasa, Barna and Tawa projects. These surveys and the general data regarding the soils of India indicate that the Narmada Basin consists mainly of black soils. The coastal plains in Gujarat are composed of alluvial clays with a layer of black soils on the surface.

The principal soil types found in the various districts lying in the Narmada basin are shown below[11]:

TABLE 3.14

Soils in the Narmada Basin District-wise

Sl. No.	Name of the State/ District	Type of Soils
1	2	3
	Madhya Pradesh	
1	Shahdol	Red, yellow, mixed red and black and medium black.
2	Mandla	Red, yellow, shallow black and skeletal.
3	Durg	Red loamy, red and yellow.
4	Balaghat	Red loamy, red, yellow and shallow black.
5	Sheoni	Shallow black and skeletal.
6	Jabalpur	Medium and deep black and skeletal.
7	Narasimhapur	Deep black and skeletal.
8	Sagar	Medium black.
9	Damoh	Medium and deep black and mixed red and black.
10	Chhindwara	Shallow black and skeletal.
11	Hoshangabad	Medium and deep black and skeletal.
12	Betul	Shallow and medium black and skeletal.
13	Raisen	Medium and deep black.
14	Sehore	Medium black.
15	East Nimar(Khandwa)	Medium black.
16	West Nimar(Khargone)	Medium black.
17	Dewas	Medium black.
18	Indore	Medium black.
19	Dhar	Medium black.
20	Jhabua	Medium black.
	Maharashtra	
21	Dhulia	Medium and deep black

[11]Souls of India by S. P. Raychaudhuri, R.R. Aggarwal, N. R. Datta Biswas, S.P. Gupta and P. K. Thomas.

1	2	3
	Gujarat	
22	Baroda . . .	Medium and deep black and grey brown.
23	Broach . . .	Medium and deep black and coastal alluvium.
24	Surat . . .	Medium and deep black and coastal alluvium.
25	Panchmahals . .	Medium black and grey brown

Land use and Agricultural Practices

3.7.2 State-wise land use details* in the basin for the year 1967-68 are shown below:—

TABLE 3.15

Land use details in the Narmada Basin

(Thousand hectares)

Sl. No.	Item	Name of State			Total
		Madhya Pradesh	Maha-rashtra	Gujarat	
1	2	3	4	5	6
1	Gross area .	8,586	154	1,140	9,880
2	Reporting Area .	8,584	154	1,129	9,867
3	Area under forests .	2,937	69	161	3,167
4	Area not available for cultivation .	663	5	131	799
5	Culturable area .	4,984	80	837	5,901
6	Uncultivated culturable area .	1,303	..	99	1,402
7	Net area sown .	3,681	80	738	4,499
8	Area sown more than once .	241	7	15	263
9	Total cropped area .	3,922	87	753	4,762
10	Net area irrigated .	130·3	5·2	66·8	202·3
11	Gross area irrigated .	132·4	7·9	73·2	213·5
12	Percentage of net area sown to culturable area	73·9	100·0	88·2	76·1
13	Percentage of net area irrigated to culturable area	2·6	6·5	8·0	3·4
14	Percentage of net area irrigated to net sown area . . .	3·5	9·9	9·9	4·5

The culturable area in the basin is about 3.02% of the total culturable area of India. The total cropped area in the basin forms 2.92% of the total cropped area in the country. The area under irrigated crops is about 4.47% of the cropped area in the basin. The general pattern, State-wise is as under:

Madhya Pradesh

3.7.3 Of the gross irrigated area of nearly 132,400 hectares, 31.4% is under rice, 36.5% under wheat, 5.2% under sugarcane, 4.4% under gram, 0.8 per cent under cotton and the rest under other crops. The other irrigated crops are jowar, bajra, maize, barley, pulses, fruits, vegetables, linseed, rape, mustard, tobacco and fodder crops. Food and non-food crops cover about 98.3% and 1.7% of the irrigated cropped area respectively.

Maharashtra

3.7.4 Of the gross irrigated area of 7,900 hectares, 51.9% is under wheat, 6.3% under rice, 2.5 per cent under sugarcane, 5.1% under cotton, 1.3% under grain and the rest under other crops. The other irrigated crops are jowar, bajra, maize, pulses, condiments, spices, groundnut, sesamum, tobacco and fodder crops. Food and non-food crops cover about 88.6% and 11.4% of the irrigated cropped area respectively.

Gujarat

3.7.5 Of the gross irrigated area of 73,200 hectares, 49.8% is under cotton, 11.3% under rice, 10.7 per cent under wheat, 0.4% under sugarcane and the rest under other crops. The other irrigated crops are jowar, bajra, maize, barley, condiments, spices, rape, mustard, fruits, vegetables, tobacco and fodder crops. Food and non-food crops cover aboutu 37.8% and 62.2% of the irrigated area respectively.

3.7.6 Summing up, of the total irrigated area in the basin, nearly 23.6% is under rice, 28.1% under wheat, 17.7% under cotton, 3.5% under sugarcane, 2.8 per cent under gram and the rest under other miscellaneous crops. Food and non-food crops cover about 77.2% and 22.8% of the irrigated area respectively.

From the agricultural point of view, the seasons are (i) the kharif or monsoon (15th June to 14th October), (ii) the rabi or cold weather (15th October to 14th February) and (iii) the hot weather or summer season (15th February to 14th June). Wherever irrigation facilities exist, perennial and eight-

*Source: Irrigation Commission Report (1972) Vol. III, Part I, Page 234.

monthly crops are cultivated. Cultivation is by a system of rotation of crops and the major crop seasons are the kharif and the rabi.

REGIONAL ECONOMY

Population

3.7.7 On the basis of the 1971 Census and the percentage of the area of each district lying within the basin to the district as a whole, the total population in the basin is about 10.60 million. The State-wise distribution is as under:

TABLE 3.16

*Population in the Narmada Basin**

State	Population (Millions)
Madhya Pradesh	8·07
Maharashtra	0·20
Gujarat	2·33
TOTAL	10·60

*Source : Irrigation Commission Report Vol. III, Part I, Page 337.

Jabalpur is the only city in the basin with a population of more than one lakh. The average density of population in the basin is 107 persons per sq. km. against the figure of 182 for India as a whole. The density varies from region to region. The most densely populated district of Baroda has 254 persons per sq km while the districts of Raissen and Mandla have 66 persons per sq km. Of the total population in the basin, nearly 81% live in the rural areas while the balance 19% live in urban areas. The working force constitutes nearly 36% of the total population. 42.9% of the working force are cultivators and 26.6% agriculturists. The remaining 30.5% of the working force is employed in manufacturing and other tertiary activities.

Forests and Agriculture

3.7.8 In the basin, forests occupy 32.1% of the total area and the culturable area 59.8%. Out of the total culturable area of 5.90 million hectares, nearly 4.76 million hectares are annually cultivated. 4.5% of the cultivated area is irrigated annually. Wheat is the most important irrigated crop in the basin covering nearly 28.1% of the total irrigated area.

CHAPTER IV

HYDROLOGY

DISCHARGE OBSERVATIONS AND RUN-OFF

4.1.1 Narmada is the fifth largest river in India. Yet systematic gauge and discharge observations were started on it only in the year 1947, when the then Central Waterways, Irrigation and Navigation Commission (CWINC) took up investigations for formulating flood control measures and for an assessment of available water resources that could be used for development of irrigation, hydro-power, etc. Prior to that, only a few high flood levels appear to have been observed in connection with a bridge project and for flood protection works at Broach during the year 1907 and 1919.

4.1.2 The CWINC later on designated as the Central Water and Power Commission (CWPC) opened 11 discharge observation stations on the Narmada during the years 1948—1951. These are listed in Table 4.1.

4.1.3 These stations were confined to important sites on the main river and its tributaries. The work of gauge and discharge observations was handed over to the State Governments in 1953. The State Governments continued observations at Jamtara, Tawa, Mortakka and Gardeshwar sites, but discontinued them at other places.

4.1.4 Subsequently, the State Governments of Madhya Pradesh and the then Bombay State set up a number of other gauge and discharge sites in order to prepare some schemes for increased food production. A list of Gauge and Discharge sites set up by the State Governments in the Narmada basin is given at Table 4.2.

So far as the main stream of the Narmada river is concerned, there are only three main important discharge sites, namely Jamtara (for Bargi), Mortakka (for Narmada Sagar) and Gardeshwar (for Sardar Sarovar).

4.1.5 *Jamtara,* 12 *Miles* (19 *km*) *below Bargi Dam Site—Catchment Area* 6,400 *Sq. Miles* (16.576 *Sq km*)...

Observation are reported to be carried out daily with curent meter. During rainy season, observations are made from a bridge on the South Eastern railway line from Balaghat to Jabalpur and during dry weather, the site is shifted 1,000 ft downstream where the water flows through a narrow channel. Observations from 1948 are available.

4.1.6 *Mortakka,* 37 *Miles* (59 *km*) *below Narmada Sagar Dam Site—Catchment Area* 25,942 *Sq miles* (67,190 *Sq km*).

Daily observations are reported to be made with floats at a section 3000 ft downstream of a railway bridge on the Western Railway (meter gauge) from Khandwa to Indore. Observations from 1948 are available.

Gardeshwar, 11 *km* (7 *miles below Sardar Sarovar Dam Site—Catchment Area* 34,496 *Sq miles* (89,345 *Sq km*)

4.1.7 From 1948 to 1961 daily observations were made by float method with the help of a boat plying across the river. In April, 1961 a high level bridge was completed across the river for the Eastern State Highway and discharge observations are reported to be made with current meter from that date. Observations made with float have been co-related, subsequently, with the observations made with current meter.

4.1.8 As was to be expected the observed annual discharge showed considerable variation between year to year at the same site of observation. Based on observations made at Jamtara, Mortakka and Gardeshwar available annual flows at different percentage of dependability are given below for the years 1948 to 1970.

Site	CA	In MAF* (In Milliard Cubic Meters) Percentage Dependability 50%	75%	90%
Jamtara	6400 Sq.M	6·80 (8·39)	5·15 (6·35)	3·58 (4·41)
Mortakka	25942	24·50 (30·22)	20·30 (25·04)	13·30 (16·41)
Gardeshwar	34496	28·70 (35·40)	22·60 (27·88)	15·20 (18·75)

8390 6350 4410
30220 25040 16410
35400 27880 18750

*Madhya Pradesh Master Plan, Vol. I, Page 77.

The figures are based on the water years 1948-49 to 1969-70.

4.1.9 At the time when the Khosla Committee was engaged in the preparation of a Master Plan of Development of the Narmada river, the discharge observations were available only for a period of 15 years from 1948 to 1962. This being too short a period to assess the dependable flow in the river, the Khosla Committee decided to hindcast the run-off figures based on the available rainfall data from the earlier years. For this purpose, a rainfall run-off relationship was established for the different zones of the basin based on available rainfall and flow data for the years 1948 to 1962. The Khosla Committee felt that the rainfall data available for periods earlier than 1915 was for stations few and far between and as such would not correctly represent the rainfall over the catchment. Hence the hindcasting of run-off from the established rainfall run-off relationship was limited to the period from 1915 to 1948. For the period 1948 to 1962, the observed run-off figures were recast from the rainfall data, on the basis of the rainfall run-off relationship established as above. The result of such study by the Khosla Committee showed the figures of annual flows for different dependabilities at the three important sites in the river as below:—

Site	In MAF* (In Milliard Cubic Metres) Percentage Dependability		
	50%	75%	90%
Jamtara	8·72	6·68	4·84
	(10·76)	(8·24)	(5·97)
Barwaha	31·17	25·14	19·72
(Mortakka) . . .	(38·45)	(31·01)	(24·32)
Navagam	35·94	28·92	22·59
(Gardeshwar) . . .	(44·33)	(35·56)	(27·56)

Madhya Pradesh in its submission to Khosla Committee stated that the observed flows being more direct and reliable should be adopted for calculating the dependable yield and that if hindcasting through rainfall run-off relationship was to be done, it should be extended to the period upto the year 1891 in order that certain series of drought years are also taken into account. Gujarat contended that instead of developing separate formula for different zones, it was advisable to adopt a single formula based on rainfall-runoff relationship for the entire catchment above Gardeshwar. Gujarat also observed that a reduction co-efficient of 0.885 should be adopted instead of the reduction co-efficient of 0.85 (adopted by the Committee) for converting surface velocity to mean velocity. The contentions of Madhya Pradesh and Gujarat were not accepted by the Khosla Committee.

4.1.10 In June 1966 the Ministry of Irrigation and Power suggested that a joint discussion at official level between the States of Gujarat, Madhya Pradesh, Maharashtra and Rajasthan should be held with the Chairman of CWPC to consider the technical aspects of Narmada water resources dependable flow of the river at Navagad may be various data available, it was agreed between the party States that "for present planning, the 75% dependable flow of the river at Navagad may be taken as 27 MAF" and that "the net utilised flow to be adopted for present planning may be taken as 28 MAF."

"Taking the 75% dependable flow as 27 MAF and allowing for:

(i) evaporation losses for major and medium reservoirs and minor tanks, say,	—4MAF
(ii) regeneration or return flow, say,	+2MAF
(iii) effect of carry over storage of 5 MAF, say	+3MAF

It was agreed that the net utilised flow to be adopted for present planning may be taken as 28 MAF."

Regarding planning for power projects it was agreed as follows:—

"Utilisable supply for power would have to be determined on a much higher dependability than that for irrigation. It was agreed that the installed capacity at any site was generally to be determined on the basis of:

(i) 90% dependable flow, as on full development

(ii) a load factor of 30% as on full development

(iii) for utilisation in the early stages, when irrigation is not fully developed, if economic studies justify there should be no objection to having:

(a) power generation at other sites, or

*Khosla Committee Report Page 48, para 5·28.

*Note :—Aggregate of all annual withdrawals from the main rivers and its tributaries.

(b) larger installation than those indicated by (i) and (ii) above."

4.1.11 The different provisions made in the agreed figures are explained below:

(i) For the purpose of utilising the water a large number of dams would be constructed and from the water surface of the reservoirs so created evaporation will take place resulting in loss of available water. The evaporation losses have been assumed to be 4 MAF (4.93 milliard cubic metres).

(ii) In the upstream projects, there will be substantial withdrawal of water for irrigation. All this will not be fully consumed and a part of this supply will return to the river through underground sources and drainage channels and is considered as return flow which will make more water available for downstream projects. This will to a large extent depend on the nature of irrigation, soil characteristics etc. and cannot be accurately determined and this return flow has been assumed as 2 MAF (2.47 milliard cubic metres).

(iii) Some carry over is expected to be provided in the different reservoirs which was assumed as 5 MAF (6.17 milliard cubic metres). This was assumed to increase the available supply by 3 MAF (3.7 milliard cubic metres).

4.1.12 Before this Tribunal Gujarat accepted the assessment of the Khosla Committee regarding yield series at Sardar Sarovar Dam site for different dependabilities and has indicated the same as under:

Percentage of dependability	Yield in MAF	In Milliard Cubic Metres
50%	35·94	43·25
75%	28·92	35·56
90%	22·59	27·76

Gujarat further mentioned that the utilizable quantum at Navagam would depend on the storages planned at appropriate locations.

4.1.13 Madhya Pradesh has computed the discharge from rainfall run-off relationship for the period from 1891 to 1948 and from actual run-off observations from 1948 to 1962. On this basis Madhya Pradesh has worked out the dependable flows as under:—

Site	In MAF (*) (In Milliard Cubic Metres) Percentage dependability 75%
Jamtara	6·36 (7·82)
Mortakka	23·61 (29·04)
Gardeshwar	27·14 (33·38)

NOTE: The yields at 50% and 90% dependabilities have not been given by Madhya Pradesh.

Madhya Pradesh has also pointed out by references to the observed discharges that the dependable accretion to the flow below Mortakka is small.

4.1.14 Maharashtra claimed that dependable river flows may be worked out based on observed discharges for the 15 years together with calculated discharges based on rainfall run-off relationship for the years 1891 to 1948. On this basis Maharashtra has worked out the dependable flow as under for project sites near the gauge sites.

Sites	In MAF † (In Milliard Cubic Metres) Percentage Dependability 50%	72%	90%
Jamtara			Not indicated in the pleadings
Narmadasagar	26·40	22·15	16·10
(Mortakka)	(32·56)	(27.32)	(19·86)
Navagam	33·95	27·17	19·24
(Gardeshwar)	(41·88)	(33·51)	(23·73)

4.1.15 In view of the pleadings of the party States the following issue was framed by the Tribunal:—

What is the utilisable quantum of the waters of Narmada *at Navagam Dam site on the basis of 75% and other dependability*?

*Madhya Pradesh, Further and better Particulars (Vol. XVII) Page 87.

†Maharashtra Statement of Case (Vol. 5)—Page 25, para 4·1.

(Issue No. 7 framed by the Tribunal at the Seventh meeting on 28-1-71 as amended by Order of the Tribunal dated 26-4-1971).

4.1.16 On 12th July, 1974, the Chief Ministers of Madhya Pradesh, Maharashtra, Rajasthan and the Adviser to the Governor of Gujarat came to an agreement of which clause (3) was to the following effect:—

> "the quantity of water in Narmada available for 75% of the years may be assessed at 28 million acre feet and that the Tribunal in determining the dispute referred to it may proceed on the basis of this agreement."

This agreement came up for consideration of the Tribunal and in its judgement dated 8-10-1974, the Tribunal decided this issue as follows:—

> "We accordingly accept the agreement of the party States on this issue (that is, issue No. 7) quantum of waters in Narmada at Navagam dam site on the basis of 75% dependability should be assessed at 28 million acre feet."

4.1.17 The question as to the total utilisable flow at 75% dependability at Navagam dam site has therefore been settled but the Tribunal felt it necessary that the dependable flows at different sites in the river as well as the run-off series on which such dependable flows are based should also be settled. Some discrepancies were noticed in the flow data filed by the party States. After a discussion the party States agreed to adopt the yield series from 1891 to 1970 as the basis for the further studies, taking into account observed values from 1948 to 1970 and hindcast series from 1891 to 1948. The series under discussion were based on the calendar year (from 1st January to 31st December). It was considered desirable that the series should be recast for the water year and that the water year may be taken from the 1st of July to 31st June of next year. On the 24th November, 1974, the technical experts of the States agreed to accept the yield series for the Mortakka and Gardeshwar sites as recast by Madhya Pradesh. The yield at different dependabilities as per this agreement is as under:—

Sites	In MAF (In Milliard Cubic Metres) Dependability Flows		
	50%	75%	90%
At Mortakka . . .	27·46 (33·90)	22·01 (27·15)	16·45 (20·29)
At Gardeshwar . . .	33·20 (40·95)	27·22 (33·58)	19·77 (24·39)

The actual series of annual flows at Mortakka and Gardeshwar agreed upon by the technical experts is given in Table 4.3 (Ex C-3).

On 26th December, 1974, the party States submitted to the Tribunal that the yield series (Ex C-3) agreed upon by the technical experts at the November 1974 meeting may be accepted and taken on record. The Tribunal agreed to this request.

TABLE 4.1

Discharge sites set up by CWINC

Sl. No.	Name of Station	Name of river	Year of establishing site	Purpose for which station established
1	Manote	Narmada	1948	To know discharge for Bilghara Dam site.
2	Bargi	Narmada	1948	To know discharge at Bargi Dam site.
3	Jamtara Rly. bridge . . .	Narmada	1949	To know discharge below Bargi Dam site (Bargi discontinued).
4	Punasa	Narmada	1951	To know discharge for Punasa Hydro-Electric Project.
5	Mortakka Rly. Bridge . . .	Narmada	1948	To know discharge for Punasa Hydro-Electric Project.
6	Khora Khada	Burhner	1949	To know discharge of Burhner river for Ghugri Dam.
7	Mohgaon	Burhner	1948	
8	Dhudhi Rly. Bridge . . .	Dhudhi river	1950	For Dhudhi Project.
9	Bargi	Barna	1949	To know discharge of Barna for Bargi Irrigation Project.
10	Tawa Dam site	Tawa	1949	To know discharge of Tawa for Tawa Irrigation Project.
11	Gardeshwar	Narmada	1948	To know discharge for Broach Irrigation Project.

TABLE 4.2

Gauge and Discharge Sites up by State Government in Narmada Basin

Sl. No.	Name of site	Name of river	Nature of observations	Observing Agency	Remarks
			I. *Madhya Pradesh*		
1	Sankalghat	Narmada	Gauge and discharge	Hiran Irrigation Division.	Data available from June 1965 to date.
2	Hoshangabad	Narmada	Do.	Irrigation Division Narsinghpur.	Data available from July 1963 to date.
3	Dharamarai	Narmada	Do.	Khargone Irrigation Division.	Observations started in 1960 by CW & PC. Taken over by M.P. Govt. in June 1962.
4	Lawakheri (Kolar Dam)	Kolar	Do.	Irrigation Division. Bhopal.	..
5	Surai Dabha	Kolar	Do.	Do.	Started in June 1954.
6	Sukta Dam site	Sukta	Do.	Sukta Irrigation Division.	Started in July 1954.
7	Barbaspur	Banjar	Gauge and discharge	..	Observations started in 1956 and continued.
8	Chipaghat	Hiran	Gauge	Hiran Irrigation Division.	Data available from September 1955 to March 1956. Site shifted to Pondi.
9	Pondi	Hiran	Gauge and discharge	Do.	Data available from March 1956 to date.
10	Dhorda Mohar	Tawa	Gauge	Do.	-
11	Chiddgam	Ganjal	Gauge	Do.	..
12	Harda Khas	Anjal	Gauge	Irrigation Division, Narsinghpur.	..
13	Mandla	Machak	Gauge	Sukta Irrigation Division.	Set up in June 1956.
14	Asapur	Agni	Gauge	Khargone Irrigation Division.	Data available from July 1955.
15	Bhamgarh	Chhota Tawa	Gauge	Do.	Data available from July 1955.
			II. *Gujarat*		
1	Broach	Narmada	Gauge	Dy. Engineer N. H. Sub-Division, Broach.	Observations continued from 1887 to date.
2	Rajpipla	Karjan	Gauge and discharge	Narmada Irrigation Circle.	Station was set up in 1954.
3	Jojwa	Orsang	Gauge	Baroda Panchayat Division.	Observations taken on weir.
4	Bodeli	Orsang	Gauge and discharge	River Gauging Sub-division.	Observations continued from June 1957 to date.
5	Wasna	Herang	Do.	Baroda Irrigation Division.	Observations continued from September 1951 to date.
6	Amadra	Unch	Do.	River Gauging Sub-division.	Observations continued from June 1952 to Feb. 1955.
7	Kikawada	Sukhi	Do.	Do.	Observations continued from June 1957 to date.

Source : Khosla Committee Report, Pages 30, 31 Table 5.2.

TABLE 4.3 (Exhibit C-3)

Annual Yield Series based on Hydrological year from 1st July to 30th June at Mortakka and Garudeshwar Sites

Hydrological year July—June	Inflow MAF at Mortakka	Inflow MAF at Garudeshwar
1	2	3
1891-92	41·41	55·18
92-93	33·95	43·88
93-94	37·81	46·70
94-95	36·71	45·71
95-96	19·62	22·84
96-97	29·46	33·94
97-98	25·18	39·10
98-99	28·93	35·15
1899-1900	4·86	4·81
1900-01	29·30	34·45
01-02	26·89	29·90
02-03	15·99	20·10
03-04	27·46	32·92
04-05	15·14	18·28
05-06	22·01	27·47
06-07	26·04	33·45
07-08	15·45	18·80
08-09	27·46	31·95
1909-1910	17·43	22·05
10-11	28·19	36·02
11-12	21·00	22·94
12-13	22·98	27·39
13-14	23·52	30·23
14-15	25·40	31·33
15-16	33·07	39·91
16-17	38·44	47·12
17-18	39·70	49·10
18-19	17·13	19·77
19-20	43·21	53·67
1920-21	16·50	21·39
21-22	23·98	30·49
22-23	25·42	31·60
23-24	36·73	44·08

TABLE 4.3 (Exhibit C-3)—*contd.*

1	2	3
24-25	28·53	35·77
25-26	25·13	29·71
26-27	39·29	46·83
27-28	25·47	32·22
28-29	26·91	33·20
1929-30	26·85	32·43
1930-31	29·97	37·73
31-32	37·55	46·37
32-33	29·35	35·87
33-34	37·73	47·10
34-35	37·79	43·73
35-36	28·43	31·86
36-37	36·12	41·28
37-38	37·41	43·21
38-39	35·23	41·51
39-40	31·38	35·37
1940-41	31·67	37·98
41-42	15·11	18 12
42-43	38·58	45·96
43-44	36·16	42·41
44-45	48·80	60·01
45-46	32·48	38·72
46-47	36·23	44·69
47-48	86·03	41·76
48-49	35·874	42·822
1949-1950	27·459	33·696
50-51	26·000	32·983
51-52	13·786	16·435
52-53	20·667	21·520
53-54	21·627	23·037
54-55	24·976	31·482
55-56	50·800	40·578
56-57	33·439	35·314
57-58	17·747	19·839

TABLE 4.3 (Exhibit C-3)—*contd.*

1	2	3
58-59	24·544	27·222
59-60	42·271	53·970
1960-61	26·188	29·049
61-62	49·621	61·230
62-63	21·462	25·065
1963-64	21·450	23·289

TABLE 4.3 (Exhibit C-3)—*contd.*

1	2	3
64-65	26·919	27·984
65-66	8·633	10·035
66-67	13·807	15·728
67-68	24·449	30·487
68-69	21·945	27·118
69-1970	32·819	43·669

NOTE :—Figures prior to 1948-49 are based on Hind Casted series and from 1948-49 to 1969-70 are observed values at concerned sites.

Sd/- K. L. HANDA
Irrigation Adviser
M.P.

Sd/- M. G. PADHYA
Chief Engineer,
Maharashtra

Sd/- D. M. SINGHVI
Superintending Engineer
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Sd/- I. M. SHAH
Superintending Engineer
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Sd/- M. R. CHOPRA
Assessor

CHAPTER V

DETERMINATION OF THE CULTIVABLE COMMANDED AREA OF GUJARAT AND MADHYA PRADESH

5.1.1 The Anderson Committee defined the terms Gross Area, Gross Commanded Area, Culturable Area, Culturable Commanded Area etc., as follows (Ex MR-80 page 5):

Gross Area—The total area within the extreme limits set for irrigation by a project system or channel.

GCA—That portion of the gross irrigable area which is commanded by flow irrigation.

Gross irrigable area—The gross area less such area within irrigation limits as may be excluded for any reason from irrigation by the project, system or channel.

Culturable irrigable area—The gross irrigable area less the area not available for cultivation, *e.g.* village area, roads and unculturable lands.

CCA—That portion of the culturable irrigable area which is commanded by flow irrigation.

Culturable lift area—That portion of the culturable irrigable area which can be irrigated by lift.

5.1.2 The glossary of technical terms published by the Central Board of Irrigation (Ex MR-104) gives practically the same definitions as the Anderson Committee Report.

SECTION A

CULTIVABLE COMMAND AREA OF GUJARAT

5.2.1. *Previous History*

In 1956 a report on the Broach Irrigation Project in the erstwhile Bombay State was prepared by the Central Water & Power Commission, Government of India. This scheme comprised a weir across Narmada River at Gora with a canal taking off on the right bank to provide for annual irrigation of 10.97 lakh acres in culturable commanded area of 11.01 lakh acres. The Broach command area was 13.3 lakh acres upto the Mahi river. Some time in September, 1957, Member, Central Water & Power Commission, suggested shifting of the site of the weir 2.5 km higher up the river and also provision of a high-level canal to irrigate areas in the Mahi and Sabarmati basins in Gujarat which formed a part of the erstwhile State of Bombay at that time. The Broach Project was modified as per Ex G-76. The high-level canal, called the Great Narmada Canal, was proposed under Stage II for commanding a gross area of 9.4 lakh acres. This canal was proposed to take off from the Mahi right Bank canal at the off-take of the Shedi branch. The additional irrigation in Mahi and Sabarmati Basins was anticipated as 4.4 lakh acres in an additional gross command of 5.6 lakh acres.

5.2.2 In 1964, a brief report on Narmada Project with FRL 425 was prepared by Gujarat (Ex G-183). The CCA and annual irrigation for the Stage I were indicated as 14.4 lakh acres and 12.24 lakh acres, respectively. Additional areas were contemplated for irrigation in Stage II and Stage III, as per table below (Extract from page, 35, Ex G-183):—

(In Lakh acres)

	Stage I	Stage II	Stage III	Total
Gross Command area .	19·22	33·12	28·12	80·46
Culturable Command area.	14·44	20·80	16·55	51·79
Annual Irrigation . .	12·62	12·61	14·96	40·19

5.2.3 Before the Narmada Water Resources Development Committee (hereinafter referred to as NWRDC), Gujarat indicated a gross command area in Zones I to XI of 78.64 lakh acres. In this, the cropped command area was given as 50.51 lakh acres. The annual irrigation proposed was 38.31

lakh acres. Subsequently, areas in the Little Rann and Great Rann, including Banni, were included for allotment of water. Areas presently under irrigation from the Mahi right bank canal were also proposed for transfer to the Narmada command, and the water so released was proposed to be utilised for areas from the Kadana high level canal, ex-Mahi River at Kadana. The areas other than Mahi command and the Ranns were divided into 11 Zones.

5.2.4 Madhya Pradesh has contended that the CCA of Gujarat, as claimed before the Narmada Water Resources Development Committee, was only 31.74 lakh acres for the area within these 11 Zones. The NWRDC did not go into the question of culturable commanded areas, but allocated water on the basis of areas proposed for irrigation.

5.2.5. In the official-level discussions of August, 1966, the CCA of Gujarat for areas excluding the Mahi command and the Ranns was indicated as 51.47 lakh acres (Ex G-73, Vol. 1, page 10).

CASE OF GUJARAT

5.3.1 Gujarat has estimated the GCA, CA and CCA in the Sardar Sarovar Project with+300 canal, and in subsequent Exhibits. Gujarat has pointed out in the Written Submission-I, page 25, that the GCA of the Narmada Canal+300 was worked out at 126.26 lakh acres, excluding the coastal salines covering an area or 4.5 lakh acres. This includes an area of 6.4 lakh acres of Banni and 29.6 lakh acres in the Ranns. Thus, the gross command excluding the Banni and the Ranns (but including Mahi Command) works out to 90.26 lakh acres, which has been planimetered on maps, as indicated by Gujarat. The case of Gujarat has been that for purpose of water allocation, the areas of GCA, CA and CCA can be worked out on the basis of taluka-wise statistics. On the basis of fully commanded talukas and partly commanded talukas in the command, Gujarat has worked out the land utilisation statistics for 1964-65 in Ex G-425 Enclosure-I. Based on taluka-wise statistics, the GCA, CA and CCA have been worked out in Ex G-626 and the water requirements have also been worked out therein. Subsequently, Gujarat has re-planimetered the partly commanded talukas in the command and prepared the GCA, CA and CCA afresh in Exhibit G-1019. The GCA and CA based on taluka-wise statistics of 1964-65 have been compared with village-wise land utilisation statistics for 1968-69, as given in the Census reports, as per Exhibit G-425, Enclosure-3 and with village-wise land utilisation statistics of 1964-65, as per Ex G-822. Gujarat has contended that the areas, as worked out in Exhibit G-425, G-426, G-715, G-716, G-822 and G-1019, are in broad agreement, though the different exhibits are based on land utilisation statistics for different years.

CGA of Sardar Sarovar Project

5.3.2 The gross command of the project excluding the Banni and the Ranns, has been planimetered as 90.26 lakh acres. This comprised 81.357 acres in Zone I to XI, and 8.903. lakh acres of the Mahi command. In Exhibit G-425, Enclosure-3, Statement-I, Column-5, the extent of total rural area in the command excluding the Ranns but including Banni and Coastal Salines, is 97.85 lakh acres. Deducting 6.4 lakh acres of the Banni and 4.5 lakh acres of coastal salines (on the basis of planimetering), and adding 3.62 lakh acres of urban area, as per Column 4 of the Enclosure, the gross command of Zones I to XI and the Mahi command comes to 90.57 lakh acres, as against 90.26 lakh acres indicated in Ex G-626.

5.3.3 As per Exhibit G-1019, the figure of GCA of Zone I to XI and Mahi command is 90.56 lakh acres, comprising 81.58 lakh acres in Zones I to XI and 8.98 lakh acres in Mahi command.

Culturable Area of Sardar Sarovar Project

5.3.4 Gujarat has filed Ex G-425, Enclosure-I, giving the land use statistics of the area commanded by the +300 canal, excluding the Ranns (also excluding Banni which is part of the Great Ranns). Gujarat has considered only five classes of land as culturable, based on the nine-fold classification. These five classes and the corresponding area in Columns 8(B) to 12(B) of the Enclosure are given below:—

(i) G—425—Enclosure I :	Acres
Col. 8(B) Miscellaneous tree crops and grooves not included in net sown area	6,800
Col. 9 (B) Culturable waste	3,57,700
Col. 10(B) Current fallows	2,54,100
Col. 11 (B) Other fallows	99,800
Col. 12 (B) Net area sown	63,38,600
TOTAL	70,57,000

	Acres
(*ii*) As per Ex G—626, the area in Zones I to XI is	63,52,700
and area in the Mahi Command is	7,04,300
TOTAL	70,57,000
(*iii*) As per G—1019, the area in Zones I to XI is	63,74,400
and area in Mahi Command is	7,07,800
TOTAL	70,82,200

5.3.5 The other four categories of the nine-fold classification are—(1) Land put to non-agricultural use, (2) Permanent pastures and other grazing area, (3) forests, and (4) barren and unculturable areas. The areas for these four classifications are indicated in Ex G-425 Annexures 1 and 4 and are given below:—

Enclosure I :	Acres
Col. 6 (B) Land put to non agricultural use	3,49,800
Col. 7(B) Permanent pastures and other grazing area	4,17,800
Enclosure 4 :	
Col. 8 Total forests	4,48,200
Col. 9 Barren and unculturable areas	11,42,000
TOTAL	23,57,800

Enclosure 4 is based on district-wise totals and not the taluka-wise statistics. The total of all the nine classes of land thus works out to 94.15 lakh acres (70.57 + 23.58) instead of 90.26 lakh acres, as planimetered in Ex. G-626, and 90.523 lakh acres as planimetered in Ex. G-1019. The details of the different classes of land are indicated in Statement 5.1.

5.3.6 Gujarat conceded that the totals of all classes of land exceed the reporting area but argued that the reconciliation was carried out by (1) changing the area of forests as given by the Taluka Panchayats to bring it in conformity with the figures under forests, as given by the district Forest Officers, and (2) adjusting the area of barren and unculturable lands to reconcile the total of reporting area. The extent of such reconciliation needed for these two classes is 3,88,700 acres. Gujarat contended that the figure of culturable area comprising the five categories of land, does not need any adjustment due to the totals of all classes of land exceeding the physical area, as that discrepancy has to be adjusted in forest areas and areas designated as barren and unculturable areas only.

5.3.7 As per G-626, page 12, the CA in Mahi command is given as 7,04,300 acres. Deducting this area, the CA of the Zones I to XI, excluding Mahi, is taken as 63.53 lakh acres (i.e. 70.57—7.04 lakh acres). As per Exhibit G-1019, the culturable area of Zones I to XI is given as 63.74 lakh acres.

Culturable Commanded Areas of Sardar Sarovar Project.

5.3.8 In Vol. I of Gujarat statement of case, page 68, the Gross Commanded and Culturable Command area of Navagam Canal with + 300 off-take level from Sardar Sarovar Reservoir are given in Table G.T.9, excluding Mahi command, Banni and Ranns:

Gross Commanded Area in		Culturable Commanded Area in	
Lakh hectares	Lakh acres	Lakh hectares	Lakh acres
33.38	82.46	21.90	54.05

5.3.9 While giving the above figures, Gujarat stated that allowance had been made for certain areas which may not in practice be commandable on the basis of the detailed planning of the canal system, although from the study of topography the entire culturable area could be classed as commandable, and further that certain areas having inferior soils had been left out, and some areas were reserved for pastures and groves. It was mentioned that about 4.15 lakh hectares (10.24 lakh acres), as given in Exhibit G-948, were not proposed for irrigation, although these areas could be classified as culturable commanded areas. It was also said that some of these areas left out would get benefit of under-ground water wherever successful tubewells were feasible. As such, the culturable commanded areas proposed for the +300 canal system excluding Mahi command, Banni and Ranns, would be 21.90 lakh hectares (or 54.05 lakh acres). The CCA as per Exhibit G-626 is 54.017 lakh acres, as worked out in Statement 5.2.

5.3.10 A detailed note, as to how the CCA had been arrived at for the command, excluding the Ranns and the Banni, is given in Annexure 12.1 to the Project Report, Ex. G-177 (pages 257 to 260 of Vol. VIII). The details of cultivable areas, which are not included in the CCA, are briefly given below:—

(a) *Deduction for Local High Patches*—This was done as per rough assessment on the basis of Mahi Command. An area of 3.55 lakh acres is not included in CCA of 61.25 lakh acres (As per exhibit G-262, the CCA is 60.35 lakh acres, and the deduction is 3.52 lakh acres, including 0.35 lakh acres in Mahi). In pursuance of the directions given by the Tribunal (vide proceedings of the meeting dated 19th April, 1976—item 34), Gujarat has filed studies giving extent of areas under high patches and area occupied for development works, including canals, distribution system, roads etc. vide Exhibits G-1024, 1025, 1026, 1027, 1037 and 1038, for three representative blocks in the low-level canal command, near Ahmedabad and near Meshana, respectively, in the command of +300 FSL Navagam Canal. The percentage as per its written reply-8 page 94 is about 5.64 per cent. As such, Gujarat considers that 5 per cent assumed by it is justified.

(b) *Culturable Waste*—It is stated in the Sardar Sarovar Project Report that according to sample survey carried out by the Agriculture Department, about 56 per cent of the cultivable waste areas cannot be brought under cultivation at reasonable cost. An area of 1.46 lakh acres has not, therefore, been included in the CCA. This included deduction for the Mahi Command. As per Exhibit G-626, this is given as 1.99 lakh acres, including 0.04 lakh acres in Mahi.

(c) *Inferior Soils*—It is stated in the Sardar Sarovar Project Report that according to soil surveys, about 3.71 per cent of the gross command falls under Class V soils. Gujarat said that about 60 percent of such soils will not be brought under irrigation. Thus, about 2.09 lakh acres are excluded from the CCA (2.02 lakh acres, as per Exhibit G-626). Mahi is said to have no such area. In the course of its argument Madhya Pradesh Pointed out that the soil surveys carried out by Gujarat and its estimate of Class V soil, Ex. G-577 page 127 were not dependable. In CMP 87 of 1976, the Tribunal gave permission to Gujarat on 9-5-1976 on its own request to re-classify the areas on the basis of available data and, where such classification was not possible to indicate areas unsuitable for irrigation. Gujarat has filed the revised classification and the abstract of this classification is given in Ex G-1081. Land irrigability classification has been done for 35.08 lakh acres (excluding Mahi), in which Class VI areas are 2.48 lakh acres, and Class V lands are 7.29 lakh acres. Suitability classification has been done for 26.42 lakh acres of which a portion of 2.57 lakh acres is unsuitable for irrigation.

(d) *Area Irrigated from Tanks and other Sources*—Gujarat stated that 0.45 lakh acres are at present irrigated by tanks and other sources in the command area referred to above. Only 50 per cent of this area has been excluded, as those sources are considered to provide irrigation of low reliability. About 0.22 lakh acres are not included in the CCA on this account.

In Ex. G-626, Gujarat has included command area of existing schemes and excluded areas irrigated by tanks, other sources and ground water from the CCA.

(e) *Area Irrigated by Ground Water*—About 3,69,000 acres were stated to be irrigated by ground water in the command during the year 1964-65 out of this, about 10 per cent was said to be irrigated by tube-wells. It is estimated by Gujarat that after introduction of irrigational from Narmada Canal, additional potential of irrigation of 2.95 lakh acres, largely through shallow tube-wells, will be created. Thus, the ultimate ground water potential in the command area would be as under:—

	Area
Existing surface wells	3,32,000
Tubewells	37,000
Future (shallow tube-wells)	2,95,000
TOTAL	6,64,000

Gujarat stated that, as irrigation from wells is relatively expensive, and surface well irrigation, has low reliability, the cultivators, who have to depend at present on well irrigation, will switch over to flow irrigation. It is presumed by Gujarat that about 67 per cent of the area now under surface well irrigation, will be transferred to flow irrigation after it is introduced. Thus, about 1.1 lakh acres only, out of the area under surface well irrigation, will not receive flow irrigation. It is further assumed by Gujarat that the area under tube-well irrigation, *i.e.*, 0.37 lakh acres, will continue to remain under tube-well irrigation, and is, therefore, deducted from the CGA. As regards the future potential of 2.95 lakh acres, likely to be created after introduction of flow irrigation, the shallow tubewells are proposed to be so planned that about 2/3rd of this area, *i.e.* 1.97 lakh acres, will be in local highly patches, and the remaining 0.96 lakh acres will be located in the area otherwise commandable by flow irrigation. Hence the area which is not to be included in the CCA, has been worked out as under:—

	Lakh acres
Out of existing surface well irrigation .	1·10
Under tube-well irrigation at present .	0·37
Out of future potential under shallow tubewells	0·98
TOTAL . . .	2·45

(2.46 lakh acres, as per Ex G-626 of which 0.32 lakh acres is in Mahi command).

5.3.11. Thus, the cultivable area not proposed to be included in the CCA of the Narmada Canal Command, excluding Banni and Ranns, but including Mahi Command, has been worked out as follows. Ex G. 626 gives slightly different figures:—

Lakh acres

		G—626 Zones	for* Mahi
(1) Local high patches .	3.55	3.17	0·35
(2) Cultivable Waste .	1.46	1.95	0·04
(3) Inferior Soils . . .	2.01	2.02	..
(4) Area Irrigated by tanks .	0.22	0.22	..
(5) Area Irrigated by groundwater	2.45	2.14	0·32
TOTAL . . :	9.69	9.50	0·71

*Figures in G—676 are later figures, which supersede Project figures.

CASE OF MADHYA PRADESH

5.4.1 The main objections of Madhya Pradesh are given in the Written Submission IV Counsel of Madhya Pradesh also filed the following statements during the argument:—

M. P. Statement 34— Discrepancies in Land use statistics.

,, 35— Adjustments of land use statistics to correspond to Planimetered area.

,, 36— Discrepancies in total of Taluka-wise areas.

,, 37— Discrepancies in Reporting area.

,, 38— Discrepancies in Forest Areas.

,, 39— Discrepancies in area not available for cultivation.

5.4.2 Madhya Pradesh has submitted a Statement 54, showing variation in zone-wise CCA. The total CCA for Zones I to XI given in Columns 7 to 11, are as follows:—

Column	In Lakh acres
7. 1966 official level discussions (August, 1966) G—73 Annexures, page—17 . . .	50·51
8. 1971 Sardar Sarovar Project Report G—177, Vol. III, pages 256 and 280 . . .	54·05
9. 1975 Details of requirements of Navagam main canal FSL 300 based on land utilisation statistics—G—630-A, Column 8 . . .	54·02
10. 1975 Details of water requirements of Navagam main canal FSL 300; June, 1975G—626 pages 12—19	54·43

5.4.3 Further information, as compiled in Statement 75 of Madhya Pradesh, is as follows (for areas in the Zones, Column 10, 11, and 12):—

Zones I to XI

(In lakh acres)

1975		1976	1976
Zone wise details based on 1964-65 statistics with CMP 309/75 of Gujarat—805 page 2, Col. 10		Filed with CMP 107/76 Taluka-wise break up G-862, page 22, Col. 11	Filed with CMP 147/76 Taluka-wise & Zone-wise deductions—G-948,-pages 4—5, Col. 12
GCA	81·360	81.357	81.357
CA	63.530	63.520	63.527
CCA	54·020	54.017	54.017

5.4.4 In Ex G-805, Gujarat has given figures by Zones for GCA, CA and CCA in lakh acres for the entire command. For Zones I to XI, the CCA given is 54.02 lakh acres.

5.4.5 In Ex G—862, Gujarat has supplied Talukawise break-up of GCA, CA and CCA for each zone under FSL+300 Canal based on the land use statistics for the year 1964-65. The total CCA under Zones I to XI comes to 54.017 lakh acres.

5.4.6 Pursuant to the directions of the Tribunal on CMP 341 of 1975 of Madhya Pradesh, Gujarat filed Taluka-wise break-up of GCA, CCA for each Zone under +300 Navagam canal, based on the land use for the year 1964-65 as per Ex G-948, and various deductions are shown. The total CCA of Zones I to XI comes to 54.02 lakh acres. It will be noted that deductions are given in Columns 6 and 7 which are made from Col. 5 of CA. Figures in Col. 6 are taken from G-626. Table-II, Col. 10 of Statement III, for local high patches, cultivable waste, inferior soils, areas irrigated by tanks and other sources, and are irrigated by ground water. Figures in Column 7 have been worked out pro-rata from the future ground water potential of the gross command area on the basis of gross Command area of each Taluka in the Zone and total gross command areas of Zones I to XI and Mahi Command.

5.4.7 The total reporting area, as obtained from the details of the village exceeds the physical area of the villages in the command. Gujarat has made an adjustment for this by correcting the figures for forest and barren and unculturable area. The forest area has been corrected to tally with the figures as supplied by the Forest officers and the balance discrepancy is adjusted in barren and unculturable area. Madhya Pradesh contended that the forms of village statistics contain details of forests as well as unculturable areas, and hence there is no justification for correcting only these categories, and proportional correction should be made in all categories, instead of making corrections in only one or two categories.

5.4.8 Gujarat considered that some portion of the inferior soils will be improved and included in the area to be irrigated. Madhya Pradesh has argued that inferior soils should be excluded from the benefit of irrigation and that even Class IV lands, which have severe limitation, should be taken out from the purview of irrigation. Even if it is decided to allocate some water to these areas, Madhya Pradesh contends that only seasonal irrigation should be allowed.

5.4.9. Madhya Pradesh has objected to the revision of the planning of several irrigation projects in Gujarat for areas lying in the command of the canal which were originally proposed to be benefited by those projects but irrigation needs are now proposed to be met from the Narmada Canal, and the waters so released from these projects used upstream of the Narmada Canal Command. Madhya Pradesh claims that such areas should be excluded from the CCA.

5.4.10 Madhya Pradesh has made its own calculation of the CCA of Gujarat in its statement 137 as follows:—

CCA of Gujarat according to Madhya Pradesh

Particulars	Quantity	Reference
1. GCA (excluding Banni and Ranns)	90.260 lakh acres	Ex G—948 page 5.
2. CA	70·57 lakh acres	
3. CA excluding Mahi	63·53 lakh acres	
4. *Deduction from CZ*	Lakh Acres	
(i) Overestimated area due to adjustment $\frac{63 \cdot 53 . . 2 \cdot 92}{70 \cdot 57}$	(—)2·63	M.P. Statement 35
(ii) Overestimated area due to misclassification in land records $\frac{63.53 \times 3 \cdot 97}{70.57}$	(—)357	M. P. Written Rejoinder Vol. IV, page 83, para 34.
(iii) Existing area under irrigation by wells, tubewells and by pumping in 1973-74	(—)8·79	G-795 page 1 Col 13 (The CA served by existing schemes will be more than 8·79 lakh acres but on the figures of CCA is accounted for.)
(iv) Existing area under irrigation by medium & minor schemes in 1973-74	(—)0.94	G-799 page 239 Col. 9
(v) Area unsuitale for irrigation e.g area under land irrigability class V and VI soils (22.60 present for LLC and 30.43 per cent for other areas)	(—)18.47 lakh acres	*CA under LLC 11 01 lakh acres See C-176/1-PP 47-48. G-1081, G-1035 percentages given in MP Statement 135 item IV(a) and IV (c)
LLC $11 \cdot 01 * + \frac{22 \cdot 60}{100 \cdot 00} = 2.49$		
Other areas $(63.53 - 11.01) \frac{30 \cdot 43}{100} \times 100.00 = 15 \cdot 98$		
	(—) 34.40 lakh acres	

Particulars	Quantity	Reference
(*vi*) Local high patches as assumed by Gujarat $(63.54—34.40 \times \frac{1}{20}$	5% (—) 1·46 lakh acres	Actually the percentages of high patches will be more (8%) but 5% is assumed as given by Gujarat (Reference M.P. Written Rejoinder Vol. IV page 71).
(*vii*) Area under exsting and contemped scheme lat by surface flow excluding Mahi	(—)4.59 lakh acres	MP-626 page 33 Col. 5, excluding Mahi area.
(*viii*) Total—*deduction* .	(—)40.45 Lakh acres	
5. Balance CCA . . (63·53—40·45)	23·08 Lakh acres	

CONTENTIONS OF MAHARASHTRA

5.5.1. The contentions of Maharashtra regarding the CA and CCA of Gujarat are given in its Note 7.

5.5.2. Gujarat has worked out the culturable area in the command of Navagam canal at 70.57 lakh acres, which corresponds to a GCA of 94.148 lakh acres, giving a percentage of 74.96 Maharashtra says that this percentage should be applied to the GCA of 90.26 lakh acres to give a CA of 67.66 lakh acres.

5.5.3. Deduction of 3.86 lakh acres should be made for inferior soils at 60 per cent of Class V soils which are 9.5 per cent of the culturable area.

5.5.4. Deduction from CCA should be made for areas irrigated under existing and proposed projects, as below:—

	Lakh Acres
Existing :	
Major and medium Projects	8·06
Tanks and other sources	0·45
Total . .	8·51
Proposed :	
Medium Schemes	0·93
Total . . .	9·44

5.5.5 Deduction from CCA should be made for areas irrigated from ground water sources as follows:—

	Lalh Acres
Existing (1973-74)	8·71
Future potential	3·30
Total . . .	12·01

5.5.6. Balance CCA to be served from Narmada should therefore, be 36.98 lakh acres.

BASIC FIGURES FOR CULTURABLE AREAS OF GUJARAT—ZONES I TO XI

5.6.1. The main contention of Madhya Pradesh is that "Gujarat has not been following the ninefold classification on which it relies for maintaining of the village records, the village records do not have the data which is required for the classification, the forms used are deficient and the records are defective". It is true that there are certain deficiencies in the forms used and defects in the records maintained, and there is not always uniformity in the maintenance of these forms from village to village, but the data appear, on the whole sufficiently reliable for determining the CA. We consider that the figure of 70.570 lakh acres compiled by Gujarat in Ex G. 626. Taluka-wise, for the CA given in Column 9, page 5, which were taken from Columns 8-B to 12-B of Enclosure I of G-425, are reliable enough for consideration of the culturable area of Gujarat, other than Banni and Ranns, and may be accepted as the basic figure for the CA. This figure includes 7.043 lakh acres of the CA for the Mahi command, vide Ex G-626, page 12. Hence the figure of CA, excluding Banni and the Ranns and Mahi is 63.527 lakh acres (70.570—7.043).

5.6.2. Madhya Pradesh has mentioned that the total area under various categories obtained from the details of the village-wise statistics, exceeds the physical areas of the villages in the command, and that Gujarat had made an adjustment for this by correcting the figures under forests and barren and unculturable areas. Madhya Pradesh considers that proportionate correction should have been made for areas under all the categories, instead of making correction in only one or two categories, as the detailed figures of village statistics contain details of forests as well as unculturable areas, and hence there is no justification for correcting only these categories, and has suggested that proportional correction should be made in all categories. Gujarat has, in CMP 39/1975, page 15 to 19, para 2, explained why the Director of Agriculture was substantially justified in reconciling the figures of ninefold classification by making consequential reconciliation in the figures of forests and barren and unculturable land only. Gujarat also says that its estimate of culturable area is on the lower side, as it has not included net area sown outside the holdings and cultivated area in forests, and from the village-wise statistics for the year 1964-65 (Ex

G-822), the CA works out to 71.29 lakh acres, as against 70.57 lakh acres on the basis of taluka-wise statistics for the year 1964-65, Gujarat considers that the exercise done by Madhya Pradesh in Statement 35 is erroneous, and states that categories (i) net area sown, (ii) Current fallows, (iii) other fallows, and (iv) Micellaneous tree crops, are parts of occupied area which is assessed to land revenue and hence there is no likelihood of any major discrepancy in these areas.

5.6.3 Gujarat has given a comparative statement (4 of Gujarat's Written Reply 8, pages 77—79) giving estimates of culturable areas for Zones I to XI and Mahi command from the land use statistics of village-wise and taluka-wise statistics for different years, and has put forward the plea that the CA based on the figures for the year 1964-65 tally with the figures for the year 1968-69, given in the district Census Hand Book. The CA based on the figures given in District Census Hand Book does not include culturable waste and land under miscellaneous tree crops, nor does it include figures for urban areas.

5.6.4 After examining the contentions of Gujarat, Madhya Pradesh and Maharashtra, we consider that an estimate of 63.527 lakh acres for CA for Zones I to XI, may be accepted as reasonable figure.

Determination of CCA of Gujarat for Zones I to XI

5.7.1 We shall now proceed to indicate how the CCA of Zones I to XI should be determined.

Area Irrigated by Ground Water

5.7.2 Gujarat has made a deduction of 2.142 lakh acres as per column 9 of Statement 3 of Exhibit G-626, for area irrigated by ground water, of which 0.88 lakh acres is from future ground water potential. On the other hand, Madhya Pradesh has shown a deduction of 8.79 lakh acres, as per item 4(iii) of their statement 137.

Conjunctive use of Surface and Ground Water

5.7.3 The report of the Irrigation Commission has dealt with the problem of conjunctive use of surface and groundwater in paras 5.38 to 5.51 of their report. Para 5.38 states:—

> "5.38. We have already stressed the need for taking ground water resources into account while preparing river basin plans. This is particularly desirable where the ground water supply is ample or where it is expected to improve with the advent of canal irrigation. There are several ways of making combined or conjunctive use of surface and ground waters. It can take the form of full utilisation of surface water supplies supplemented by ground or the direct use of ground water during periods of low canal supplies or canal closures. It can also take the form of irrigating pockets exclusively with ground water in a canal command, especially where the terrain is uneven. Planning for combined use of surface and ground water calls for greater ingenuity than is needed for their separate use. It has to be admitted that so far no projects have been planed on the basis of such combined use of water. Such combined use as is now practised was not pre-planned but has come into being out of necessity."

5.7.4 The basic point for consideration is whether the culturable area, which has proven or potential ground water resources from shallow wells or deep or medium depth tubewells, should be excluded from the flow command of a project.

5.7.5 Designing of an irrigation project on the basis of 75 per cent dependability of river flows is a great improvement on some of the older projects designed on mean yearly supplies, or less. Even then the delay in the onset of monsoon or break in it, may cause substantial damage to crops if they are to depend wholly on flow irrigation, especially as the cultivators have to invest more due to higher inputs. Also the high yielding varieties require that supply of water to irrigated crops should be timely, adequate in depth and in number of waterings. Such shortage of supplies at critical times can only be met by ground water. Ground water can also serve areas which are not under canal irrigation.

5.7.6 Another aspect of the problem requiring consideration is whether an area having proven or potential source of ground water, should be excluded from flow irrigation command simply because it has an alternative source. It is established that flow irrigation, wherever available, is much cheaper than irrigation by groundwater. A land owner, in the command of canal, should not be at a disadvantage simply because he has an alternative source of ground water. In Northern India it has been the general policy that the land owners in the command of a project were not discriminated on this account, and every one in the command area was given a share of flow irrigation proportionate to his CCA. It was then left to his ingenuity and economic judgement to make the best conjunctive use of flow irrigation and ground water. Where cannal

supplies were inadequate, farmers made greater use of groundwater. In Punjab, farmers have been growing, in recent years, a great deal of rice in spite of low rainfall, by making conjunctive use of canal water and ground water.

5.7.7 The availability of groundwater may be compared to extra benefit available to areas of relatively higher rainfall, and water allowance is not reduced on that account. Proper conjuctive use of rainfall and water available from canals or wells usually results in change of crop pattern and sometimes increase in intensity of cultivation.

5.7.8 It has been also established that higher crop intensities can be achieved mainly in areas where conjunctive use of flow irrigation and ground water is made. In Madhya Pradesh, a large number of shallow wells exist and some have been dug recently on the initiative taken by the enlightened cultivators. They are a good source of irrigation; it is not proposed to make any reduction on account of such wells, either in Madhya Pradesh or in Gujarat.

5.7.9 Considering all the above factors, we consider that CCA to be served by a project should also include areas having or likely to have, groundwater resources, whether from shallow wells, medium or deep tubewells.

5.8.1 Total deduction for Columns 5, 6, 8 and 9 given in Statement 3 of Exhibit G-626, will then be as follows: —

		Lakh Acres
Col. 5	Local high patches . .	3·176
Col. 6	Culturable waste	1·950
Col. 7	Inferior soil (other than the deductions to be made for unsuitability of land for irrigation, which would be dealt with separately)	Nil
Col. 8	Area irrigated by tanks and other sources (other than Mahi) 7·44—6·33 for Mahi Command	1·110
Col. 9	Area irrigated by groundwater including future potential	Nil
	Total . .	6·236

The culturable commanded area after the above deductions will be computed as follows—

CA of Gujarat

	Lakh Acres
Zones I to XI, as per para 5·6·4· .	63·527
Deduct area as above	6·236
Balance area to be considered for CCA . .	57·291

Permanent Pastures and other Grazing Lands

5.8.2 Madhya Pradesh has included permanent pastures and other grazing lands in the category of culturable area. Gujarat has not included such areas and has also objected to Madhya Pradesh's inclusion of such areas. For land utilisation statistics, the pastures may not be considered as culturable, the stress being more on crop producing areas, and need for grazing areas being maintained for the use of cattle, etc. Irrigated fodder crops, especially green fodder, are needed increasingly to give better cattle-feed for the improved breeds being increasingly introduced. In most of the dairy projects, it has been mentioned that generally two cows would need an acre of irrigated green fodder. Thus, there appears to be need to bring substantial pastures area also under irrigation. It is, therefore, reasonable to include 75 per cent of the area of pastures in Gujarat in CCA. This would still leave 25 per cent area (about one lakh acres) of unirrigated pastures and grazing land.

5.8.3 The area of pastures and grazing lands has been indicated to be 4.178 lakh acres, and 75 per cent of that area would be 3.133 lakh acres. Thus, the total CCA will be as follows: —

	Lakh Acres
CCA, as per para 5.8.1	57.291
Additional for pastures and grazing land . .	3·133
Total CCA .	60·424

Deductions for Land Unsuitable for Irrigation on account of Areas Falling in Class V and Class VI

5.8.4 First of all it is proposed to examine the area of the low level canal project (sanctioned project proposed by the erstwhile Bombay State) and determine; if possible, lands falling under the category unsuitable for irrigation. The detailed soil surveys of this area have been carried out and a report is given in Ex G-171. In that report, the lowest category of lands is indicated as Class IV, which is irrigable with special ameliorative methods, like subsurface drainage, leaching, green manuring etc., and is potentially fertile. Such areas comprise 2.6 lakh acres out of a total of 11.49, giving 22.6 per cent (Ex G-171, page 44). The lands have now been classified as Class V and Class VI under the new classification by Gujarat. A reasonable estimate would be that 75 per cent of such lands are not suitable for irrigation even after special measures. Hence the percentage of areas to be excluded would

work out to 17 per cent. These areas are in the lower contours and include a large segment of area known as Bhal lands. Since most of the command of the high-level canal now proposed would be in somewhat higher contours, the drainage conditions there would be better and, therefore, area unsuitable for irrigation might not be as high as in the case of the low level command.

5.8.5 Under the new classification given by the Government of Gujarat, classification into Class V, Class VI and areas otherwise unsuitable for irrigation (under suitability categories) has been done for CCA of 61.503 lakh acres out of a GCA of 78.039 lakh acres. The summary of the revised classification has been given in Ex G-1081. The total area categorised under Class V, VI and otherwise unsuitable for irrigation, are as given below:—

	Lakh Acres
(1) Class V	7·288
(2) Class VI	2·485
(3) Unsuitable for irrigation	2·573
Total	12·346

5.8.6 Assuming that 40 per cent of Class V lands will eventually be suitable for irrigation, the total area proposed to be deducted as unsuitable, would be 9.43 lakh acres, or approximately 15 per cent. The details are given in items 5 to 9 of Statement 5.4.

5.8.7 The contention of Madhya Pradesh regarding land irrigability classification applies to the total surveyed area and not specifically to the CA. Since in determining CCA, lands which fall in the lower categories of Class V and VI would tend to get eliminated on account of the land use to which they are put, this percentage cannot be applied to determine the net figures of CCA. Gujarat has pointed out that the contention of Madhya Pradesh is not applicable as the categorisation has been carried out making use of the available data. Further, the low level canal area for which surveys wider done at an earlier date also indicate inferior soils as about 17 per cent, as per para 5.8.4. Considering that the areas proposed to be commanded by +300 canals are at comparatively higher elevations, we consider that the deduction of 15% for inferior soils, as determined above, is reasonable.

5.8.8 The net CCA, after allowing this deduction, will work out as follows:—

	Lakh Acres
CCA, as worked in para 5.8.3	60·424
Deduction @ 15 per cent	9·064
CCA suitable for irrigation	51·360

5.8.9 Gujarat and Madhya Pradesh were requested to work out the deductions that would be necessary on account of proposed irrigation channels and other development works. Gujarat has estimated this percentage as 2.6 in Ex G-1024 to 1027, 1037 and 1038. It is proposed to make a deduction of 2.6 per cent from the net CCA proposed for irrigation. Applying this deduction to the net CCA of 51.36 lakh acres, as per paragraph above, the CCA for which water is to be allotted would be 51.36 less 1.34, i.e. 50.02 lakh acres.

5.8.10 Out of the area of CCA proposed to be irrigated as above, the area proposed to be irrigated by lift without the use of Gujarat's device for drop and lift for crossing the depressions, would be about 4.00 lakh acres, as per estimate worked out in Statement 5.5.

Conclusion

5.9.1 For all these reasons, we consider that CCA of Zones I to XI should be estimated to be 50.02 lakh acres, of which the culturable lift area would be 4.00 lakh acres. Statement 5.6 shows at a glance as to how the CCA of 50.02 lakh acres has been worked out.

STATEMENT 5.1

Culturable Area of Sardar Sarovar Project

Zones I to XI (excluding Banni and Ranns and Mahi command), as per statistics of Taluka-wise figures 1964-65.

I. The break-up of five classes of land considered as culturable area by Gujarat is given below:—

G—425 Encl 1	Lakh Acres
Col. 8(B) Land under misc. tree crops and grovers area not included in area sown	0·068
Col. 9 B culturable waste	3·577
Cot. 10B current fallows	2·541
Col. 11B other fallows	0·998
Col. 12B Net sown area	63·386
Total	70·570

Culturable area :—

(*a*) In Zones I to XI . . .	63·527	G-626-Encl 3 (63·744 as per G—1019)
(*b*) In Mahi . . .	7·043	G—666-Encl 3 (7.078 as per G—1019)
	70·570	(70·822 as per G—1019)

II Areas considered as not Culturable

G—425 Encl 1

Col. 6B Land put to non-agricultural use	3·498	lakh acres
Col. 7B permanent pastures and other Grazing area . .	4·178	,,
	7·676	,,

G—425 Encl 4 (based on district-wise statistics)—

Col. 8 Total Forest . . .	4.482	lakh acres
Col. 9 Barren & unculturable .	11·420	,,
	15·902	
Total . .	23·578	
Total area of all classes . .	94·148	,, (However, the area as planimetered, is 90·260 as per G—626).

STATEMENT 5.2

Culturable Command Area of Sardar Project

Zones I to XI :

	Culturable area In Zones I to XI	Culturable area In Mahi Command	In lakh acres Total
	63·527	7·043	70.570
Deductions for CCA as per G-626/3			
Col. 5—Local high patches . .	3·176	0.352	
Col. 6—Culturable waste . .	1·950	0·040	
Col. 7—Inferior soils . .	2·022	..	
Col. 8—Area irrigated by tanks and other sources . .	0·220	0.003	
Col. 9—Area irrigated by groundwater (including future potential in brackets) . .	2·142 (0·880)	0.319 (0·100)	
Total *Deductions*	9·510	0·714	10.224
Culturable command area . .	54·017	6·329	60.346

Thus, culturable Command area, as worked out by Gujarat, in Zones I to XI is 54.017 lakh acres.

STATEMENT 5.3

Madhya Pradesh Statement 137 (Revised) (Revised MP Statement 84)

CCA and Water Requirements of Gujarat according to Madhya Pradesh

Sl. No.	Particulars	Quantity	Reference
		Lakh Acres	Page 5
1	CA (excluding Banni and Ranns as the Ranns and Banni areas are not reclaimable).	90.26	G-948
2	CA Do.	70·57	Do.
3	CA excluding Mahi command as the Mahi command is committed to be irrigated (and partly already being irrigated) from the Mahi waters. (See M.P. Written Submission Vol. VII pages 80-89 paragraphs 16 to 20 and MP Written Reply Vol. VII(2)Page—14 para 9) (70·57—7·04).	63·53	Do.
4.	*Deduction from CA*		
	(*i*) Over estimated area due to adjustment $\frac{63.53 \times 2.92}{70.57}$	(—) 2.63	MP Statement 35
	(*ii*) Over estimated area due to misclassification in land records $\frac{63.53 \times 3.97}{70.57}$	(—) 3.57	MP Written Rejoinder Vol. IV, page—83, para 34
	(*iii*) Existing area under irrigation by wells, tube-wells and by pumping in 1973-74	(—) 8.79	G—795, page 1 Col. 13 (The CA served by existing schemes will be more than 8.79 lakh acres but only the figure of CCA is accounted for)
		—14.99—contd.	
	(*iv*) Existing area under irrigation by medium & minor schemes in 1973-74	(—) 0.94	G—799, page 239, Col. 9
	(*v*) Area unsuitable for irrigation e.g. area under land irrigability class V and VI soils (22.60 percent for LLC & 30.43% for other areas)	(—) 18.47	*CA under ILC 11.01 lakh acres See G—176 I-PP 47.48
	LLC $11.01^* \times \frac{22.60}{100.00} = 2.49$	2.49	G-1081, G—1085 percentages given in MP Statement 135 item IV (*a*) and IV(*c*)

STATEMENT 5·3—*Contd.*

Srl. No.	Particulars	Quantity	Reference
		Lakh Acres	
	Other area $\frac{(63.53-11.01)\times 30.45}{100.00}$ =15.98	(—) 34.40	
	(*vi*) Local high patches 5% as assumed by Gujarat $\frac{(63.53-34.40)\times 1}{20}$	(—) 1.46	Actually the percentage of high patches will be more (8%) but 5% is assumed as given by Gujarat (Reference MP written Rejoinder Vol. IV page—71)
		Lakh Acres	
	(*vii*) Air under existing and contemplated schemes by surface flow excluding Mahi	(—) 4.59	MP—626 page 33 Col. 5, excluding Mahi area
	(*viii*) Total deduction	(—) 40.45	
5	Balance CCA (63.53—40.45)	23.08	
6	Water available from enroute river (0.41+4.03)	4.44	G—462 & MP/626 pages 23—24 and MP 1062 pages 65—67 para 21.
7	Area that can be irrigated with a delta of 2.18 feet* by the waters of the enroute rivers shown in item 6 above $\frac{4.44+10}{2.18}$	30.37	*MP Statement 26
8	Balance CCA (23.08—20.37)	2.71	
9	Add possible overlapping of area in item 4(*iii*) (*iv*) 4(*vii*)	2.00	The area irrigated from Mahi weir was about 1.65 lakh acres in 1973-74 (G—1001) Gujarat has stated in Gujarat Written Reply 8,(Pp 93—98) that some of the area irrigated by Mahi weir is included in G—795 (item 4(*iii*) above) Madhya Pradesh does not admit this contention of Gujarat (see MP Written Rejoinder Vol., VII (I) PP 41—42 para 15). About, 2 lakh acres is 2 however, accounted for to cover the possible over lap.
10	Total balance area (CCA) to be served (item 8+item 9)	4.71	
11	Water requirements of Gujarat for 4.71 lakh acres at a delta of 2.18 *feet. $\frac{4.71\times 2.18}{10}$	1.03 MAF	*MP Statement 26
	say ..	1.00 MAF	In MP statement 2 the share of Gujarat is worked out as 1.35 MAG

STATEMENT 5.4

Culturable Commanded Area of Gujarat—Zones I to XI Peroentage of Area considered Unsuitable for Allotment of Water

		Area in Lakh Acres	Reference
1.	Total GCA in Zone I to XI	A 81.360	P. 46 G—1081 & G—630A for deduction for Mahi.
2.	Urban area to be excluded from GCA	B 3.051	P. 4 and 5, G—425 (Enclosure 3).

Note—(1) Madhya Pradesh has submitted that the ground water potential in Gujarat in the command area is of the extent of 15 lakh acres (Madhya Pradesh Written Rejoinder. vol. VII (1) page 32 para (*iii*). After introduction of irrigation in the area from the en route rivers the ground water potential will increase further (Refer Madhya Pradash Statement 78 page 18 remarks Column). Thus substantial ground water potential is not accounted for in the above calculations. It would be more than adequate to take care of any variation in the estimate of avaliability from en route rivers in item 6.

(2) The above calculation are without prejudice to Madhya Pradesh's contention that Gujarat is not entitled to a 300 FSL Canal

(3) According to the analysis of Madhya Pradesh (MP—1135 (2) Annexure I) the area under land irrigability classes V and VI is much more than 18.47 lakh acres (assumed in item 4 (*v*) above on the basis of G—1085 and G—1081).

	Area in Lakh Acres		Reference
3. Balance CCA considered for command =(A—B)	C	78.309	
4. GCA for which reliable soil surveys are available in Zones to XI, as per Gujarat's Summary Report of Land Irrigability Appraisal of the Command	D	61.503	P. 46, G—1081.
5. Area of Class V Unsuitable for irrigation as per the following details : Area calssified as Class V (Considered temporarily not suitable for irrigation pending further investigations) is 7,23,738 acres (G—1081, p. 48) Gujarat has considerd that about 60% or Class V lands will not be brought under irrigation. Adopting 60%, the area to be excluded is 7,28,738 × 60/100	E	4.372	
6. Area of Class VI (considered not suitable for irrigation).	F	2.485	G—1081, p. 50.
7. Area Classified as unsuitable (As per classification into suitability categories).	G	2.573	G—1081, p. 50.
8. Total area considered as unsuitable for irrigation out of D above (E+F+G)	H	9.430	
9. %age of unsuitable area as compared to area for which reliable soil surveys are avallable.	H/D	15.3 say 15 percent	

STATEMENT 5.5

Estimate of Culturable Lift Areas
Saurashtra Branch

CCA, CA and GCA of areas above gravity canal, in Zones XI-A, XI-B(i) and XI-B(ii) have been indicated in G-783, page 8, as below, in lakh acres :—

Zones	GCA	CA	CCA
XI A	3.19	2.77	2.46
XI-B(*i*)	2.00	1.54	1.42
XI-B(*ii*)	1.06	0.82	0.74
Urban area	0.36	..	..
	6.61	5.13	4.62

	Lakh Acres
1. Adopting basic figure of CA	5.130
2. Deductions for items excluded by Gujarat on pro-rata basis $5.13 \times \frac{6.236}{63.527} =$	(—) 0.504
	4.626
3. *Add* for Pastures and grazing land on pro-rata basis $\frac{5.13 \times 3.133}{63.527} =$	0.253
	4.879
4. Deduction of lands unsuitable for irrigation @15%	0.732
	4.147
5. Deduction for canals and other development works @ 2.6%	(—) 0.149
	3.998
say	4.0 lakh acres

STATEMENT 5.6

CCA of Gujarat (Zones I to XI) considered suitable for Allotment of Water

		(In lakhs Acres)
		63.527
1. Basic figures of CA for Zones (5.6.4)		
2. *Deductions* for items excluded by Gujarat (5.8.1)		
(*a*) Local high patches (5%)	(—) 3.176	
(b) Culturable waste	(—) 1.950	
(*c*) Inferior soils (other than lands unsuitable for irrigation)	Nil	
(*d*) Area irrigated by tanks and other sources (other than Mahi) @ 75% dependability	1.110	
(*e*) Area irrigated by ground water—including future potential	Nil	
	6.236	6.236
		57.291
3. *Add* for pastures and grazing land (75% of 4.178) (Para 5.8.3.) (Para 5.8.3)		3.133
		60.424
4. *Deductions* or land unsuitable for irrigation		
(*a*) 60% of Class V lands	4·372	
(b) Class IV lands	2.485	
(*c*) Otherwise unsuitable for irrigation	2.573	
(para 5.8.6.)	9.430	
The percentage deduction is $\frac{9.43}{61.503} = 15.3$ say 15		
Adopt 15% deduction (para 5.8.8) $\frac{(60.424 \times 15)}{100}$		(—) 9.064
		51.360
5. *Deduction* for canals and other development works @2.6% (para 5.8.9)		(—) 1.340
Net CCA to be considered for allotment of water (Para 5.8.9)		50.02

SECTION B

CULTURABLE COMMAND AREA OF MADHYA PRADESH

Pre-dispute History

5.10.1 Madhya Pradesh has, in its statement 16, indicated that its estimate of culturable command area (CCA) was considered as 60 lakh acres in Narmada basin in 1960, and this has now been increased to a culturable command area of 70.70 lakh acres.

5.10.2 Ex G-51 reproduces extracts from a report of the *Ad hoc* Committee in connection with the investigations of the River Valley Projects, Government of India, Ministry of Works, Mines & Power. That Committee considered it feasible to bring under irrigation 37 lakh acres of cultivated and culturable land in Madhya Pradesh in the Narmada basin. Only eight storages and a number of barrages were contemplated. This estimate was based on investigation made in 1948.

5.10.3 The Broach Irrigation Projects, *vide* Ex G-176, page 5, indicates that GCA for all the schemes in Narmada basin works out to 60.12 lakh acres. It assumed that areas under minor and scarcity-area schemes will be same as under major and medium schemes. At page 11, 16 schemes are listed as having a potential of 30.06 lakh acres. This includes Punasa Project (now Narmadasagar) with a CCA of 1.21 lakh acres and Barwaha Project (now Omkareshwar) with a CCA of 1.48 lakh acres.

5.10.4 Ex MP-17 (Irrigation & Power Potential of Madhya Pradesh 1963) shows that the area to be irrigated in the Narmada basin was estimated at 46 lakh acres. Page 6, para 9(b), of the Exhibit indicates that the assessment does not include medium and minor schemes.

5.10.5 The outline Master Plan (Ex MP-74) estimated the culturable area as 128.22 lakh acres, and the culturable command area as 77.50 lakh acres.

5.10.6. The Narmada Water Resources Development Committee (Ex MP-166) estimated that the culturable area was 128.22 lakh acres out of the basin area of 212.33 lakh acres and a portion of 82.2 lakh acres was sown annually.

5.10.7 Madhya Pradesh has indicated that detailed investigations for all the schemes could not be carried out due to historical reasons and non-availability of maps of adequate scale and the very large number of schemes envisaged and planned and so the assessment had to depend on some projections based on neighbouring areas and proportionate evaluations.

Contention of Madhya Pradesh before the Tribunal

5.11.1 Madhya Pradesh has made an assessment of the culturable area and culturable command area in the Narmada basin in its Master Plan (Ex MP-312). The assessment of culturable area has been made on the basis of village-wise five-fold land utilisation statistics of 1964-65 for the reporting area. The statistics of the individual villages lying within the basin boundary have been compiled, except that for villages lying partly within and partly outside the basin, the statistics of selected villages having an aggregate area equivalent to the total basin areas covered by partly included villages, have been taken. To this, the culturable area from Reserved and Protected forests has been added, bringing the total culturable area in the basin to 143.97 lakh acres. The culturable area comprises the following categories of land:—

A. *Reporting Area*

	Lakh acres
(1) Net sown area	81·39
(2) Fallow lands	24·44
(3) Pastures & groves	12·50
(4) Culturable area in villages forests	12·58
(5) 50% of the area under rivers, Nalas and Ponds	2·75
	133·66

B. *Non Reporting Area*

(6) Sown area, included in reserved & protected forests	1·84
(7) Culturable area in reserved and protected forests which has either been excised, or will be excised for cultivation	8·37
	10·21
Total area (A+B)	143·87

Items 1 to 5 are from the Reporting area of 168.57 lakh acres, of which area not available for cultivation is 34.91 lakh acres. The non-Reporting area is 43.78 lakh acres, including 10.21 lakh acres of culturable area from Reserved and Protected forests. The total area of the basin is 212.35 lakh acres (168.57 + 43.78). Due to historical reasons, all the projects feasible in the basin have not been identified or investigated. As there are a large number of medium and minor schemes, investigations would

take a long time. Madhya Pradesh has, therefore, determined the CCA on the following basis, as explained in the Master Plan.

Zones

5.11.2 Madhya Pradesh has divided the basin into three Zones on the basis of natural units of a basin, together with the tributaries in that basin, from the view of availability of water and water planning. The three Zones proposed are—(1) the upper Zone upto Bargi; (2) middle Zone from Bargi to Narmadasagar and (3) lower Zone below Narmadasagar. These are also related to the three important discharge observation sites at Jamtara (for Bargi), Mortakka (for Narmadasagar) and Garudeshwar (for Sardar Sarovar).

5.11.3 The determination of CCA of Madhya Pradesh in the basin has been furnished by Madhya Pradesh in its Master Plan (MP-312, Vol. IA, pages 8 to 14, at paragraphs 18.20 to 18.34).

> "18.20. Statement 18.1, Vol. II, gives some particulars of all the major projects planned so far in the Narmada basin. Of these, the Central Water & Power Commission (CWPC) had carried out, between 1954 and 1964, on behalf of Madhya Pradesh, surveys and investigations of six major irrigation projects, *viz.* Bargi, Punasa (Narmadasagar) and Barwaha (Omkareshwar) on the main river and Tawa, Barna and Kolar on its tributaries. Madhya Pradesh modified and revised the above projects for reasons given in Col. 5 of Table 18.2.

TABLE 18.2

Irrigation Projects Investigated by CWPC

Sl. No.	Name of Project	Culturable commanded area— as provided by CWPC	As revised by M.P.	Reasons for modification and revision
1	2	3	4	5
		hectares	acres	
1	Narmada Sagar	23,300 55,000	121,200 300,000	(a) certain areas were left out. It was seen that by (i) extending the canal, (ii) providing lift, additional areas could be commanded. (b) Cropping intensity water depth as provided by CWPC were too low.
2	Barna	60,000 150,000	60,000 150,000	
3	Kolar	61,000 152,000	30,300 75,000	As per (*b*) above
4	Tawa	242,400 600,000	242,400 600,000	As per (b) above
5	Omkareshwar	89,200 220,000	132,100 327,000	As per (*a*) (*ii*) & (*b*) above
6	Bargi	242,400 600,000	266,000 600,000	As per (*a*) & (*b*) above
	Total	718,500	852,600	
	CCA	1,777,000	2,112,000	

The total CCA of these projects, as given in the revised project reports, are on the basis of actual field surveys and agricultural statistics."

"18.21 In addition, since 1964, preliminary studies have been carried out and field investigations and surveys are presently in different stages of progress for the following 18 irrigation and multipurpose projects (each with CCA equal to or exceeding 10,000 hectares or 25,000 acres):—

> Upper Narmada, and Chinki projects on the main river, and Upper Burhner, Halon, Dhobatoria, Sher, Machrewa, Shakkar, Dudhi Morand, Chhota Tawa, Ataria Sukta, Upper Beda, Man, Lower Goi Jobat and Ganjal Projects on different tributaries of the Narmada. Gross project area of irrigation for each of these 18 project has been determined on the basis of actual surveys, and in their absence, from a study of topo-sheets. Culturable area has been worked out on the basis of village statistics. Culturable commanded area has been taken generally as 90 per cent of the culturable area of the project. The total CCA on these 18 projects works out to 397,415, hectares (982,000 acres)" Projects reports for all these schemes have been prepared and field by now.

"18.22 The total CCA of all the 24 major irrigation projects, described above works out to 1,253,000 hectares (3,094,000 acres). This includes 123,000 hectares (303,000 acres) which will be irrigated by lift ranging from 7.6 to 41.7 metres (25 to 137 ft.) Statement No. 18.2 Vol. II of Ex MP-312, shows the Projects-wise distribution. Zone-wise, as follows:—

TABLE 18.3

Zone wise distribution of CCA

Zone	Thousand hectares	Thousand acres
Upper	51	125
Middle	899	2222
Lower	302	747
Total	1252	3094

"18.23 *Medium Projects Identified*—For a detailed study of the irrigation potential by medium projects and minor schemes, an essential requirement is large scale 1 : 15,000(about 4 inches-1 mile) maps of the basin, with contour intervals of 1 to 3 metres (about 3 to 10 feet). The best maps available are to a scale of 1:63,360 (1 inch=1 mile), with contour intervals as far apart as 15.2 metres (50 feet). Even these maps are not available for some portions of the basin, which lie in the territories of the erstwhile State of Vindhya Pradesh, Bhopal and Madhya Bharat. Even so, from a study of such maps, as are available to a scale of 1:63,360 (1″ = 1 mile), and 1:126,720 (1″ = 2 miles), and surveys carried out, Madhya Pradesh has identified as many as 441 medium projects (each with CCA from 405 hectares to 10,120 hectares (1,000 to 25,000 acres). The number includes all projects already in operation or under construction. Statement 10.3 Vol. II of Ex MP-312, shows for each of the principal tributaries, and groups of smaller tributaries, the number of medium projects together with the aggregate CCA on these projects."

"18.24 The gross project area of each of the identified medium project has been marked on the maps as available, and planimetered. For 60 projects, distributed over the entire basin, the culturable area within the gross project area of each project has been worked out from village-wise statistics. Based on the percentages of culturable area to gross project area so obtained the total culturable area of each project has been taken as 80 per cent of the gross project area in upper zone, and 85 per cent in the middle and the lower zones, except for the following tributaries or groups of smaller tributaries on which a lower percentage has been adopted in accordance with village statistics, as shown below:—

Zone	Tributary of Group	Percentage of Culturable area to gross project area
Upper	Banjar	65
	Group II	70
Middle	Shakkar	75
	Dudhi	70
	Hather	70
	Tandoni	80
	Tawa	75
	Chandrakeshar	80
Lower	Goi	75

The CCA of each medium project has been taken as 85 per cent of the culturable area of the project."

"18.25 *Area under Unidentified Medium Projects*—For about 350,000 hectares (887,000 acres) for which maps even to the scale of 1:126,720 (1″ =2 miles) are not available, an estimate for the CCA of the major and medium projects and the minor schemes, taken together, has been made on a prorata basis, adopting the same ratio of CCA to GCA, as obtained for such projects in the adjoining contoured area. After deducting from this area commanded by the major projects and schemes, the rest of the CCA is apportioned to medium projects in the ratio of A/(A+B) where A is the CCA under medium projects and B is CCA of minor schemes in the adjoining area. This estimated CCA has been worked out separately and is shown in Statement 18.3 of Vol. II."

"18.26 *Minor Schemes Identified*—In addition to medium projects, there will be a very large number of minor schemes each with a CCA of less than 405 hectares (1,000 acres). It would follow from what has been stated above that, without large scale maps with relatively small contour intervals, it was not possible to determine precisely all the particulars of minor schemes necessary for planning.

Preparation of large-scale maps will take considerable time. For the purpose of this Master Plan, an attempt has, therefore, been made for that part of Narmada basin for which 1:63,360 (1″=1 mile and 1:126,720 (1″ = 2 miles) maps are available to mark as many minor schemes, as possible, by a close study of the maps."

"18.27 It was obviously not possible to mark the very small schemes with CCA, say, of less than 60 hectares (150 acres). Statement 18.3, Vol. II of Ex MP-312, shows the number of the existing and proposed minor schemes (CCA 405 to 60 hectares, or 1,000 acres to 150 acres), tributary-wise (or by groups of tributaries), as has been possible to identify on the available maps, together with CCA of these schemes. As will be seen from this Statement, the total number of identified minor schemes included in this Master Plan are 1927."

"18.28 The culturable area of such minor schemes as lie in the revenue areas, has been taken as 90% of the gross area, and of those lying in forest areas, as 80% of the gross areas. The CCA

*Such minor schemes, as have so far been undertaken in Madhya Pradesh, were based on field surveys.

of minor schemes has been determined in the same manner as for medium projects."

"18.29 *Area under Unidentified Minor Schemes*—For about 359,000 hectares (887,000 acres) for which the requisite maps are not available, estimate for the CCA of minor schemes (each with a CCA of 405 hectares to 60 hectares, or 1000 acres to 150 acres), has been made on the same basis, as per medium projects detailed in paragraph 18.25. The estimated CCA has been indicated separately in Statement 18.3, Vol. II."

"18.30 In addition to the 1927 minor schemes mentioned on paragraphs 18.27 and the estimated CCA referred to in paragraph 18.29 above, there will be numerous smaller schemes (less than 60 hectares or 150 acres each, and village tanks), which can only be located by field surveys for which some provision must be made in the Master Plan. This has been done in Statement 18.3, Col. 6 of Vol. II."

"18.31 *Pumping Schemes*—Apart from the medium and minor schemes referred to above, considerable development will be possible by pumping water from streams all over the basin and from the numerous reservoirs to be created on the main river and the tributaries. Such development has, until recently, been rather slow in Madhya Pradesh, largely for want of electricity in villages and the relatively low price of agricultural produce. But, as will appear from the following, with the development of rural electrification in the entire State, there is clear evidence of rapid development of irrigation by pumps:—

> In 1968-69 alone the number of pumps energised was almost equal to the total number energised during all the preceding years.
>
> The pace of development has kept up since. During the Fourth Plan, about 125,000 new pumps are expected to be energised in the State. Taking into account the pumps already electrified upto the Third Five Year Plan, the total number of pumps electrified at the end of the Fourth Plan will be about 157,000. It is estimated that in each of the Fifth and the Sixth Five Plans, 150,000 more pumps will be energised. The total number of pumps in operation at the end of the Sixth Five Year Plan period (1983-84) is expected to approach half a million."

"18.33 *Aggregate Area to be Irrigated*—The made by Madhya Pradesh in the Narmada basin have indicated that, on an average, a pump installed on a Nalla or a stream irrigates about 3 hectares (7.5 acres). During 1969-70, there were 2,767 pumps installed on rivers and Nallas in the Narmada basin. It was estimated that at the end of Fourth Plan, about 9,000 pumps will be installed on streams and Nallas in the Narmada basin, and by the end of Tenth Plan, 90,000 pumps will be installed.

Development of irrigation by pumps has a bright future in the Narmada basin. However, provision has been made for such development on a conservative basis. Statement 18.3, Vol. II of Ex MP-312, shows the distribution tributary-wise of 263,000 hectares (650,000 acres) to be protected by pump irrigation."

"18.33 *Aggregate Area to be Irrigated*—The aggregate CCA that would be developed by major and medium projects, minor schemes and by pumps, zone-wise, will be as follows:—

CCA proposed to be developed by Irrigation Projects

Particulars	Upper Zone	Middle Zone	Lower Zone	Total
	Thousand Hectares			
Major Projects	51	899	302	1252
Medium Projects	186	444	168	798
Minor (Storage & diversion) schemes	99	305	144	548
Pumping Schemess	12	177	74	263
Total	348	1825	688	2861
	Thousand Acres			
Major Projects	125	2222	747	3094
Medium Projects	459	1096	416	1971
Minor (Storage & diversion) schemes	245	754	356	1355
Pumping Schemes	31	436	183	650
Total	860	4,508	1,702	7,070"

"18.34 As will be seen from the above paragraphs, the total CCA proposed to be provided with irrigation facilities is 2,861,000 hectares (7,070,000 acres) against a total culturable area of 5,822,000 hectares (14,387,000 acres). Diagram 18.3 shows zone-wise culturable area and culturable commanded area by major, medium projects, minor schemes and pumping schemes."

Claims for Area for Irrigation outside the Basin

5.11.4 Madhya Pradesh has, in its Statement of Case (Vol. 4 page 69, para 5) submitted:—

> "That (i) no diversion outside the basin is permissible unless the immediate as well as

future needs of the basin are fully provided for, and (ii) diversion, if at all, is from within the equitable share allotted to the State."

In the event the Tribunal rejects this legal contention, Madhya Pradesh submits that its claims made on the basis of the upper Narmada Diversion (Ex MP-390), the upper Burhner Diversion (Ex MP-391), and Bargi Diversion Project (Ex MP-161) may be taken into account (MP Written Submission III, Page 108, and CMP-269/76) for irrigating areas in Mahanadi, Sone and Tons basins which have no other adequate source of water supply. The details of these projects are given in Ex MP-894 (filed with CMP 269/76). The GCA, CA and CCA of these projects are as below:—

Lakh Acres

S. No.	Project	GCA	CA	CCA
1	Bargi Diversion	6.760	6.020	4.830
2	Upper Narmada Division	0.394	0.338	0.243
3	Upper Burhner Diversion	1.033	0.872	0.960
	Total	8.207	7.230	6.033

CONTENTIONS OF GUJARAT

5.12.1 Gujarat has argued that Madhya Pradesh has not given details of minor schemes in its pleadings. Madhya Pradesh has proposed 24 major irrigation projects, 441 identified and 16 assumed medium schemes, 1927 identified and 130 assumed minor schemes with CCAs over 150 acres each and a large number of minor schemes with CCAs less than 150 acres each, equivalent number of such schemes given by Madhya Pradesh being 1173 and a large number of pumping schemes. For six major projects, original project reports have been prepared by CWPC, and for the Revised Projects for increased CCA, no command area surveys have been carried out. For the remaining 18 major projects, no proper surveys and investigations for feasibility of projects sites, reservoir surveys, command area surveys and soil surveys have been carried out.

5.12.2 As regards medium and minor schemes, the essential large-scale maps of 4" to 1 mile, with contour intervals of 3 to 10 ft., are not available. For 60 projects, which have been used as a basis for determining the percentage of CA and CCA, the details of the break-up have not been retained and are not available. For 25 model schemes, details of GCA, as given in Exhibit MP-350, vary to a large extent from respective GCAs given in the proformae. CCA for 22 Schemes in Kundi basin vary, as given in appraisal made in March 1968, pleadings and in performae.

5.12.3 In case of minor schemes, large-scale maps would take considerable time to prepare and until that time, the potential of irrigation by medium and minor schemes could be estimated on general considerations only, such as total cultivable area. Therefore, it is impossible to make any realistic assessment of the CCA on any project-wise basis.

5.12.4 In its pleadings, Madhya Pradesh estimated the CCA in the Narmada basin in Madhya Pradesh by applying different percentages to the cultivable area in the three different zones of the basin. Determination of the CCA on basin-wise basis, is linked to the determination of culturable area in the basin. Gujarat contends that, according to the figures given by Madhya Pradesh, the culturable area in Madhya Pradesh for the purposes of planning of irrigation would be only 100.31 lakh acres. The figures, given by Madhya Pradesh and as given by Gujarat, are given below:—

Lakh Acres

	As given by M.P.	As given by Gujarat
1)) Net sown area	81.39	81.39
(2) Fallow Lands		
(a) Current fallows	3.37	3.37
(b) Fallows 2-5 years	5.51	5.51
		Miscellaneous tree crops & groves
(c) Fallows more than 5 years	15.56	8.69
	24.44	17.57
(3) Pastures & groves	12.50	Nil
(4) Culturable area of forests in revenue village	12.58	Nil
(5) Area under water	2.75	Nil
(6) (a) Sown area in reserved & protected forests	1.84	1.84
(b) Area excised or proposed to be excised from forests	8.37	Nil
	143.87	100.80

Gujarat has claimed that the culturable area in the basin should be based on the nine-fold classification prescribed by the Government of India, whereas Madhya Pradesh has followed the five-fold classification. The main difference relates to the following items, as indicated in Gujarat's Statement 7:—

Lakh Acres

Classification	As per five fold	As per nine fold	Proposed to be included in CA as per Gujarat
(1) Other fallows over 5 years	15.56		
(a) Permanent pastures and other grazing lands	..	18.60	..
(b) Miscellaneous	..	0.15	0.15
(c) Culturable waste	..	10.56	8.54
	15.56	29.31	8.69
(2) Pastures & groves			
(a) Orchards & groves	0.02	..	..
(b) Scrub jungle & groves	12.48	..	..
	12.50	Nil	Nil

Gujarat contends that of 10.56 lakh acres of culturable waste, 2,02 lakh acres are of Class 'C' i.e. uneconomic small patches or large blocks of land which are not reclaimable for cultivation at a reasonable cost, as given in Ex MP-365. Permanent pastures and grazing land cannot be considered as culturable area in the nine-fold classification.

5.12.5 Gujarat has also contended that Madhya Pradesh has determined the culturable areas in forest on "eye appraisal", that no soil surveys have been carried out in such forest areas excised or proposed to be excised, and that such areas should not be considered.

5.12.6 Regarding the areas under water, which would get exposed for cultivation, Gujarat contends that 50% assumed to be available is an ad-hoc figure without any justification, and that on the basis of data supplied, very little area has been cultivated in the past. It further contends that if any such area is to be cultivated, it would hardly require irrigation.

5.12.7 Gujarat, therefore, submits that the realistic assessment of culturable area in the Narmada basin in Madhya Pradesh must be taken as 100.80 lakh acres on the basis of standard nine-fold land use classification and the assessment made in March, 1970 for the Master Plan is not acceptable.

5.12.8 Madhya Pradesh has envisaged that the Irrigation should be provided to not less than 40 per cent of the culturable area in the upper zone, 60 per cent of the culturable area in the middle zone, and 35 per cent of the culturable area in the lower zone, and has estimated the total CCA in the basin at 71,92,000 acres, and observed that it would constitute 50 per cent of the culturable area of 1,43,87,000 acres. Gujarat contends that this estimate is based on exaggerated figure of culturable area in the different zones of the basin as well as unjustifiable high percentages applied to the culturable area for determining CCA in each zone.

5.12.9 The Khosla Committee, in its Report (Ex G-83, pages 67 and 68, para 6.21, 6.22 and 6.23), determined the CCA in the Narmada basin in Madhya Pradesh from the total culturable area by first determining the net available cultivable area after making the following three deductions:—

(1) Culturable area likely to be submerged under Major Projects at 50 per cent of the total submergence;

(2) Culturable area likely to be submerged under medium and minor irrigation works at 20 per cent of the total area to be irrigated there-under assumed at 40 lakh acres; and

(3) Culturable area in figures of the basin water-shed to provide catchment of 8.800 sq miles to afford run-off of 9.6 maft., for irrigating assumed CCA of 40 lakh acres under medium and minor irrigation works with overall delta of 2.4 feet, taking 25 per cent of the required catchment as culturable area.

Khosla Committee determined the net available culturable area at 83 lakh acres and the extent of area to be irrigated at 41.5 lakh acres on the basis of the following observations of the Planning Commission in their Report on the Third Five Year Plan:—

"By realising the entire potential for irrigation of 175 million acres (gross) over the next

20—25 years (by which time the cultivated area may increase to about 350 million acres), the proportion of irrigated lands may, perhaps, rise to 50 per cent."

The Khosla Committee then raised this figure to 65 lakh acres on the assumption that some pasture lands might be brought under irrigation and that minor irrigation schemes might expand to some portions of the fringe area and also to areas otherwise inaccessible to irrigation.

5.12.10 Gujarat considers the estimate of Maddhya Pradesh for CCA as exaggerated. It has earlier claimed that for major projects, for which reports are prepared by CWPC, the CCA has been increased by Madhya Pradesh without further surveys. Similarly, CCA for other major projects is based on insufficient command area surveys and soil surveys, etc. Gujarat contends that assessment of CCA of minor schemes cannot be made as large-scale maps are not available. For these reasons. Gujarat submits that project-wise assessment is not feasible and that only general assessment can be made. For this, Gujarat refers to the Irrigation Commission Report, 1972 (Ex G-512), which indicates that the irrigation potential from the surface water in Madhya Pradesh should be 28.28 million hectares, say 30 per cent of the total cultivable area. Gujarat also refers to the Maharashtra State Irrigation Commission Report, 1962 (Ex MR-23, page 35), that the Irrigation potential may be taken as a percentage of cultivable area in basins which have difficult terrain. Gujarat also cited the report of the Cauvery Fact Finding Committee, which is one of the best developed rivers in India, so far as the exploitation of irrigation potential is concerned, where the net irrigated area is of the order of 24.6 per cent of the cultivable area. On the basis of the cultivable area of 100.8 lakh acres and applying a percentage of 300 per cent. Gujarat contends that CCA in the Narmada basin in Madhya Pradesh would be of the order of 30 lakh acres.

5.12.11 Madhya Pradesh has claimed that there is a gradual increase in the sown area, the increase being over 29 per cent from 1950-51 to 1972-73, as per Madhya Pradesh Statement 17. Gujarat argued that the increase is only by a redistribution of culturable land and that it is not by making land available from unculturable area.

5.12.12 Gujarat also disputed the techno-economic feasibility of the Diversion Projects proposed by Madhya Pradesh. Regarding the Bargi (Diversion) Project Gujarat contends that the site is not suitable that long link canals are idle, that the area has high reliability of rainfall with low degree of irrigation need, that the existing cropping pattern has double cropping even without irrigation, and that Madhya Pradesh has not established that other alternative resources are not available. Regarding the Upper Narmada Diversion Project, Gujarat contends that investigations are not adequate, there is high intensity of cropping even without irrigation, and that the CCA has been over estimated by including fallow areas, areas under water, forests etc. Regarding Upper Buhmer Project, it contends that the surveys have not been carried out for the command, that the area has adequate rainfall the cropping pattern suggests high intensity even without irrigation, and CCA has been over-estimated, Gujarat therefore, submits that the extra basin irrigation needs claimed by Madhya Pradesh are of doubtful feasibility and ought to be ignored.

DETERMINATION OF CULTURABLE COMMAND AREA OF MAJOR PROJECTS

5.13.1 Madhya Pradesh has filed before the Tribunal project reports for 24 major irrigation projects in the Narmada basin in Madhya Pradesh. The total CCA on the major projects, as per the project reports, is 30.99 lakh acres (Ex MP-1156, page 26). Detailed command area surveys to prepare 5 ft. contour maps of the command for laying down the canal system, were not carried out in many of the projects (Ex MP-1156, page 6). In the case of about 6 projects, CWPC has prepared command area maps, but these projects have been subsequently revised, increasing the areas in most cases. For such increases also command area surveys are not available.

Culturable Area

5.13.2 In the case of these projects, the canal alignment has been determined on the basis of strip surveys and the command boundary has then been fixed. The village-wise statistics for this entire command area are then compiled on five-fold classification, and some of the classes of land considered as culturable. As per Madhya Pradesh Statement 29, the GCA for 15 major projects for which soil surveys have been carried out, is 37,55,124 acres, Adding 3,74,868 acres of GCA for the 9 projects, which are not included in the Statement but given in Ex MP-1156, the total GCA of the major projects comes to 41,29,992 acres. As per Ex MP-1156, Statement VI repro-

duced as Statement 5.7, the GCA for all the major projects is given as 44,60,879 acres, as against 42,87,106 acres, indicated in the Master Plan. In this area, the culturable area comprises the following categories of land, as indicated in M.P. Statement 14, and Ex MP-810:—

As per MP Statement 14		As per Exhibit MP-810		
1		2		
	(Acres)			(Acres)
Cultivated . .	29,90,167	Sown area . .		29,79,345
Culturable fallows.	3,04,650	Other uncultivated land, excluding fallow lands and culturable waste		
		A	1,51,448	
		B	62,828	
		C	70,194	
			2,84,470	2,84,470
Pastures & Groves	1,55,395	Pastures & grazing land		5,11,479
		Misc. Tree crop & Grass.		6,835
Culturable area in Revenue forests	88,149	Culturable area available from forest.		40,899
Culturable area in reserved forests	5,000			
Area under Nalas, river-beds & ponds	49,265	Culturable area under water		69,370
	2,97,809			
Extra in Tawa & Sukta without break-up given in col. 12. .	1,31,200	Fallow lands. .		1,27,177
	37,23,826			40,19,575
		Deduct—Culturable area Covered by existing & proposed medium & minor schemes.		(—)46,796
		Area considered not available for irrigation . .		(—)2,50,119
				37,22,660

The culturable area thus comes to about 37.22 lakh acres as against 34.94 lakh acres indicated in the Master Plan. The CCA has been generally assumed by Madhya Pradesh to be about 90% of the culturable area more or less on an *ad-hoc* basis.

5.13.3 The Tribunal directed Madhya Pradesh to carry out detailed surveys for blocks of about 50,000 acres under the command of each of the three major projects—Bargi, Tawa and Narmadasagar. Madhya Pradesh has accordingly field information regarding detailed surveys for a block of about 50,000 acres each in each of the three major projects, viz., Bargi, Narmadasagar and Tawa, in Exhibits MP-852 and 956, 854 and 982 and 853 and 957, respectively. On the basis of the results of the surveys Madhya Pradesh has computed that the CA is 84.6 per cent, 91.7 per cent and 96.5 per cent of the GCA and the CCA is 85.7 per cent, 93.6 per cent and 95.8 per cent of CA, as against 85 per cent, 85 per cent and 90 per cent adopted in the project reports for Tawa, Narmadasagar and Bargi projects, respectively, and claimed that the CCA, as worked out by Madhya Pradesh, is thus, on the conservative side.

5.13.4. Gujarat, in its Sur-rejoinder 1, has contended that the surveys filed by Madhya Pradesh cannot be considered as representative. The contentions of Gujarat are given below:—

> "Gujarat submits, that the details of the three blocks under Bargi, Narmadasagar and Tawa projects (*vide* Exhibits MP-852 and 956, 854 and 982, 853 and 957 respectively), when compared with the corresponding details for the whole of the command areas under Bargi, Narmadasagar and Tawa projects, (*vide* Exhibits MP-157, Vol. II, pp 204-205 for Bargi Project, MP-158, Vol. I, p. iii, and Vol. III, p. 96 for Narmadasagar Project, and MP-179, Vol. I, p. 30 for Tawa Project) show that the said blocks cannot be considered as representative even for the said projects, leave aside the contention of Madhya Pradesh to treat those details as representative of the command area of all the major projects under Narmada basin.

A table giving comparison is given below:—

TABLE I

Name of Major Project	Percentages of CCA to GCA (Major Projects)	
	For the Block under the project	For full command Proposed in the project reports.
Bargi . .	92·51	71·06
Narmadasager .	85·87	56·78
Tawa . .	72·54	71·44

Note:—(1) Figures of percentage in Col. 2 for Bargi, Narmadasagar & Tawa are ratio of figures of CCA and GCA given in Ex-MP. 956 982 and 957, respectively.

(2) Figures of percentage in Col. 3 are ratio of figures of CCA and GCA given in Ex-MP-157, Vol. II, pp. 204-205, for Barg project MP-158, Vol. I, p. iii, and Vol. II, p. 39 for Narmadasagar Project, and MP-179, Vol. I, p. 30 for Tawa Project.

It may not be out of place to note that the CWPC, which admittedly had carried out held investigations and studied the Survey of India maps, did not include additional areas now proposed by Madhya Pradesh in the proposed GCA in the project reports formulated by it. The additional areas now proposed by Madhya Pradesh for the Bargi, Narmadasagar and Omkareshwar projects were not proposed to be irrigated by the CWPC in spite of availability of enough water at the respective project sites. The total absence of information regarding detailed survey of even a single block for the additional area at least does reinforce the submission of Gujarat that the additional areas now proposed to be included in the GCA of the aforesaid projects by Madhya Pradesh are too inhospitable to benefit by irrigation."

5.13.5 It is necessary for us to closely examine these rival claims. The culturable fallow area of 3.047 lakh acres has been fully accounted for by Madhya Pradesh, as culturable. Gujarat has contended that culturable waste under the category of uneconomic small patches or large blocks of land which are not reclaimable for cultivation at a reasonable cost, should not be included in the culturable area. As per Exhibit MP-810, the area under class C of culturable waste (i.e. uneconomic small patches or large blocks of land which are not reclaimable at a reasonable cost), is 0.702 lakh acres. In the case of Gujarat, it was considered that 56 percent of the culturable waste cannot be brought under cultivation at reasonable cost. Compared to this, a deduction of 0.702 lakh acres, (2.02 lakh acres from the culturable area of the whole basin), which is about 25 per cent of the culturable waste as suggested by Gujarat, appears reasonable. The culturable fallows, which may be excluded from Major projects, may be, therefore, taken as 0.702 lakh acres.

5.13.6 Pastures and groves account for 1.65 lakh acres in the major projects. All this area has been considered culturable by Madhya Pradesh. In the case of Gujarat, it was considered that pasture and grazing land should be considered as culturable area, although Gujarat contended that all pastures should be excluded.

5.13.7 An area of 93, 149 acres from revenue and reserved forests has been included in the culturable area of Madhya Pradesh. Since, there is no prohibition against forest area being released for cultivation, this area may not be deducted from culturable area, as contended by Gujarat.

5.13.8 An area of 49,265 acres has been taken as area under water in nallahs/rivers and ponds which would get exposed in the later part of the year, and, according to Madhya Pradesh, would be available for cultivation. This is 50 per cent of the total area under such rivers, tanks, etc. The areas under water may be considered as comprising three parts, (i) areas which are submerged throughout the year, (ii) area which are submerged in a part of the year and (iii) areas under tanks or shallow depressions get abandoned with the introduction of a regular irrigation system and become fit for normal cultivation. The later two parts have been considered by Madhya Pradesh as fit for cultivation and irrigation. In case of areas which get submerged in parts of the year, no irrigation system can be planned and cultivation is generally done with the residual moisture in the soil. Therefore, such areas cannot be considered for providing irrigation facilities. As regards the last category also farmers might desire to maintain the tanks and draw supplies for one crop taking supplementary irrigation from the canal system. Only the ponds and tanks which get abandoned can be considered for irrigation. Gujarat has contended that the figures of actual cultivation from such areas which get exposed are insignificant as indicated by the available statistics. Madhya Pradesh has, however, argued that with the introduction of irrigation many of the tanks are likely to become redundant and cse to be used as tanks and in course of time they will be ploughed up and normal cultivation made possible in the land covered by them. As already mentioned above the extent of such areas are uncertain and are not likely to be significant. Considering all these factors, there area under water may not be included in the culturable area for irrigation.

5.13.9 An area of 1,31,200 acres is shown as extra CA in Tawa and Sukla Projects (1.12 lakh acres in Tawa and 0.19 lakh acres in Sukta) in M.P. Statement 14 Gujarat, in Ex G-1243, has demarcated area on right bank of Tawa which overlaps the command of Dudhi project. In the Project Report of Tawa (Ex MP-179), it has been indicated that the right bank canal has been curtailed due to no-availability of water and that the area served is only 1.0 lakh acres instead of 2.20 lakh acres which could be covered by extension of the canal. Therefore, the extra 1.12 lakh acres shown in the Statement has to be deleted. Regarding Sukta, the gross area of the Project is shown in the project report as 59.000 acres and CA as 47,000 acres, while culturable area is shown

as 60,000 acres in Statement 14. There is, thus, a discrepancy. However, the difference of 19,000 acres in CA shown in MP Statement 14 though small is without justification and many may be ignored. Thus, the total area which may be excluded from the culturable area of major projects is 0.702 lakh acres from culturable fallows which are unsuitable for reclamation, 0.493 lakh acres from areas under water and a culturable area of 1.312 lakh acres shown extra in Tawa and Sukta projects. The balance CA would be 34.732 lakh acres, as in Statement 5.10.

Culturable Command Area of Major Projects

5.13.10 Madhya Pradesh has proposed a culturable command area of 30.99 lakh acres for the various major projects generally at 90 per cent of the CA. In the absence of command area surveys, the actual commanded area cannot be determined. However, as a sample survey, the Tribunal directed Madhya Pradesh to carry out detailed surveys for blocks of more than 50,000 acres under the command of the three major projects, viz., Bargi, Tawa and Narmadasagar. On the basis of these surveys, Madhya Pradesh has claimed that the CCA is on the conservative side since the per centage of CCA to culturable area works out to 85.7 per cent, 93.6 per cent, 95.8 per cent, as against 85 per cent, 85 per cent and 90 per cent adopted in the project reports for the Tawa, Narmadasagar and Bargi projects, respectively (Ex MP-1156, p. 11).

5.13.11 In the surveys filed by Madhya Pradesh the items deducted from culturable area to determine CCA consist of 2.32 per cent for high patches, 2.89 per cent for cut-up areas, 1.84 per cent for area to be occupied by canal system, and 1.71 per cent for development works, like roads, market etc., in all amounting to about 8.8 per cent. Regarding high patches, the percentage of 2.32 appears to be too low for being adopted on a larger scales. In the case of some Madhya Pradesh projects, high patches have been excluded from the gross command of the project, and in some cases hills and mounts have been considered as area not available for cultivation. Further, some cultivable areas in rolling land may exist which cannot be adequately served by irrigation, unless sprinkler system is introduced. In case of comparatively flatter area of Gujarat, high patches have been deducted at 5 per cent. With more undulating and highly areas in Madhya Pradesh, in the absence of more extensive surveys, the percentage of 2.32 as worked out cannot be extrapolated to cover the entire command of all the projects.

5.13.12. Cut up areas have been assessed as 2.89 per cent. Considering the large number of tributaries and small streams and steep sloped land encountered in Madhya Pradesh, this percentage appears to be too low for being projected for the area commanded by all the projects. But in the absence of detailed data, a percentage of 10 per cent is adopted for high patches and cut up areas.

5.13.13 The area for development works has been assessed as 3.76 per cent. It appears reasonable to adopt this percentage.

5.13.14. In the case of pastures and groves, only about 75 % may be considered as likely to be brought under irrigation as adopted in case of Gujarat. On account of this 38,850 acres would need to be deducted for determining culturable command area.

5.13.15 It has further to be considered whether all area under revenue and reserved forests may be considered fit for irrigation, particularly as the forests are generally on poor soils and on sloping or rock ground with shallow soil cover. Once the excision of the forests in a certain area takes place, and land is denuded of forests cover, the soil cover being shallow is easily eroded, rendering the land unfit for cultivation, and the forest settlers move on to new areas. In view of this only 50% of area is considered fit for bringing under irrigation at a reasonable cost. Hence it is reasonable that an area of 46,575 acres (50% of 93,149) may be deducted for determining culturable commanded area.

5.13.16 No deductions have been made for areas unsuitable to take irrigation on the basis of detailed soil surveys. As per the direction of the Tribunal. Madhya Pradesh has carried out detailed soil surveys for major projects with a command of more than 50,000 acres. On the basis of these surveys, Madhya Pradesh has estimated that there are no lands with irrigability classification of Class V and that lands with irrigability classification of Class VI comprise 0.42 per cent of the surevey area. It appears unusual to have such a low percentage of area unsuitable for irrigation, particularly in areas with steep and undulating topography. Without very detailed examination, no comments can, therefore, be offered as to the reasons for such unusually low areas to be considered unsuitable for irrigation. In some of the projects, it is noticed that areas with other sources of irriga-

tion have already been deducted from the gross command. It is, therefore, difficult to properly assess the extent of such areas included in the command area of the major projects.

5.13.17 Madhya Pradesh has claimed that only about 6 per cent of the area has groundwater sources, while Gujarat contends that much higher potential would be available. For the reasons given in the case of Gujarat, we do not propose to make any deductions on account of alternative resources of groundwater. Any question of alternative resources from other rivers does not arise in the case of Madhya Pradesh for use within the basin. Therefore, no deduction is necessary on account of alternate resources.

5.13.18 The culturable command area would thus work out as detailed in Statement 5.11 enclosed.

	Lakh acres
Basic culturable area in major projects . . .	34·732
Deduct for high patches, cut up area etc. (Pastures, groves, area under revenue and reserve forests) .	4·326
Balance	30·406
Deduct area for development works at 3·76% of 30·406 on the basis of MP-1156	1.143
	29·263
	say 29·263 lakh acres

The CCA to be served by major projects, as proposed by Madhya Pradesh, is 30.99 lakh acres, as against 29.26 lakh acres as determined above.

Culturable Lift Areas

5.13.19 Of this area, CCA of about 3.03 lakh acres has been proposed to be served by lifts ranging from 7.6 to 41.7 metres (25 to 137 ft.) as indicated in MP-312, Vol II Statement 18.2.

Culturable Command Area of Medium, Minor and Pumping Schemes of Madhya Pradesh in Basin

5.14.1 Madhya Pradesh has proposed CCA of 70.7 lakh acres to be served by major, medium, minor and pumping schemes in the basin. Out of this, the area to be served by schemes other than the major schemes, is given as 39.76 lakh acres. The procedure for determining the CCA has been given in details in the Master Plan. The GCA for a number of identified and unidentified medium and minor schemes has been determined on the basis of a few sample schemes. Thereafter, per centage of culturable area and the culturable command area have also been based on a few schemes and applied for the entire basin on the basis of number of schemes in areas for which maps are available and on prorata basis for areas for which maps are not available.

5.14.2 For determining the GCA of the various schemes in the basin, the determination of the number of scheme and their command, without proper surveys, can give only a very approximate idea of the command which is likely to be benefited. In the case of minor schemes this becomes all the more difficult, in view of the very large number of schemes. In the case of pumping schemes, by the very nature of such schemes for benefiting small areas, the concept of culturable command area does not apply as in the case of medium and minor schemes. In the absence of detailed surveys, and the identification of all possible schemes, the determination of the CCA is only a very approximate estimation. The claim of Madhya Pradesh cannot therefore, be scrutinised in detail and only general conclusions are possible.

5.14.3 On the basis of the percentage adopted in the Master Plan, Madhya Pradesh has determined the Gross Command Area in the basin from all schemes, as about 98.18 lakh acres, of which the area for medium and minor projects including pumping schemes, is given as 55.31 lakh acres vide Statement I of Madhya Pradesh Rejoinder, Vol. II attached as Statement 5.8. In this Statement, a uniform percentage of 85% of GCA has been adopted for determining CA, and 85% of CA has been adopted for determining CCA. However, in the Master Plan, varying percentages have been indicated for different tributaries and zones.

5.14.4 The Basin Area is 212.35 lakh acres, and GCA of all schemes, as indicated by Madhya Pradesh, is 98.18 lakh acres. Thus, nearly 50% of the entire area of the basin is considered as commanded by irrigation projects. This appears to be rather optimistic, but it cannot be verified without more detailed investigations.

5.14.5 As a possible guideline for estimating the CCA of medium, minor and pumping schemes, the Tribunal directed Madhya Pradesh to conduct detailed surveys of selected blocks in the three zones and identify all areas which are likely to be benefited from the different categories of schemes. Madhya Pradesh has filed the surveys of six blocks. vide Ex MP-1108, 1077 and 1106. The results of these are summarised at page 12 of MP-1156. The area of the blocks likely to be benefited by medium,

minor and pumping schemes varies between 20% to 45% for different blocks, with an average of about 30%.

5.14.6 Excluding GCA of the major projects, the balance area of the basin is about 167.74 lakh acres, of which 55 lakh acres (about one-third of the balance area) is expected to be covered by medium and minor projects, including pumping schemes for irrigation. This gives roughly 2 square miles of catchment for providing irrigation facilities for one square mile of area. From general experience, a catchment of 3 to 5 square miles is required for providing irrigation facilities for one square mile of area.

5.14.7 On the basis of surveys carried out by Madhya Pradesh, the average percentage of CA to GCA, and CCA to CA, for all three Zones, has been worked out as 89.28% and 85.9%, respectively, for medium projects (Ex MP-1156 page 2), vide Statement 5.12 attached. At page 14 of Exhibit MP-1156, it is indicated that the percentage of CCA to GCA for medium projects surveyed, varies between 81% to 86%, and in the case of minor schemes, from 86% to 90%. Madhya Pradesh, therefore, considers that CCA taken as 80% of GCA, as adopted in the Master Plan, is on a conservative basis.

5.14.8 Gujarat has taken inspection of some medium and minor schemes of Madhya Pradesh and, on the basis of such inspection, Gujarat contends that the percentage of CA and CCA to GCA is much lower for these schemes, which are distributed all over the basin, and the schemes selected by Madhya Pradesh for survey cannot be considered as representative of the conditions in the basin (Gujarat Sur-rejoinder 1, page 21). Gujarat has stated that Madhya Pradesh has made available details regarding medium and minor schemes as under:—

(i) Pursuant to the directions of the Tribunal, dated 26-9-1975, under six blocks selected by Madhya Pradesh *vide* Exhibit MP-958, 964, 965, 993, 994, 995, 1040, 1041, 1061, 1077, 1078, 1106, 1107 and 1108.

(ii) Pursuant to the directions of the Tribunal, dated 17/18.3.1975, for the schemes for which details were asked for by Gujarat *vide* Exhibit MP-967, 968, 992, 1005, 1025, 1036, 1037, 1044 and 1045.

(iii) Pursuant to the directions of the Tribunal dated 16/17-12-1974 for the existing schemes in Narmada basin, *vide* Exhibit MP-1051, 1079, 1109 and 1112.

Considering these, Gujarat, in its Sur-rejoinder 1, pages 36-37, has contended as under:—

"On the basis of the data supplied pursuant to the directions dated 17/18th March, 1975, listed at (iii) above, Gujarat has, in its Written Reply 25, pp 3-4, shown that for medium and minor schemes the CCA calculated by Madhya Pradesh is over-estimated by 35.26 & 70.92% (9.61/13.55 into 100), respectively. Thus, Gujarat has challenged the figures of CCA as given by Madhya Pradesh. However, assuming without admitting the correctness of the figures of CCA given by Madhya Pradesh, Gujarat has compared the figures of percentages of CCA to GCA of the scheme (*vide* Statement 15. pp. 116—118, for medium Schemes. Statement 22 pp. 124-125 for minor schemes and Statement 29, pp. 137-138, for pumping schemes) given in (I) and (iii) above.

TABLE 4

Percentage of CCA to GCA in Medium Schemes

Zone	Under the blocks selected by Madhya Pradesh.	For existing schemes
Upper Zone	80·08	31·49
Middle Zone	85·28	50·92
Lower Zone	93·58	72·06
Overall	95·92	51·35

TABLE 5

Percentage of CCA to GCA in Minor Schemes

Zone	Under the blocks selected by Madhya Pradesh	For existing schemes
Upper Zone	85·15	60·42
Middle Zone	87·39	75·82
Lower Zone	88·01	63·47
Overall	86·98	67·91

Ratio of CCA to GCA in Pumping Schemes

Zone	Under the blocks selected by Madhya Pradesh	For existing schemes
Upper Zone	93.75	..
Middle Zone	—	71·38
Lower Zone	92·39	63·25
Overall . . .	92·70	70·04

28. From what has been pointed out hereinabove, the following conclusion emerge:—

* * * * *

(ii) Madhya Pradesh has by furnishing information regarding selected, medium, minor and pumping schemes of two blocks in each of three Zones attempted to present an unduly rosy picture of culturable area likely to be benefited by irrigation from medium, minor and pumping schemes. The said schemes do not represent all medium, minor and pumping schemes proposed by Madhya Pradesh.

(iii) The realistic figures of the area likely to be benefited by irrigation by major, medium, minor & pumping schemes would not exceed 25.26, 12.76, 3.94 and 0.25 lakh acres, respectively (*vide* Gujarat W.R. 25, page 6). Even the said figures are likely to come down on the detailed investigations and after applying suitable deductions, as may be considered necessary, for average soil, water table and topographical conditions."

5.14.9 Gujarat has contended that the schemes selected by Madhya Pradesh for surveys are close to the commands of major projects, where the proportion of culturable area in the command area is 76.67%, while the proportion in the areas of the basin lying outside such commanded areas, is only 40%. (Gujarat Sur re-joinder I, page 22). Gujarat has compared the figures of net sown area (which form the *main* constituent of culturable area, according to its argument) for the schemes selected by Madhya Pradesh and those inspected by Gujarat Based on these details, Gujarat, has contended that there is a difference of about 25% for medium schemes and about 40% for minor schemes. According to Madhya Pradesh surveys, the CCA is 85.9% of GCA for medium, and 87.4% of GCA for minor schemes. If the deduction of percentage of sown area is applied to the figures, the CCA as contended by Gujarat, will be 60% of GCA for medium schemes, and 48% of GCA for minor schemes, as worked out in Statement 5.13 attached.

5.14.10 All these schemes are either planned or surveyed, and a certain amount of bias in their selection may be possibly attributed to the results by either State. Madhya Pradesh has given details of schemes in operation and under construction, for which details of the GCA and CCA etc. have been given. Though in some cases the CCA appears to exceed the GCA, which is not possible, and average of medium, minor and pumping schemes has been taken, excluding those where such discrepancies exist, and given in Statement 5.14 attached. From this, it is seen that CCA is 52 to 70% of GCA.

5.14.11 Inspite of the difficulties pointed out earlier for determining the GCA for medium and minor schemes (excluding pumping schemes), the GCA as estimated by Madhya Pradesh, may be accepted as working hypothesis. Adopting the percentages of CCA to GCA, based on the schemes for which inspection has been taken by Gujarat the CCA for the medium and minor schemes has been worked out in Statement 5.15 attached, as 25.92 lakh acres. Adopting the percentage of CCA to GCA, based on the schemes in operation and under construction, the CCA for all the medium and minor schemes has been worked out in Statement 5.16 attached, as 30.09 lakh acres.

5.14.12 The CCA for these schemes i.e. 33.26 lakh acres as given by Madhya Pradesh, would be including areas under water, full extent of pastures, etc., and also may not account for areas needed for development works, canals etc., and unsuitable areas based on soil surveys and small patches of high areas not served by the distribution system. Even allowing 10% for all these, such areas would be about 3.33 lakh acres and the balance area available for irrigation would be 29.93 lakh acres.

5.14.13 Gujarat has contended that the area likely to be benefited from medium and minor schemes in Madhya Pradesh would not exceed 16.95 lakh acres. As already mentioned, it is difficult to determine the actual command area of the schemes and the CCA to be benefited therefrom, without detailed surveys.

5.14.14 In the case of pumping schemes, the CCA has been determined by Madhya Pradesh on the basis of projection of the likely number of pumps, but from the details of schemes already in operation or under construction, it is seen that these assumptions have not materialised so far and the growth of pumping assumed in the Master Plan is far from the actual development. Madhya Pradesh has adopted 6.5 lakh CCA for pumping schemes. This is about 10 per cent of the major, medium and minor schemes, or 20% of medium and minor schemes. We think that this assumption is unduly optimistic and that 10 per cent of the area served by medium and minor schemes would be more reasonable. This would be about 3 lakh acres.

5.14.15 Based on the above estimates the CCA for medium schemes is likely to be 16.54 lakh acres, that for minor schemes 13.55 lakh acres, and for pumping schemes about 3 lakh acres, making a total of 33.09 lakh acres.

Diversion Outside the Basin

5.15.1 Madhya Pradesh has proposed three projects for diversion of waters from the Narmada valley to the neighbouring Mahanadi, Sone and Tons basins for irrigation with incidental power generation from drops available because of the diversion. These projects are the Upper Narmada Diversion Project, Upper Burhner Diversion Project and Bargi Diversion Project, with a total diversion of 2.165 MAF. The CCA proposed to be irrigated is 6.03 lakh areas. The salient features of these projects are given below:—

(i) *Upper Narmada Diversion Project (Feasibility Report) Exhibit MP*-39—The project envisages more storage in the Upper Narmada Project increasing the FRL from 2400 to 2455, with a annual diversion of 0.175 MAF through open channel and tunnels into the Mahanadi basin where the water will be picked up by a dam across the Patpara nalla for irrigating 24.300 acres in Bilaspur District. Tunnel No. 1, 8' diameter and 11 miles in length pierces through a high ridge between Narmada and Mahanadi basins for diverting the water. A head of 1120 feet is created by the diversion which enables generation of 18.9 MW of power at 100% LF.

(ii) *Upper Burhner Diversion Project (Feasibility Report) Exhibit MP*-391—The project envisages an annual diversion of 0.320 MAF from the Upper Burhner reservoir through open channels and tunnels for diverting water into the Mahanadi basin where the water is dropped into the Nirra Nadi. From a dam across the Nirra Nadi, the water is further diverted and fed to the Hanp reservoir for irrigation of 70.350 acres in Durg and Bilaspur Districts in addition to supplying protective irrigation to the extent of 25% requirements for 25.636 acres. In the absence of increased storage at Upper Burhner, the additional storage required for the diversion would need to be provided at the Hanp reservoir. The features of the Hanp reservoir have not yet been finalised, as mentioned at page 21, Volume I of the Project Report. The tunnel 10' diameter and 9 miles in length pierces through the ridge between Narmada and Mahanadi basins. A head of 66 feet is created at the diversion which enables generation of 20.83 MW of power at 100% LF.

(iii) *Bargi Diversion Project (Feasibility Report) Exhibit MP*-161—The Project envisages construction of a dam on the Narmada river at Basania for power generation. The tail water of this dam will be picked up at the Bargi dam and diverted into the neighbouring Sone and Tons basins through a right bank canal from the Bargi dam for irrigating an area of 4.83 lakh acres in Rewa and Satna Districts. This canal cuts across the Sleemanabad ridge between Narmada and Sone basins through a deep cutting for about 15 miles. The maximum depth of cutting is about 106 feet of which about 70 feet is in rock. A separate project report has been filed for the Basania dam (Exhibit MP-388). The water after diversion is picked up at the Amkuhi barrage through the main canal and fed into the Rewa and Satna branches for irrigation. A head of 147 feet at Basania and 44 feet at the diversion enables generation of power of about 22.86 MW at 100% LF. The salient features of these projects are attached in Statement 5.9.

5.15.2 Gujarat has contended that the claim for these diversions should be rejected mainly on the following grounds:

(1) Techno-economic feasibility;

(2) Inadequate investigations to establish technical feasibility;

(3) Adequate rainfall not requiring irrigation.

Regarding the techno-economic feasibility the benefit-cast ratios as worked out in the Project Reports indicate a satisfactory ratio though the detailed investigations have been made and estimates prepared. Without more details no comments can be made regarding the techno-economic feasibility. Regarding the technical feasibility of the project, the difficult engineering problems are likely to be the long tunnels and long deep cuts. However, these are not beyond the realm of the available technology and have to be considered as feasible. Regarding the adequacy of rainfall it appears that the rainfall in these areas is not different from that of the upper zone in the Narmada valley. Irrigation is provided not only for providing irrigation facilities for areas with inadequate rainfall but also for protective irrigation or for increasing yields. The rainfall in the command of the Upper Narmada Diversion Project is about 46 inches, in the Upper Burhner Diversion 48 inches and in the Bargi Diversion Project 45 to 48 inches. The rainfall in the Narmada valley upto Bargi is about 57 inches (MP-157, Vol. I, page 22). Even in the case of Bargi Project which is contiguous to the areas proposed by the Bargi Diversion Project, which is the biggest diversion proposal, the rainfall in the Bargi command is 50 to 55 inches (MP-157, Vol. I, page vii). Therefore, these areas outside the basin may not be rejected for irrigation though the delta required may be considerably less than for areas with lesser annual rainfall as water requirements for Kharif crops will be mostly for protection due to failure of timely rainfall.

5.15.3 From the details given in the project reports it is not possible to work out the various deductions suggested from the culturable areas as in the case of major projects within the valley. We propose therefore that the GCA of these projects may be reduced pro rata for high patches, unsuitability for irrigation, area from forests and under water, as in the case of major projects in the valley, as per Statement 5.11. This gives a CCA of 5.36 lakh acres (6.03 × 27.7).

Most of this area is fed by gravity except for small areas under lift irrigation.

Total CCA of Madhya Pradesh

5.16.1 The total CCA of Madhya Pradesh comprises areas under major projects, medium and minor projects, (including pumping schemes) in the basin and schemes proposed for diversion outside the basin. The CCAs as determined in the preceding paragraph are as below:—

	Lakh acres
(1) Major projects in the basin	29·26
(2) Medium and minor schemes including pumping schemes in the basin	33·09
(3) Areas outside the basin	5·70
TOTAL	68·05
Say. 68	lakh acres.

A statement showing the GCA, CA and CCA as claimed by Madhya Pradesh and as we have estimated is attached as Statement 5.17. Madhya Pradesh has claimed that water for areas outside the basin is an alternative claim which has to be treated as an additional claim if its claim of CCA of 70.7 lakh acres, deltas and intensities as claimed, or if the allotment of water of 24 MAF is reduced. As such, the claim for areas outside the basin is treated as an additional claim and included in the CCA of Madhya Pradesh.

5.16.2 For major projects, details of break-up of the CCA are available. From these details, the zone-wise distribution of the CCA, as estimated now, has been prepared. In the case of medium, minor and pumping schemes, such details are not available and the zone-wise distribution of CCA, as estimated now is taken as proportional to the area claimed. Statement 5.18 attached indicates the zone-wise CCA as claimed by Madhya Pradesh and as decided now. Diversion outside the basin has also been split up for upper and middle zones and included in the Statement.

5.16.3 In general, we should mention that while the estimates for GCA, CA and CCA of major projects are made on fairly good data of the command areas, the estimates for medium and minor schemes (including pumping schemes) and for areas outside the basin suffer from lack of command area surveys and detailed investigations.

Advise of the Assessors

5.17.1 We have consulted our technical Assessors Dr. M. R. Chopra, Mr. Balwant Singh Nag and Mr. C. S. Padmanabha Aiyar with regard to the matter of this chapter. They have advised us that they all agree with the conclusions reached by us in paragraphs 5.9.1 and 5.16.1. and also the reasoning given in the other paragraphs.

STATEMENT 5.7

*Gross Area Proposed to be Covered by Projects**

Sl. No.	Name of Project	Gross Area (in acres)	Area of medium schemes included in the gross area (in acres)	GCA of the major projects, (Col. 3 minus Col. 4) (in acres)
1	2	3	4	5
1	Upper Narmada	53429		
2	Upper Burhner	36130		
3	Halon	37684		
4	Dhobatoria	41182		
	Total in Upper Zone	168425		168425
5	Bargi	931637		
6	Ataria	39733		
7	Chinki	211190		
8	Sher, Shakkar Machrewa	215400		
9	Dudhi	163272	14000	
10	Barna	202541		
11	Tawa	002254		
12	Kolar	96100		
13	Morand Ganjal	162664		
14	Sukta	60703		
15	Chhota Tawa	122386	12641	
	Total in Middle Zone	3207880	26641	3181239
16	Narmadasagar	528320		
17	Omkareshwar	423459		
18	Deda Upper	36285		
19	Man	43464	3033	
20	Lower Goi	51905	5119	
21	Jobat	36482	548	
	Total in Lower Zone	1119915	8700	11111215
	GRAND TOTAL	4496220	35341	4460879

*Refer Ex-MP—1156 Statement VI.

STATEMENT 5.8

Statement I of Madhya Pradesh's Rejoinder, Vol. II

Statement showing GCA, CA and CCA of Major medium and Minor Projects Including Pumping Scheme in Narmada Basin in M.P. as per Revised Master Plan MP-312,Vol. II, pages 139--144

Sl. No.	Details of projects.	As given in Revised Master Plan MP-312,Vol. II, pages 139 to 144 GCA	CA	CCA	Remarks
1	Major Projects	42·84	34·94	30·94	
2	Medium Projects	27·56@	23·19	19·71	
3	Minor Projects :				
	(*i*) CCA with more than 150 acres	11·10	9·44	8·0	
	(*ii*) CCA with less than 150 acres	7·65	6·50	5·53	
	(iii) Pumping schemes	9·00	7·65	6·50	
	Total Minor Projects.	27·56@	23·59	20·05	
	Total Medium and Minor Projects.	55·31	46·78	39·76	
	GRAND TOTAL.	98·18	81·72	70·70	

NOTE:— (*i*) CA of medium and minor schemes is worked out @85% of GCA thereof.
(*ii*) CCA of medium and minor schemes is worked out @85% of CA thereof.
(*iii*) @Please also see Statement I on pages 76 and 77 of Gujarat's Reply 6.

STATEMENT 5.9

Salient Features of Projects Proposed by M.P. for Diversion Outside the Basin

		Upper Narmada Diversion Project (MP—390)	Upper Burhner Diversion Project (MP—391)	Bargi Diversion Project (MP—161) including Basania dam (MP—383)
1	Gross command area (lakh acres)	0·39	1·03	6·78
2	Culturable area (lakh acres)	0·34	0·87	6·02
3	Culturable command area (lakh acres)	0·24	0·70 +0·26 (firming up)	4·83
4	Canal discharge (in cusecs)	240	440	6,490
5	Annual diversion (MAF)	0·175	0·32	1·67
6	Power (MW) at 100 % LF	18·9	20·83	6·86 (Amkuhi Canal) 16·0 (Basania final phase)
7	Maximum Head (ft.)	1120	660	44 (Amkuhi Canal) 147·0 (Basania)
8	Difficult engineering features (*i*) Tunnel/deep cutting	11·0 miles long tunnel of 8·0 ft. dia.	9·0 miles long tunnel of 10·0 ft. dia.	15 miles of cutting maximum depth of cutting of 106" of which about 70" is in rock.
	(*ii*) Investigations	Only topogrphical surveys done	Only topographical surveys done	Topographical surveys have been done & 7 bores for the deep open excavation are taken.
9	Command area surveys.	Done for 50% of area	Not done	Not done
10	Annual Rainfall (inches)	46	48	45 to 48

STATEMENT 5.10

Culturable Area of Major Projects of Madhya Pradesh in Narmada Basin

(In lakh acres)

		As per MP	As decided by the Tribunal
1	Cultivated area.	29.902	29·902
2	Culturable fallow—Deduct for patches which are not reclaimable at reasonable cost (class 'C') of culturable waste=0·702 (3·047—0·702) . . .	3·047	2.345
3	Pastures and groves considered as culturable.	1·554	1·554
4	Culturable area in revenue forests (no deduction for CA)	0·881	0·881
5	Culturable area in Reserved forests (no deduction for CA)	0·050	0·050
6	Area under water Nalas, rivers and ponds.	0·493	..
7	Difference in Tawa and Sukta without break-up.	1·312	..
		37·239	34·732

STATEMENT 5.11

Estimate of CCA of Major Projects of Madhya Pradesh in Narmada Basin

(In lakh acres)

1	Basic culturable area in Major Projects, as suggested now		34·732
2	Deduct for :—		
	(*a*) High patches and cut-up area at 10% of CA	3·473	
	(*b*) Pastures and groves (25 per cent of 1·554)	0.388	
	(*c*) Areas under revenue and reserved forests (50% of 0·931) . . .	0·465	
	Total	4·326	4.326
	Balance		30·406
	Deduct area for development works @3·76 per cent of 30·406 on the basis of MP—1156		1·143
	CCA of Major projects.		29·263
	Say		29·26 lakh acres

The CCA to be served by major projects, as proposed by Madhya Pradesh, is 30·99 lakh acres (Ex. MP—1156).

STATEMENT 5.12

Statement Showing Percentages of CA to GCA and CCA to GCA for Medium and Minor Schemes Worked out by Madhya Pradesh as per detailed Surveys of Six Blocks

Sl. No.	Zone	GCA (Acres)	CA (Acres)	CCA (Acres)	Percentage of CA / GCA	Percentage of CCA / GCA	Remarks
	Medium Schemes						
1	Upper Zone	11,082	9,331	8,978	84·20	81·01	Ex MP—1156 p-17.
2	Middle Zone	33,374	29,488	28,461	88·36	85.38	Do
3	Lower Zone.	11,261	10,927	10,533	97.03	93.6	Do.
	Total	55,717	49,746	47,972	89.28	85.9	
	Minor Schemes						
1	Upper Zone	5,607	4,951	4,810	88·3	85.8	Ex MP—1156, p.-1 8
2	Middle Zone	7,014	6,360	6,130	90·67	87·4	Ex MP—1156, p-19
3	Lower Zone	4,488	4,358	4,012	97.10	90·0	Ex MP—1156, p-20
	Total	17,109	15,669	14,952	91·58	87.4	

STATEMEMT 5.13

Statement Showing Percentage of Net Sown Area to GCA for Medium, Minor Schemes Selected by Gujarat after Inspection & Under the Block Selected by Madhya Pradesh

Sl. No.	Zone	GCA (Acres)	Net Area sown (Acres)	Percentage of net area sown GCA	Remarks
	AS SELECTED BY GUJARAT				
	Medium Schemes				Sur-rejoinder 1
1	Upper Zone	1,31,607	30,637	23·28	Page 83
2	Middle Zone	2,01,114	90,896	45·20	Page 83
3	Lower Zone	1,24,320	73,028	58·74	Page 84
	Total	4,57,041	1,91,561	42·57	
	Minor Schemes				
1	Upper Zone	69,868	14,930	21·37	Page 93
2	Middle Zone	1,34,178	42,378	31·58	Page 93
3	Lower Zone	21,873	14,288	65·32	Page 94
	Total	2,25,919	71,596	31·69	
	AS SELECTED BY MADHYA PRADESH				
	Medium Schemes				
1	Upper Zone	11,082	6,008	54·21	Page 83
2	Middle Zone	33,374	20,140	60·35	Page 83
3	Lower Zone	11,263	10,159	90.20	Page 84
	Total	55,719	36,307	65·16	
	Minor Schemes				
1	Upper Zone	5,191	3,326	64·26	Page 93
2	Middle Zone	7,014	4,508	64·27	Page 94
3	Lower Zone.	3,121	2,718	87·08	Page 94
	Total	15,326	10,552	68·85	

NOTE : Gujarat has compared the percentage of net sown area to GCA for the different schemes considering that the sown area is the main constituent of CCA. There is a difference of about 25% in case of medium projects and about 40% in case of minor projects. The percentage of CCA to GCA of the schemes as given by Madhya Pradesh is reduced by this percentage to determine the CCA as contended by Gujarat. The percentage of CCA therefore works out to 60% (85·9—25%) of GCA for medium schemes and 50% of GCA (87·4—37) for minor schemes.

STATEMENT 5.14

Statement Showing Percentage of CCA to CGA for Medium, Minor and Pumping Schemes based on Schemes Existing or Under Construction

Sl. No.	Zone	No. of Schemes	GCA	CCA	Percentage of CCA / GCA	Remarks.
	Medium Schemes					
1	Upper Zone	5	30,071	9,470	31·49	Ex MP—1951
2	Middle Zone	14	1,23,258	63,257	51·31	Ex MP—1079 & 1109
3	Lower Zone	8	31,392	22,621	72·06	Ex MP—1112
	Total		1,84,721	95,348	51·61	
	Minor Schemes					
1	Upper Zone	2	2,855	1,725	60.42	Ex MP—1051
2	Middle Zone	52	24,845	18,597	74·85	Ex MP—1079 & 1109
3	Lower Zone	190	42,120	29,583	70·24	Ex MP—1112
	Total		69,820	49,905	71·48	
	Pumping Schemes					
1	Upper Zone	..	...	..	...	
2	Middle Zone	25	10,048	7,698	76·61	Ex MP—1079 & 1109
3	Lower Zone	12	2,072	1,360	65·63	Ex MP—1112
	Total		12,120	9,058	74·74	
	Total Minor Projects.		81,940	58,963	71·96	

NOTE :—Schemes for which CCA is not given or it is shown more than GCA have not been taken into account.

STATEMENT 5.15

Estimation of CCA of Medium and Minor Projects Excluding Pumping Schemes in Narmada Basin in Madhya Pradesh Based on the Contention of Gujarat

(Area in lakh acres)

Sl. No.	Details of projects.	GCA	CCA as percentage of GCA	CCA for minor schemes	CCA for medium & minor schemes
1	2	3	4	5	6
1	Medium Projects.	27·56	60%	..	16·54
2	Minor Projects.				
	(*i*) CCA with more than 150 acres	11·10	50%	5·55	..
	(*ii*) CCA with less than 150 acres	7·65	50%	3.83	..
	Total Minor Projects.	18·75		9·38	9·38
	Total Medium and Minor Projects	46·31			25·92

NOTE : 1. GCA has been taken from Statement 5.8.

2. Percentage in Col. 4 have been adopted as explained in Statement 5·13.

STATEMENT 5.16

Estimation of CCA of Medium, Minor and Pumping Schemes in Narmada Basin in Madhya Pradesh as per Schemes in Operation & Under Construction

		Area in lakh acres
(1) *Medium Scheme*		
Para 5.14.1	The culturable command area to be served by schemes, other than major schemes is proposed by Madhya Pradesh, as—	39·76
As per Statement 5·8, as referred to in para 5.14.3.	GCA of Medium Schemes is given as—	27·56
Statement 5·2	CCA of medium schemes, as claimed by Madhya Pradesh	19·71
	Percentage of CCA/GCA on above basis, comes to	71·5%
	According to Gujarat's contention, CCA should be taken as	12·76
Statement 5·14	On the basis of information supplied by M.P. for medium schemes existing or under construction, the percentage of CCA to GCA	51·61%
Statement 5·15	Considering that the future schemes may improve, it is proposed that CCA may be taken as 60% of CCA, which comes to—$\frac{27·56 \times 60}{100}$	16.54
(2) *Minor Schemes* (excluding pumping schemes) Statement 5·8	Madhya Pradesh has proposed 18·75 lakh acres (27·75—9·00) as GCA for minor schemes	18·75
	It has proposed CCA as	13·55
	Percentage of CCA/GCA on above basis comes to	72.30%
Statement 5·12	In support of this, M.P. has selected some schemes for which CCA/GCA	87·4%
Statement 5·13	(*i*) For these schemes Gujarat has given the net area sown to GCA as	68·85%
	(*ii*) For minor schemes for which inspection was taken by Gujarat, the percentage of net area sown/GCA	31·69%
	Gujarat has contended that the schemes selected by Madhya Pradesh are, therefore, not representative.	
Statement 5·14	On the basis of information supplied by M.P. for minor schemes (excluding pumping schemes) existing or under construction, the percentage of CCA to GCA	71·48%
Statement 5·15	Considering that the future schemes may improve, it is proposed that CCA as considered by Madhya Pradesh may be accepted *i.e.*, 72·3%	13·55
Pumping Schemes		
Statement 5·8	CCA of Major projects	30·94
	CCA of medium & minor schemes (19·71+13·55)	33·26
		64·20
	Madhya Pradesh has adopted 6·5 lakhs as CCA for pumping schemes. 10% This is about 10% of major and medium and minor schemes 10% of medium and minor schemes would be more reasonable (16·54+13·55) $\frac{1}{10}$	3·00
	Total figures for medium minor & pumping schemes	
		Lakh acres
	Medium	16.54
	Minor	13.55
	Pumping	3·00
		33·09

STATEMENT 5.17

GCA, CA and CCA as Claimed by Madhya Pradesh and as now decided by Tribunal

Lakh Acres

Sl. No.	Details of Projects	As claimed by M. P.			As now decided	
		GCA	CA	CCA	CA	CCA
1	Major Projects	42·87	34·94	30·94	34·73	29·26
2	Medium Projects	27·56	23·19	19·71		16·54
3	Minor Projects					
	(*i*) CCA with more than 150 acres	11·10	9·44	8·02		
	(*ii*) CCA with less than 150 acres	7·65	6·50	5·53		
	(*iii*) Pumping Schemes	9·00	8.65	6·50		
	Total Minor Projects	27·76	23·59	20·05		16·55
4	Diversion outside the basin	8·20	7·23	6·03*		5·70
	Grand Total	106·38	88·95	70·70		68·05

*This is an alternative claim if CCA of 70·70 lakh acres is reduced. Therefore, this is not added to the CCA as claimed by Madhya Pradesh.

NOTE: Likely change in GCA is not considered.

STATEMENT 5.18

CCA as Claimed by Madhya Pradesh and as now Decided by the Tribunal

CCA As Claimed By Madhya Pradesh

Lakh Acres

Particulars	Upper Zone	Middle Zone	Lower Zone	Total Zone
Major Projects	1·25	22·22	7·47	30·94
	+1·20	+4·83		+6·03
Medium Projects	4·59	10·96	4·16	19·71
Minor Schemes	2·45	7·54	3·56	13·55
Pumping Schemes	0·31	4·36	1·83	6·50
Total	8·60	45·08	17·02	70·70
	+1·20	+4·83		+ 6·03
				=76·73

Figures indicated with + are diversion outside the basin.

CCA As Now Decided

Particulars	Upper Zone	Middle Zone	Lower Zone	Total Zone
Major Projects	1·12	20·67	7·47	29·26
	1·14	+4·56		+5·70
Medium Projects	3·85	9·20	3·49	16·54
Minor Schemes	2·45	7·54	3·56	13·55
Pumping Schemes	0·14	2·01	0·85	3·00
Total	7·56	39·42	15·37	62·35
	+1·14	+4·56		+5·70
				=68·05

Figures indicated with + are diversion outside the basin.

CHAPTER VI

WATER REQUIREMENTS OF MADHYA PRADESH & GUJARAT

REQUIREMENT FOR IRRIGATION

Claim of Madhya Pradesh

6.1.1 Madhya Pradesh has claimed an aggregate annual requirement of 24.079 MAF of Narmada water for consumptive uses in the Narmada basin in Madhya Pradesh comprising 23.279 MAF for irrigation for a CCA of 70.70 lakh acres and 0.80 MAF for domestic and industrial water supply. The details are fully set out in Madhya Pradesh Statement 3, filed in September 1975, where the claims for CCA under major, medium, minor and pumping schemes and the water requirement for each category of scheme are given zonewise. Madhya Pradesh has stated at page 108 of Volume III of its Written Submission during the opening of its Case that if the Hon'ble Tribunal "Holds that water can be allocated for extra-basin areas also, than this Hon'ble Tribunal will be pleased to consider Madhya Pradesh's claim for its extra-basin areas also. It may, however, be noted that the claim for water for extra-basin areas is not a claim in addition to 24.079 MAF". Thus, the total claim of Madhya Pradesh for Narmada water is 24.079 MAF, rounded to 24.10 MAF in Statement 3 referred to above.

Claim of Gujarat

6.1.2 Gujarat, in its Written Submission 1-A during the Opening of its Case has stated at page 47 that its total water requirement, excluding evaporation loss at Sardar Sarovar, is 22.02 MAF, comprising as under:—

	Million Acre Feet
For irrigation from Navagam Canal	20·73
For domestic and industrial use	1·00
For use downstream of Sardar Sarovar Dam	0.70
	22·43
Available from en route rivers	(—)0·41
Net required	22.02

In Table 9 of Exhibit G-626, Gujarat has given particulars of the four parts of the commanded area to be irrigated as below:—

	CCA in lakh acres	Water required at canal head Million Acre Feet
1. Zones I to XI	54.02	12·81
2. Mahi Command	6.33	1·56
3. Banni	2.28	1·32
4. Ranns	8.75	5.04
Total	71.38	20.73

Report of Dr. Ambika Singh, Assessor

6.1.3 At the 28th meeting of the Tribunal held on 20th to 22nd November, 1974, we directed Dr. Ambika Singh, Assessor, to investigate and report on the estimate of reasonable water requirements of the States of Gujarat and Madhya Pradesh both within and outside the Narmada basin from a scientific point of veiw. His report dated 15-10-1977 is enclosed at Annexure VI.1. We had indicated in our direction to the Assessor the various factors to be kept in view in making his scientific study. These are set out in the introductory part of his report.

The party States have filed their respective comments on Dr. Ambika Singh's Report, Exhibits MP/1198, MR/156, G/1288 and R/308. We have perused these comments also.

MADHYA PRADESH

CCA in Madhya Pradesh

6.2.1 Madhya Pradesh Statement 27 gives details of CCA proposed to be served with Narmada water by various categories of projects. We have examined the proposal in the previous chapter and have

indicated the area which in our view need to be considered. The figures are tabulated below:—

(Lakh Acres)

	Proposed by Madhya Pradesh	Accepted by the Tribunal
I. Within the basin		
Major projects	30·94	29·26
Medium projects	19.71	16.54
Minor projects	8.02	8.02
Microminor projects	5.53	5·53
Pumping schemes	6·50	3·00
	70·70	62·35
II. Outside the basin	6,033	5.70
		68·05

Water requirement of Madhya Pradesh for irrigation will, therefore, be considered for a CCA of 68.05 lakh acres.

Cropping Pattern and Irrigation Intensity Madhya Pradesh

6.3.1 Statement 19, filed by Madhya Pradesh in November, 1975, gives figures of intensities of irrigation proposed from time to time for the area to be irrigated with Narmada water in Madhya Pradesh. There is considerable diversity in the various proposals. In its Statement 20 as also in Statement 13 of Exhibit MP-712 (November 1975), Madhya Pradesh has set down the intensities as given below and has claimed water on that basis.

Category of projects	Zones		
	Upper	Middle	Lower
Major	195	157	197
Medium	120	114	114
Minor	107	109	104
Pumping	154	161	157

For microminor schemes, with CCA less than 150 acres each, an intensity of 100 per cent has been adopted.

6.3.2 Dr. Ambika Singh has dealt at some length with the question of cropping pattern and irrigation intensity for Madhya Pradesh in his report (Annexure VI.1). He has given in Table 3 of paragraph 5.44 of the report, the cropping pattern and intensities considered suitable by him for the various zones and under different categories of projects. He has proposed reduced intensities for all categories of projects, excepting microminor, for reasons given by him. These are compared below with those proposed by Madhya Pradesh.

	Proposed by Madhya Pradesh (M.P. Statement 20)	Recommended by Dr. Ambika Singh (weighted average)
Major projects	168	111
Medium projects	115	110
Minor projects	107	90
Microminor projects	100	100
Pumping schemes	159	111

In our view there is an inbalance in the intensities proposed by the Assessor as would be evident from the paragraphs that follow.

6.3.3 Madhya Pradesh has submitted project reports of 24 major projects to the Tribunal mostly prepared after the setting up of the Tribunal in 1969. In most of these high intensity of irrigation has been adopted, the highest being 206 per cent in Narmadasagar project (1969), Exhibit MP-158, followed by 203 per cent in Omkareshwar project (1972) Exhibit MP-323. In the few projects that have actually been taken up for implementation the intensities adopted are significantly lower. In the Tawa project (1970), Exhibit MP-179, submitted to World Bank for aid, the intensity adopted is 138 per cent. In the Barna project (1971), Exhibit MP-328, it is 104 per cent. In three other major projects, the Hasdeo, the Upper Wainganga and the Bariarpur, submitted by Madhya Pradesh to Government of India for approval, the accepted intensities are 157 per cent, 129 per cent and 85 per cent respectively. It is, therefore, clear that the intensities proposed by Madhya Pradesh in its Statement 13 of Exhibit MP-712 are on the high side. In our view it would be reasonable to adopt an average intensity of 135 per cent for major projects and 120 per cent for pumping schemes.

6.3.4 As regards medium and minor projects, Madhya Pradesh has furnished information in Exhibits MP-1051, MP-1079, MP-1109 and MP-1112,

regarding performance of existing projects in the upper, middle and lower zones of Narmada basin during 1973-74, 1974-75 and 1975-76. The result is tabulated below:—

Serial No.	Zone	CCA (Acres)	Average annual irrigation developed (Acres)	Average intensity (per cent)	Reference to Exhibit
	Medium Schemes				
1	Upper Zone.	9,470	5,991	63.26	MP-1051
2	Middle Zone	60,657	47,111	77.67	MP-1079 & MP-1109
3	Lower Zone.	20,191	13,736	68.03	MP-1112
	Minor Schemes				
1	Upper Zone	Nil	Nil	Nil	—
2	Middle Zone	8,887	4,773	53.71	MP-1079 MP-1109
3	Lower Zone	3,389	1,797	53.02	MP-1112

Allowing for better performance in future years, it would be reasonable to adopt an average intensity if 90% for medium projects and 75 per cent for minor and microminor schemes.

6.3.5. Dr. Ambika Singh has discussed the cropping pattern proposed by Madhya Pradesh in paragraphs 5.42 and 5.43 of his report and has made his own recommendation for cropping patterns for various categories of projects in the three zones of Narmada basin for the intensities proposed by him. For the purpose of assessing water requirement of Madhya Pradesh the same cropping pattern adjusted more or less prorata for the intensities indicated by us in the paragraphs above may be adopted.

Deltas in Madhya Pradesh

6.3.6 As regards deltas, Dr. Ambika Singh has adopted the figures given by Madhya Pradesh in Statement 13 of Exhibit MP-712. In this statement deltas for major, medium and minor projects are as in Statements 9, 10, 11 and 12 of that exhibit and for pumping schemes as planned for the medium schemes at pp 47—52 of Volume II of Exhibit MP-312. For microminor schemes a delta of 1.5 feet has been assumed by Madhya Pradesh. The weighted average deltas in Table 4 in Dr. Ambika Singh's report come to, major projects 2.57, medium projects 2.07, minor projects 1.89 pumping schemes 2.56 and microminor schemes 1.5 feet. These are deltas at canal head. We accept these figures as reasonable.

Water Requirement of Madhya Pradesh for Irrigation

6.4.1. With the figures for irrigation intensities and deltas accepted by us in the paragraphs above, the water requirement of Madhya Pradesh for irrigation in the CCA as determined in the preceding chapter works out as under:—

Category of Project	CCA lakh acres	Intensity % of CCA	Delta at canal head ft.	Water requirement NAF
Major				
Within basin . 29·26 Outside basin . 5.70	34·96	135	2·57	12·129
Medium .	16·54	90	2·07	3·081
Minor .	8·02	75	1·89	1·137
Microminor .	5·53	75	1·50	0·622
Pumping .	3·00	120	2·56	0·922
	68·05			17·891

The water requirement of Madhya Pradesh for irrigation is thus 17.891 MAF.

GUJARAT

CCA in Gujarat

6.5.1 As stated in paragraph 6.1.2. above, Gujarat has proposed providing irrigation in the following culturable commanded areas:—

	CCA in lakh acres
Zones I to XI	54·02
Mahi Command	6·33
Banni & Ranns	11·03
	71·38

6.5.2 In the first place, we see no reason why the area under Mahi Command (6.33 lakh acres) should be included under Narmada command. This area is already irrigated or intended to be irrigated by Mahi waters under the sanctioned Mahi Right Bank Canal Project, Stage I [Ex. G/342(IV) (i) Stage I has already been completed by Gujarat which comprises a diversion weir at Wanakbori and Mahi Right Bank Canal Works. Gujarat made no proposal for including this area

in Narmada Command originally before the Khosla Committee but Dr. Khosla, on his own initiative, suggested that Mahi area should be brought under the Narmada Command so that 1.58 MAF of water may be released for the use of border areas of Rajasthan. As regards the Great and Little Rann of Kutch and Banni area also, we see no justification for Gujarat's claim to irrigate these areas from Narmada. Gujarat has claimed 6.36 MAF of water for this area on the basis of CCA of 11.03 lakh acres and delta of 5.8 feet (at canal head). Gujarat made no claims for the Great Rann of Kutch and Banni area before the Khosla Committee. So far as the Little Rann is concerned, the Dutch Team was of the opinion that desalination was a great problem and the soil studies made by Gujarat did not furnish sufficient basis to show that desalination was possible (*See* Ex. G. 349). In any case, these areas are admittedly barren and sparsely populated. The soil conditions in this area are characterised by high salinity, a very low horizontal permeability, a vertical permeability of nearly nil a high ground water table and an impervious layer near the ground water surface. The whole area is also subject to high evaporation and low rainfall. There is no adequate evidence produced by Gujarat that these areas are capable of being reclaimed at reasonable cost. Neither the pot experiments conducted at the Soil Research Institute, Baroda nor the experiments conducted at Umrath on 36 acres of land could be extrapolated to this area. The pilot plot in Banni area on light soils has no doubt shown the possibility of growing crops but Gujarat has not investigated or furnished data from which design parameters for effective reclamation of the area could be derived. Even if it is assumed that the area could be reclaimed and developed with the quantity of water indicated by Gujarat, the project would be highly uneconomic. A delta of 3.8 feet at field head has been proposed for the area. Taking into consideration 50% towards transit loss, the delta at canal head will be 5.8 feet. We, therefore, accept the argument of Maharashtra and Madhya Pradesh that the claim of Gujarat for 6.36 MAF of water for irrigating 11 lakh acres in Ranns and Bani should be rejected. Our Assessor, Dr. Ambika Singh has expressed the same view in his report, Ex. C-5. For these reasons, we are of the opinion that the Mahi Command area, the Little and Great Ranns of Kutch and Banni area should be excluded from the computation of the equitable share of Gujarat.

6.5.3 In the preceding Chapter, we have dealt with Gujarat's proposal for providing irrigation in a CCA of 54.02 lakh acres in Zones I to XI. We have concluded therein that only a CCA of 50.02 lakh acres in the zone area need to be accepted for irrigation from Navagam Canal.

Cropping Pattern and Irrigation Intensity

6.5.4 In examining the claim of Gujarat for Zones I to XI, Dr. Ambika Singh has stated in his report that the cropping pattern proposed by Gujarat for the area is reasonable and is nearer its existing cropping patterns. We agree with him.

6.5.5 In Exhibit G-960 (May 1976) Gujarat has shown its proposed intensities for the zone area zone-wise. These are abstracted in Statement 6.1 (attached herewith). The intensities range between 60% for Zone V and 110% for Zone IXA. The weighted average intensity comes to 90.36% and Gujarat has claimed water for this area on that basis.

6.5.6 Dr. Ambika Singh has stated in his report that in his view the intensity of annual irrigation in the area of Zones I to XI should not be more than 65% and has explained that his suggestion is made in the light of paucity of water and soil conditions there. We, however, notice that an intensity of 87 per cent had been accepted in the Broach Irrigation Project, as approved by Planning Commission, *vide* Exhibit G-6. In Kadana Project (1961) Exhibit G-342, the intensities provided are 98% for Mahi Right Bank Canal and 80% for Direct Canal. In the neighbouring Ukai Project area, Gujarat provided an intensity of 100% for Left Bank Canal and 105% for Right Bank Canal, *vide* Ukai Project Report Volume I—Exhibit G-188. In the face of these provisions, we are unable to accept the Assessor's recommendation in the matter for estimating the requirement of water for Gujarat as distinct from what might be apportioned to it. In our view, the reasonable intensity for estimating the requirement is 85% with a cropping pattern proposed by Gujarat.

Delta in Gujarat

6.5.7 In Exhibit G-960, at page 27, Gujarat has added 50% for transit losses to the water at field head to work out the requirement at canal head. In other words for delta at canal head it has added 50% to the delta at field head. In dealing with Zones I to XI Dr. Ambika Singh has stated that the delta proposed by Gujarat is reasonable but has pointed out that if the main canal, branches and distributaries upto 100 sausec capacity are lined than 50% transit loss is an over-estimation and that the loss is not expected to be more than 33.3 per cent.

6.5.8 In Maharashtra's Note 7 of February, 1977, calculations are given by Maharashtra of Gujarat's water requirement. In these calculations, Maharashtra has assumed 33⅓% as transit loss to be added to water requirement at field. In Note 2 to these calculations, Maharashtra has stated as under:—

> "Gujarat has proposed lining to main canal branches and distributaries upto 100 cusecs capacity. Even so, transit losses are provided at 50% of field requirement, which according to Maharashtra, is an over-estimate. The tranist losses are not expected to be more than 3⅓ per cent."

In Madhya Pradesh's Master Plan (1972) Exhibit MP-312, it is stated in a footnote at page 48 of Volume II as under

> "The transmission losses as adopted, represent a loss of 33% on the canal head capacity for major projects, 28.5% for medium projects and 26% for the minor schemes. The bigger channels will have to be lined if the losses have to be limited to these percentages."

Thus the delta at field is increased by Madhya Pradesh by the following percentages to obtain the delta at canal head:—

Major projects	50%
Medium projects	40%
Minor projects	35%

Again, in the Report of the Irrigation Commission (1972) Volume I page 117, it is stated that "commonly accepted figures for transit losses in alluvial plains of North India are 17% for main canal and branches, 8% for distributaries and 20% for water course, which gives a total loss of 45% of the water entering the canal head." Thus with loss of this magnitude, 82% more water has to be provided at canal head than required at field. This, of course is for an unlined canal. Also the figure differs from project to project and depends upon the permeability of bed and bank material and in a small way to some other factors. Nevertheless, these figures do indicate that a transit loss equal to 50% of the water received at the field is not unreasonable in major projects with their larger channels lined. Both Gujarat and Madhya Pradesh have adopted this figure, which we accept.

6.5.8 In Exhibit G-960 (May 1976) at page 27. Gujarat has claimed 12.554 MAF of water for an annual irrigation of 48.812 lakh acres (see Statement 6.1 attached). This gives a delta of 2.57 feet at canal head with a transit loss of 50% of the water reaching field head. We accept this delta for Gujarat.

Water Requirement of Gajarat for Irrigation

6.5.9 For the accepted CCA of 50.02 lakh acres for Gujarat and with an intensity of irrigation of 85% and delta at canal head of 2.57 feet Gujarat's water requirement for irrigation comes to 10.927 MAF.

STATEMENT 6.1

Annual Intensity of Irrigation Proposed by Gujarat for Various Zones Vide G-960 (May 1976)

Zone	Proposed intensity (of CCA)	Area irrigated annually (Acres)	CCA (Acres)
1	2	3	4
I . . .	108·0	92,124	85,300
II . . .	104.0	68,537	65,900
IIIA . . .	108.0	282,960	262,000
IIIB . . .	109.0	28,230	25,899
IIIC . . .	96.0	103,872	108,200
IIID . . .	100.00	503,000	503,001
IIIE . . .	80.0	161,440	201,800
IV . . .	107.0	239,680	224,000
V . . .	60.0	124,440	207,400
VIA . . .	105.00	74,550	71,000
VIB . . .	100.0	103,800	103,800
VIIA . . .	84.0	180,512	214,895
VIIB . . .	84.0	77,952	92,800
VIIIA(I) . . .	65.0	181,415	279,100
VIIIA(II) . . .	85.0	408,256	480,301
VIIIB(I) . . .	90·0	92,070	102,300
VIIIB(II) . . .	106.0	45,050	42,500
IXA . . .	110.0	59,840	54,400
IXB . . .	86.0	473,870	551,012
XB . . .	95.0	399,570	420,600
XB . . .	78.0	258,648	331,600
XIA . . .	93·0	400,458	430,600
XIV(I) . . .	107·0	237,215	221,696
XIV(II) . . .	90·0	186,568	207,298
XIC . . .	85·0	97,154	114,299
		488,1,211	5,401,701

Weihted average intensity $\frac{4881211}{5401701} \times 100 = 90.36\%$

WATER REQUIREMENTS FOR DOMESTIC AND INDUSTRIAL PURPOSES

Madhya Pradesh

6.6.1 Water requirement for domestic and industrial purposes in Madhya Pradesh is dealt with in Chapter 10 of the Master Plan for Development of Water Resources of the Narmada in Madhya Pradesh 1972—Exhibit MP-312.

6.6.2 Water requirement has been indicated for the year 2021. In addition to water supply to towns (population in excess of 5000) within the basin provision has been made for supply to Indore, Mhow and Bhopal which are outside the basin. It is stated that these will depend on Narmada for domestic water requirements. For rural use, apart from human population, live stock also has been taken into account. It has been envisaged that half the rural requirement would be drawn from surface water and the rest from groundwater. Allowing for the availability from groundwater source and taking into account conveyance losses; the requirements for consumptive use for domestic purposes to be met from the Narmada has been worked out to be 0.439 MAF.

6.6.3 As regards industrial requirements, it is said that of the total requirement of 0.370 MAF, 20 per cent would be met from groundwater source and the remaining 0.296 MAF from Narmada. In addition, the Satpura Thermal Power Station would require 0.099 MAF. Thus, the total annual consumptive use of industries and the Thermal Power Station adds up to 0.395 MAF.

6.6.4 The total consumptive use for domestic water supply and industries for which water has to be drawn from the river is thus claimed to be 0.834 MAF (0.439 for domestic use and 0.395 for industrial and thermal power station use). This has been rounded off to 0.8 MAF.

6.6.5 Gujarat has, in its Written Submission 2 (April 1975) stated at page 54 that it does not dispute Madhya Pradesh's estimate of 0.8 MAF for its total consumptive use for domestic water supply and industries to be served by Narmada waters.

6.6.6 In the Master Plan Exhibit MP-312, Vol. I(a), it is stated at pp. 22-23 that while the total consumptive use for domestic and industrial purposes to be met from surface water would be 0.800 MAF, the withdrawal from the river flows for these uses would be 1.519 MAF. The difference of 0.719 MAF, the withdrawal from the river flows for these tion and return flows. As regenerated and return flows are taken into account in assessing 28 MAF of utilisable water of 75 per cent dependability, the requirement of Madhya Pradesh for domestic and industrial use of water is to be estimated as 1.519 MAF and not 0.800 MAF which is its consumptive use.

Gujarat

6.7.1 Gujarat's requirement of water for domestic and industrial use is stated in Sardar Sarovar Project Report Part III Volume III (Exhibit G-177) at pp 337—341. The assessment of the requirement is for the year 2001. Gujarat's Written Submission No. 1-A (May 1975) summarises the requirement at page 40 as follows:—

	Million litres/day	Million gallons/ day
(*i*) Ahmedabad	1,728	380
(*ii*) Other cities with population of more than 1 lakh	227	50
(*iii*) Kandla	227	50
(*iv*) Towns, for population of more than 10,000	545	120
(*v*) Diversified industries in Narmada Command	227	50
Total	2,954	650

The total comes to 0.87 MAF but has been rounded off to 1.0 MAF.

6.7.2 As regards domestic water requirement of villages in the command area of Navagam Canal, it is stated at page 341 of Sardar Sarovar Project Report Part III Volume III (Exhibit G-177) that "this requirement is not added here as these villages will be able to get sweet water supply from the underground water resources built up by continued irrigation or by seepage from village tanks which can be fed by the proposed Narmada Canal during period of surplus flows in canal."

6.7.3 In Maharashtra's Note 4 (February, 1977), it has been averred that the existing use of water in 1971 has been as stated below and should be taken into account.

Ahmedabad city	80·00	mgd.
Saurashtra cities	11·32	,,
Small towns in Saurashtra and Kutch Region	28·26	,,
	119·58	,,
or say	120	

Thus, the anticipated increase in the requirement in a period of 30 years between 1971 and 2001 is 530 mgd. (650—120), Madhya Pradesh's requirement of 1.519 MAF is for the year 2021. Projecting Gujarat's incremental requirement for 50 years on *pro rata* basis, Gujarat's requirement comes to $530 \times 50/30 = 883$ mgd. Including existing use, therefore, Gujarat's total requirement in the year 2021 would be 1003 mgd. (120 + 883) or 1.343 MAF.

6.7.4 The Dharoi Project on the Sabarmati, as approved in 1971, provides for water supply to Ahmedabad and Gandhinagar to the extent of 161 mgd. (150 + 10.8) *vide* Dharoi Project Report, Vol. 1 pp 25-26 (Exhibit G-185). This is to be drawn for nine months in a year as during three months there is sufficient flow in the river below Dharoi to meet the requirements, *vide ibid.* For meeting the present requirement, the supply from the river is augmented by drawing 18 mgd from tubewells (*vide ibid*). Supply from tubewells should continue to be utilised.

6.7.5 The quantum of water which is already available or has been secured for domestic and industrial use of Gujarat is as under.

	Million gallons		
(*i*) For Ahmedabad and Gandhinagar			
From Dharoi Project for nine months @161 mgd. (273 × 161)	43,953		
From Sabarmati river below Dharoi for 3 months @161 mgd. (92 × 161)	14,812		
From tubewells for 9 post-monsoon months (273 × 18)	4,194		
Total	62,959		
(*ii*) Saurashtra cities	11·32	mgd.	
Small towns in Saurashtra and Kutch Region	28·26	mgd.	
say	40 mgd.		14,600
(*See* paragraph 6.7.3) Total	or 0·284	MAF	77.559

The total requirement of Gujarat for domestic and industrial use being 1.343 MAF, the balance to be met from Narmada is 1.059 MAF.

Assessed Requirements

6.8.1 The requirement of water for domestic and industrial use to be met from the Narmada may, therefore, be estimated as follows:—

Madhya Pradesh	1.52 MAF
Gujarat	1.06 MAF

Gujarat's Claim for Releases for use below Navagam

6.9.1 Gujarat in its Written Submission Volume I-A page 36 has claimed 1,000 cusecs throughout the year or 0.7 MAF annually of Narmada water for releases below Navagam for meeting established uses of navigation, domestic water requirements and irrigation. It has further stated that "it would be necessary to let down a minimum quantity of 1,000 cusecs continuous for reaching these conclusions.

6.9.2 But Gujarat has not given the basis or the break up of the requirement of 0.7 MAF claimed as an incumbent requirement as between (a) navigation, (b) domestic use, (c) irrigation use or (d) arresting salinity progress. Gujarat has also not furnished any studies or any other material to support its case on the quantum of requirement for navigation or the other three heads.

6.9.3 Gujarat has quoted from the Report of the Inland Water Transport Committee, Government of India, (Exhibit G-400) to indicate the extent of navigation on the river. (*Ibid* pp 27—39). According to this Report, the Narmada is navigable by sailing vessels and country boats for a total distance of 160 kms from the sea. The river is tidal upto Mangaleshwar about 66 kms from the river mouth. Broach lies in this reach. Navigation is now possible for only 12 days in a month for sailing vessels of 50 to 100 tonnes capacity because of accummulation of silt in the river and formation of several sand bars between Broach and the sea. River navigation has been on the decline not only on the Narmada but on other rivers in the country, being unable to stand the competition of rail and road transport which provide better facilities. In any case, Broach which is the main port for sailing boats is in tidal reach and can continue to have the benefit of navigation.

6.9.4 In Exhibit G-86, page 20, Gujarat has given figures of annual irrigation and withdrawals by three irrigation schemes which lift water directly from the Narmada river. The annual irrigation adds up to 7,734 acres only and the withdrawal for it to 1239 mcft per annum. An additional withdrawal of 223 mcft is shown for Broach water supply scheme. The total committed use is thus 1472 mcft or 0.033 MAF. After the construction of Sardar Sarovar Dam, there will still be considerable discharge in the river downstream of the dam during the rainy period and in the remaining period on appreciable flow of regenerated water. On creation of Sardar Sarovar and introduction of irrigation

from Navagam Canal on the right bank of the river and from Karjan project on the left bank, the present regenerated inflow would get augmented by more than twice the committed use of 0.033 MAF. This river flow, apart from the available groundwater there, should be sufficient to meet these requirements. As regards salinity ingress, this would affect only a few villages some distance upstream of the tidal reach. In the 66 kms of tidal reach, a release of 1000 cusecs from Sardar Sarovar as proposed by Gujarat would be wasteful as it can hardly have any significant impact against the heavy daily flush of saline tidal water.

6.9.5 In view of what has been stated in these paragraphs, it is not possible to accept Gujarat's plea for apportionment of water for downstream uses.

6.10.1 We have consulted our Assessors, Dr. S. B. Hukkeri, Dr. M. R. Chopra, Shri Balwant Singh Nag and Shri C. S. Padmenabha Aiyar with regard to the subject matter of this Chapter. They all advise us that they agree with the conclusions reached in paragraphs 6.4.1. 6.5.2. 6.5.9. and 6.8.1. and the reasoning given by us for reaching these conclusions.

ANNEXURE VI.1

Camp : New Delhi

15-10-1977

PROF. AMBIKA SINGH

DEAN, FACULTY OF AGRICULTURE

P.M.B. 1044, AHMEDU BELLO

UNIVERSITY, ZARIA

(Nigeria)

Dear Sir,

I have the honour to submit herewith my Report "On the Water Requirements of Madhya Pradesh and Gujarat." I am most greatful to you for granting me time to submit my report. I have taken this opportunity to examining all the written arguments of the party States and all the relevant exhibits filed by the party States so far on the subject of this report.

Yours sincerely,

Sd./-
AMBIKA SINGH

Mr. Justice V. Ramaswami,

Chairman,

Narmada Water Disputes Tribunal,

NEW DELHI.

Introduction

1.0 I was appointed part-time Assessor (Agronomy) and was in the 28th meeting of the Narmada Water Disputes Tribunal directed to investigate and report on the following technical matters.

1.1 Estimate of reasonable water requirements of the States of Gujarat and Madhya Pradesh both within and outside the Narmada basin from a scientific point of view after taking into account:

(a) the areas proposed to be irrigated;

(b) climate;

(c) effective rainfall available for crops proposed;

(d) consumptive use of water;

(e) evaporation data—evaportranspiration, crops co-efficient and other relevant factors;

(f) intensity of irrigation suggested;

(g) net culturable command areas of major, medium and minor projects;

(h) the chemical and physical qualities of soils and their suitability for proposed or modified crop pattern:

(i) the present and future crop patterns; and

(ii) any other relevant factors.

The tribunal further directed me "to take into account the claims to Narmada waters put forward by Gujarat and Madhya Pradesh in their respective Statement of Case and Rejoinder, the Master Plan of Madhya Pradesh and the various project reports and the other documentary evidence respectively submitted by each State."

1.2 My report was to be submitted on or before the 15th May, 1975. Documents continued to be submitted by party States till January, 1977. Therefore, the final drafting of the report actually started in the later half of January, 1977.

1.3 Permission was granted till the end of March, 1977 for submission of the report (*vide* proceedings of the Tribunal dated the February 7, 1977).

1.4 Besides examining documentary evidence, I made field visits in the proposed command areas of Gujarat and Madhya Pradesh. In these visits I was accompanied by the experts of these States who showed me the soil conditions and other relevant factors. These visits proved very valuable in arriving at the conclusions given in the subsequent chapters.

1.5 I wish to thank the officers of the Tribunal and State Governments for all the help and assistance rendered during the course of this study.

Utilizable Quantum of Water and Claims of the party States

2.0 As per the Tribunal's directions dated 8-10-74 net utilizable quantum of water at 75% depend-

ability in the Narmada River at Navagam dam site has been determined as 28 MAF. The requirement of Maharashtra and Rajasthan for use in their territory are 0.25 and 0.50 MAF respectively. Deducting these quantities, the net available quantity of water for use in Gujarat and Madhya Pradesh is 27.25 MAF.

Madhya Pradesh is the upper riparian State. Therefore, it is logical to start with its claim first and then present the case of the lower riparian State Gujarat in a scientific study.

Claims of Madhya Pradesh

2.1 Madhya Pradesh has claimed an aggregate annual requirement of 24.08 MAF (Figures rounded to two decimal places) of Narmada water for consumptive uses in the Narmada basin in Madhya Pradesh comprising (i) 23.28 MAF for irrigation for a CCA of 70.70 lakh acres and 0.80 MAF for domestic and industrial water supply. The details are fully set out in Madhya Pradesh's Statement 3 where the claims for CCA under major, medium minor and pumping schemes and the water requirement for each category of the scheme is given zonewise. Madhya Pradesh has also claimed 1.82 MAF of Narmada waters for irrigation outside Narmada basin, but in alternative to some use in the Narmada basin.

Claim of Gujarat

2.2 In its Written Submission I-A during its opening of the case Gujarat has submitted its total water requirements from the Narmada for consumptive uses and for release below Navagam. In its claim made before the Tribunal Gujarat has proposed to irrigate 71.38 lakh acres from Narmada waters. This claim includes four parts of the command. Table 9 of (Ex. G-626) Column 6 gives water requirements at the field of the command as under:—

Part of the command	Water requirement at field in MAF
1. Zones I—XI	8·54
2. Mahi Command	1·04
3. Banni	0·88
4. Ranns	3·36
Total	13·82

Column 7 of the table assumes transit losses at 50% of the field requirement. The total under column 8 gives total irrigation water requirement of the command at canal head at 20.73 MAF. Adding reservoir evaporation losses of 1.2 MAF and its domestic and industrial uses (1.00 MAF) and release below Navagam (0.70 MAF) and 0.41 MAF available water from *en route* rivers the water requirement of Gujarat from Narmada for consumptive uses and release below Navagam are $20.73 + 1.20 + 1.00 + 0.70 - .41 = 23.22$ MAF.

Total of the Claim of two States

2.3 The water requirements of both the States as per their claims works out $(24.08 + 23.22) = 47.30$ MAF. Only 27.25 MAF water is available for allocation, between two States. As water requirement is dependent on CCA, assumed cropping patterns and intensities of irrigation and delta, an examination of these will be done to work out the reasonable water requirements of the party States. Before doing so the historical perspective is very briefly presented.

Historical Perspective of the Claims

2.4.0 The claims of the party States have been examined in the past by Khosla Committee (G-83) in 1965 and official level discussion in 1966. Madhya Pradesh has prepared a Statement (Statement No. 16) in which it has put in the chronological order from 1948 to 1971 the area to be irrigated in lakh acres and water requirement at canal head in MAF in Madhya Pradesh and Gujarat. This statement indicates the rising claims of both the States on Narmada waters.

2.4.1 As far as Madhya Pradesh is concerned, its claims before Khosla Committee have been given in MP/74 and before this Tribunal in the Revised Master Plan (MP/312). The revised Master Plan gives *inter alia* details of land categories and zonewise requirements for irrigation under major, medium and minor and pumping schemes.

2.4.2 As for as Gujarat is concerned, on page 5 and 5A of the Written Submission I of Gujarat during the opening of its case, a comparative statement of GCA, CA and CCA of Narmada+300 Canal are given as per pleading Vol. I, as per Project Report (G/177) and as per G/626 based on Ex./425 enclosure No. 1. Madhya Pradesh has also prepared another comparative statement showing figures of GCA, CCA and Water requirement before Khosla Committee and before this Tribunal

(Written Submission of Madhya Pradesh during opening of its case Vol. IV page 5A).

Methodology of the Study

3.0 In order to carry out fully the directives of the Tribunal one has to follw simulation methods in water development which have so successfully been applied to such problems and have been summarised in Irrigation and Drainage Paper No. 23 of the Food & Agriculture Organisation of the United Nations, Rome 1974 (Simulation methods in Water Development by Carr and Underhill). This publication shows, *inter alia,* that in the assessment of water requirement of an area there are several variables which have to be considered. Some of them have been explicitly listed in the directive given to me by the Tribunal. In order to develop a model on the lines suggested in the publication, one has to quantify or at least codify in a quantitative terms the variables that characterise the model components. The most important one in which an agronomist comes into picture is Irrigation Water requirement per acre. This irrigation water requirement is a complex parameter for it is a function of both cropping pattern and crop requirement. Corpping pattern is decision variably implying that one can choose from the whole range of possible values. The range of cropping patterns now possible in the party States are multiple cropping on one extreme and the existing cropping pattern prevalent in the area proposed to be irrigated. Between these two ertreme several cropping patterns are possible and could be selected. As will become evident in a later chapters Madhya Pradesh has emphasised the multiple cropping aspects in its pleadings whereas Gujarat is quite nearer to existing pattern. Similarly for delta to be adapted for the constituent crops of the cropping pattern, only the optimum value is well defined as it is worked out in agronomic experiments. When enough water is not available, one has to bring into consideration several exogenous parameters (non-agronomic variables) and give delta at a sub optimum level. Similarly intensity of annual irrigation (percentage of CCA) could be varied on the basis of exogenous factors.

3.1 The presentation of the claims of the party States at various points of time shows the variations in the CCA, cropping patterns, intensity of irrigation and delta. The honourable Tribunal has to allocate water to these States for consumptive uses during the coming 40 years or so. During this period several unpredictable changes in agricultural techniques are likely to take place. I have, therefore, not attempted to develop a model simulating the condition of present agriculture or a projected agriculture in areas proposed to be irrigated in the party States to (a) allocate water optimally among various crops and (b) to estimate the marginal value product of water. Instead, an empirical examination of the components of water requirements is made based on the facts put before the Tribunal by party States and my own agronomic knowledge and judgement.

3.2 I would like to point out here that even this empirical examination is not so simple as it seems on the surface. If one starts examining the situation in depth several basic questions arise. What is the objective/s of irrigation? They are many and could be put in the following broad categories:

(1) in arid areas irrigation is provided as the principal source of water throughout the year.

(2) in arid and semi-arid areas, irrigation acts as a regular supplement to insufficient rainfall or to make up for the maldistribution of rainfall during the crop season.

(3) in areas where even if rainfall is generally high but is confined to three or four months in the year irrigation is needed for growing a second crop in the season.

(4) in semi-arid areas or in unpredictable monsoon areas, irrigation acts as an insurance against failure of rains.

(5) in semi-humid areas irrigation could be applied as a measure to increase the yield of crops requiring more regular supply of water than found in nature.

(6) on soil infested with salinity and/or alkalinity irrigation is goven for soil reclamation and crop production.

3.3 All these situations are found in one or the other proposed areas to be irrigated by Madhya Prodesh and Gujarat. Therefore, even for empirical examination some naturally accepted guidelines are required within the framework of which the claims of the party could be examined.

3.4 Such guidelines have been given by National Commission on Agriculture. Their report have been recently submitted. Part V of their report entitled "Resource Development" is relevant in the context. Part of this Report, which will help in the

examination of claims is discussed in the next chapter.

Guidelines for Development of Irrigation

4.0 In the chapter 15.6 entitled "Development of Water Resources" (Report of National Commission on Agriculture), several policy issues have been discussed. In my assessment. I propose to work within them. Water resources of Narmada are insufficient to meet the irrigation requirement of the party States. That being so, it becomes necessary to so utilise the available water as to secure the maximum crop production per unit of water extending at the same time the benefit of irrigation to as many farmers as is technically and economically feasible. This implies that irrigation intensities should be low and irrigation work should be treated as 'protective'. This also implies that fewer waterings should be given to crops that are required for securing maximum yield but depth of each watering should be sufficient to keep the salts, if any, down the profile.

4.1 Rainfed rise is growing extensively in Narmada basin of Madhya Pradesh particularly in the upper part. In this part good rainfall occurs only in July and August while the crop requires copious water for 4 months. Given irrigation facilities to supplement rain water, excellent yields can be secured here, particularly as this enables the timely and proper use of inputs like fertilisers etc. In view of this irrigation projects should be planned to irrigate maximum areas during the rainy season by supplementing rainfall. Evaporation losses are lowest during winter months and highest during April to July. During the hot season, therefore, use of irrigation supplies is less economic than in the rest of the year. It is, therefore, advantageous to bring as much area as is possible under irrigation during the winter months or the eight months excluding hot weather.

4.2 The raising of more than one irrigated crop in a field leads to the better use of inputs and also of residual soil moisture from the previous crops. Only where area is limited and water ample, the adaption of high intensity is called for. If available water can physically serve a large commanded area other considerations arise in selecting intensity of cropping. A high intensity of irrigation in such a case would benefit fewer farmers in a large measure than otherwise. This would accentuate social disparity in the farming community. Here the higher intensity would also not give any increased overall production as the gross irrigated area would be determined by the available irrigation supplies and not irrigation intensity. Thus is such a situation lower intensities are called for. Growing of crops in hot season March—June should be avoided as during this period evaporative demand of atmosphere is very high and per unit productivity of water is low.

Delta

4.3 In planning irrigation projects there is tendency to allow optimum delta worked out from experiments. Delta involves frequency, timing and depth of watering. In water paucity areas an irrigation system may cater for fewer waterings than required for maximum yields. This may be so in order to extended the benefit of irrigation to a large number of farmers. Under these conditions it becomes very important that irrigation is done during the crucial stages of crop growth if serious reduction in crop yield is to be avoided. As an example of this universal rule (called Law of Diminishing Return) an experiment on wheat (Sonora 64) has been quoted on page 80 of the National Commission on Agriculture Report, Part V. A single irrigation 25 days after sowing raised the yield to three times of that of an unirrigated crop. With 3 waterings at the most appropriate stage the yield was 3.8 times and with 4 waterings 4.5 times and 5 waterings only 5.1 times. These results illustrate that in water paucity areas with a fewer than optimum number of waterings on a large area and appropriate timings of irrigation, a greater overall production can be secured.

4.4 These basic principles illustrate how intensity of irrigation cropping pattern and delta could be varied to obtain optimum results under different situations of water availability.

4.5 The basic considerations of planning irrigations schemes have been the cropping pattern, the intensity of irrigation and duty of water which connotes the relation between the area irrigated and the quantity of water required to irrigate it. Once the project is constructed, there is hardly any enforcement of cropping pattern or irrigation intensity. Delta or duty of water could be controlled. In view of this, I will examine the suggested cropping patterns and intensities to work out reasonable water requirement of the party States. Delta as proposed by the party States will be kept as such in the calculations. Unless one has very intimate knowledge and practical experience of farming situation in an area he should not make alternation in frequency, timing and depth of watering.

EXAMINATION OF CLAIMS OF MADHYA PRADESH

5.0 The claim of Madhya Pradesh is given in para 2.1.

Approach of Madhya Pradesh in Estimating Water Requirement.

5.1 Water requirement of crops have been worked out by Madhya Pradesh as per procedure explained in the Guide for Estimating Irrigation Water Requirement. Series 2A, 1971 Water Management Division of Ministry of Agriculture, New Delhi (MP/416). MP/ 674 gives detailed calculation of water requirements. As far as I am concerned, the approach is correct and scientific. Commenting upon the approach and calculation, Gujarat in its Written Submission 2 (Page 50) has observed "Madhya Pradesh has taken climatic parameters of Jabalpur for the entire upper reach, of Hoshangabad for the entire middle reach and of Khandwa for the entire lower reach. It is submitted that climatic parameters of these stations are not representative of the climatic parameters of the reach for which they are taken". This contention of Gujarat is not correct as is evidenced by the data given in table 1. This table 1 has been constructed from table 3 (page 12 of MP-712). To the figures given in the Statement 3 on page 12, I have juxtaposed the average moisture deficit figures for Jabalpur, Hoshangabad and Khandwa as given in the Statement 4.3 of Vol. II of the Master Plan 1972 (MP/312).

TABLE 1

Average moisture deficit (in inches) in the 3 zones in the Narmada basin in Madhya Pradesh contrasted with average moisture deficit at Jabalpur, Hoshangabad and Khandwa.

Month	Upper Zone		Middle Zone		Lower Zone	
	Average	Jabalpur	Average	Hoshangabad	Average	Khandwa
July .	..	..	..	..	..	..
August .	..	..	..	..	..	..
Sept. .	..	..	..	..	..	..
Oct. .	1.21	2.6	2.56	3.2	3.1	3.4
Nov. .	2.59	2.5	2.6	2.7	2·73	2.7
Dec. .	2.21	2.3	2.65	2.7	3.03	3·0
Jan. .	1.51	1.8	2.49	2·6	3.14	3.4
Feb. .	2·71	2.7	3.45	3.4	4.46	4.4
March .	3.82	4·7	5.15	5.2	6·48	6.3
April .	5·51	6.1	6.47	6.4	8·25	8·1
May .	7.00	7.4	7.32	7.7	10.39	10.0
June .	1.07	0·1	0·32	0·5	2·72	2·6
Total .	27·63	30.2	34.01	32·4	44.31	43·9

28 Agri.—13.

The data given in Table 1 indicate that Madhya Pradesh is fully justified to take Jabalpur, Hoshangahad and Khandwa as representative site for the respective zones. The second comment of Gujarat is on the constant K (evapotranspiration) which has not been experimentally determined by Madhya Pradesh in Narmada basin. It is a practice all over the world to take the value of 'K' from similar ecological situations when experimentally determined values are not available. This gives a good approximation. After all one is not very precisely determining the water requirement. It is only being approximate. MP-674 (Water Requirement of Crops in Narmada Basin) gives detailed calculations. The method is followed all over the world in such studies and is a scientific one.

CCA in Madhya Pradesh

5.2 Madhya Pradesh has given the objective of irrigation in the basin in the following words (MP/312):—

> "Provision for irrigation facilities to all culturable lands in the basin which can be developed from the Narmada river system by gravity or by reasonable lift, from Major, Medium, Minor Schemes and by direct pumping from streams and reservoirs." (MP/312/Vol. I page 6).

The above-mentioned objective is egalitarian one and no one should object to it. Gujarat has alleged that Madhya Pradesh has been progressively increasing its claim of culturable area and water requirements. M.P. Statement 16 shows the claims made by Madhya Pradesh and Gujarat from time to time. The claim of M.P. was 60 lakh acres in 1960 and now it is 70.70 lakh acres. Khosla Committee while assessing the water requirement of Madhya Pradesh accepted the principle that whatever the upper riparian can possibly bring under irrigation even in distant future should be allowed to it (Page 68 para 6.23). Revised Master Plan Vol. II page 140 Statement 18.2 and M.P. Statement 3 gives the claim for irrigation under major projects for the 30.74 lakh acres. Similarly in Statement 18.3 at page 144 Vol. II the CCA for medium, minor and pumping schemes is given as 39.76 lakh acres. The CCA of 70.70 lakh acres (30.74 + 39.76) includes 6.50 lakh acres by pumping schemes (page

13 of Vol. I-A of MP/312 table 18.5). Pumping schemes on rivers have developed after the drought of 1966. The government has encouraged such schemes in the areas where electric supply is available. Madhya Pradesh is one State in India where still culturable areas exist which with the introduction of irrigation can be cultivated. The present land use in such areas is pasture or forest. All over the world with the increase in population such land have been brought under plough. The cultivated land of today were pastures or forests of yesteryears. The basis for allocation of water should be culturable area and not only the cultivated area.

5.3 I am in agreement with the points made by Madhya Pradesh in their Written Submission 2 pages 26—37. The Tribunal should accept 70.70 lakh as CCA for Madhya Pradesh. If CCA under pumping schemes is deduced from total CCA, the remaining CCA is (70.70—6.50) = 64.20 lakh acres. Khosla Committee accepted and agreed to 65 lakh acres. Pumping schemes, as indicated earlier in this Chapter, are development after the submission of the Report of Khosla Committee.

Cropping Pattern, Irrigation Intensity and Delta

5.4.0. In Madhya Pradesh's Statement 19 and 20 full particulars of the cropping patterns and the intensity of irrigation is given. In Statement 20 zonewise CCA, the average intensity and annual irrigation in the Narmada basin in Madhya Pradesh by major, medium and minor schemes and pumping schemes is given. As indicated therein, the overall intensity for all irrigation schemes in the basin works out 140 per cent. In M.P. Statement 21, Madhya Pradesh has given the existing irrigated crop pattern in its basin areas as per figures given in the Report of the Irrigation Commission (G-512, Vol. III part I page 335). Madhya Pradesh has pointed out that Khosla Committee did not take into consideration the high yielding varieties, short duration crops and high fertiliser use while making its estimate of water requirement and allocation. The high yielding varieties were introduced in 1966 after the Khosla Committee Report which was finalised in 1965. Therefore, the cropping pattern suggested by Khosla Committee has become out of date.

5.4.1 As per Statement 20 Madhya Pradesh has given the following intensities of irrigation in different types of projects:—

TABLE 2

Project categorywise average intensities of irrigation in Madhya Pradesh

Project	Average Intensity (Per cent)
Major	168
Medium	115
Minor	107
Microminor	100
Pumping	159
Overall intensity of irrigation schemes in the basin	140

Obviously these intensities are very high and are not in conformity with projections made by National Commission on Agriculture. Before examining and suggesting an alternate irrigation intensities, the cropping patterns suggested by Madhya Pradesh are examined below.

5.4.2 In the cropping patterns for major Projects of Madhya Pradesh in upper zone (Upper Narmada, Upper Burhner, Halon and Dhobatoria) 195% intensity of cropping is suggested. This is aggregate of 90% kharif, 79% rabi and 26% summer croping. In summer cropping 17% area under pulses are proposed. The return from them will be very low and uneconomic. This should not be allowed in the light of the recommendation of National Commission on Agriculture. Similarly area under vegetables and fodder crops should be reduced. Area under paddy should also be reduced. While making this suggestion, the guiding principle is that only low land paddy cultivation should be encouraged. Upland paddy requires more irrigation and return is not as high as on other upland crops for per unit of water. (Page 74 of the National Commission on Agriculture Part V Resource Development).

5.4.3 In the middle zone, under major projects (page 15 Ex. MP/712) average intensity of cropping is 157%. It varies from 194% in Bargi to 104% in Barna, Kharif cropping ranges from 92% in Bargi to 52% in Barna. In this category again 18—22% areas are proposed to be cropped with summer pulses which is very uneconomic. Similarly under major projects in lower zone 24% area is proposed under summer pulses. This should not be allowed.

5.4.4 I have given some examples above to show that how the proposed intensity of cropping is not in line with our national thinking for best utilisation of water resources. Taking into consideration the suggestions made by National Commission on Agriculture and my own agronomic judgement (I have made it very clear in Chapter 3 page 7 that cropping intensity is a matter of judgement). I have prepared an alternate irrigation intensity which is likely to develop in Madhya Pradesh in next 40 to 50 years. It is given in Table 3 below:—

TABLE 3

Irrigation Intensity Proposed for Narmada Basin in Madhya Pradesh

Kharif		Rabi		Hot weather	
Crops	Irrigation Intensity %	Crops	Irrigation intensity %	Crops	Irrigation intensity %
1	2	3	4	5	6
		A. *MAJOR PROJECTS*			
(i) *Upper Zone*					
Paddy	20	Wheat HYV	20	Vegetables	1
Jowar/maize	20	Wheat local	20	Fodder	2
G. Nut	3	Peas	5		
Pulses	..	Gram	10		
Fodder	..	Berseem & other fodder	3		
Vegetables	2	Vegetables	1		
Perennials	5				
	50		59		3
Total intensity of irrigation 50+59+3=112					
(ii) *Middle Zone*					
Paddy	15	Wheat HYV	20	Vegetables	1
Maize/Jowar	20	Wheat local	20	Fodder	2
Premonsoon Cotton	5	Peas	4		
G. Nut	3	Berseem & other fodder	2		
Pulses	..	Gram	11		
Vegetables	2	Vegetables	2		
Fodder	5				
Perennials	4				
	49		59		3
Total intensity of irrigation 49+59+3=111					

TABLE 3—*Contd.*

1	2	3	4	5	6
(iii) Lower Zone					
Paddy	10	Wheat HYV	20	Vegetables	1
Maize/Jowar	16	Wheat local	20	Fodder	2
Premonsoon Cotton	15	Peas	4		
G. nut	5	Berseem & other fodder	2		
Pulses	..	Gram	11		
Vegetables	2	Vegetables	2		
Perennials	2				
	50		59		3
Total intensity of irrigation 50+59+3=112					
B. *MEDIUM PROJECTS*					
(i) Upper Zone					
Paddy	15	Wheat (H)	20	..	..
Maize/Jowar	20	Wheat (L)	20	..	..
G. nut	5	Peas	6	..	..
Pulses	..	Berseem	3	..	..
Vegetables	2	Gram	13	..	..
Fodder	..	Linseed	3		..
Perennials	2				
	44		65		
Total (44+65)=109					
(ii) Middle Zone					
Paddy	10	Wheat (H)	20	..	..
Maize/Jowar	20	Wheat (L)	21	..	..
Premonsoon Cotton	5	Peas	6	..	..
G. nut	5	Gram	12	..	..
Fodder	..	Berseem	3	..	..
Vegetables	2	Vegetables	2	..	..
Pulses	..				
Perennials	2				
	44		64		
Total (44+64)=108					

TABLE 3—*Contd.*

1	2	3	4	5	6
(*iii*) *Lower Zone*					
Paddy	8	Wheat (H)	15	..	..
Maize/Jowar	15	Wheat (L)	20	..	..
Cotton	15	Peas	5	..	..
G. nut	4	Berseem	2	..	..
Pulses	..	Vegetables	1	..	..
Vegetables	2	Maize/Jowar	15	..	..
Fodder	..			..	..
Perennials	2			..	..
	46		58		
	Total (46+58)=104				

MINOR SCHEMES

(*i*) *Upper Zone*					
Paddy	8	Wheat (H)	20	..	..
H. Jowar/Maize	15	Wheat (L)	20	..	..
G. nut	5	Gram	10	..	..
Pulses	..	Vegetables	1	..	..
Vegetables	2	Berseem	2	..	..
Fodder	..	Peas	5	..	..
	30		58	..	..
	Total (30+58)=88				
(*ii*) *Middle Zone*					
Paddy	5	Wheat (H)	20	..	..
H. Maize/Jowar	15	Wheat (L)	20	..	..
Cotton Premonsoon	5	Peas	8	..	..
Pulses	..	Gram	8	..	..
Fodder	..	Vegetables	1	..	..
G. nut	5	Berseem	2	..	..
Vegetables	2				
	32		59	..	..
	Total (32+59)=91				

TABLE 3—*Concld.*

(iii) Lower Zone					
Paddy . . .	3	Wheat (H) . . .	15	..	..
H. Jowar/Maize	12	Wheat (L) . . .	18	..	..
Cotton . . .	15	Peas	5	..	..
G. nut . . .	8	Gram	5	..	..
Pulses . . .	..	Vegetables . . .	2	..	..
Vegetables .	2	Berseem . . .	1	..	..
Fodder . . .	..				
	40		46		

Total (40+46)=86

Irrigation intensity for microminor and pumping schemes has not been differentiated cropwise. It will be 100 and 112% respectively.

On the basis of alternate average intensity suggested by me in para 5.4.4 and the CCAs and average delta given in Madhya Pradesh Statement 27 (Statement 13 of MP/712) the water requirement in the 3 zones of the Narmada basin in Madhya Pradesh by major, medium, minor projects and pumping schemes has been worked out and is given in Table 4:—

TABLE 4

Water requirement in the 3 Zone of the Narmada Basin in Madhya Pradesh by Major, Medium and Minor Projects and Pumping Schemes

	Total CCA Million Acres	Average intensity of irrigation %	Average delta in feet	Water Requirement MAF (1)×(2)×(3)
	1	2	3	4
1. *Major Projects*				
Upper Zone	0.125	112	2.50	0·350
Middle Zone	2·222	111	2.38	5.870
Lower Zone	0·747	112	3.13	2·618
Total .	3.094			8.84
2. *Medium Projects*				
Upper Zone	0.459	109	1·93	0·965
Middle Zone	1·096	108	2.03	2·402
Lower Zone	0.416	114	2.31	0·999
Total .	1·971			4·37
3. *Minor Schemes* (More than 150 acres each)				
Upper Zone	0·192	88	1·75	0·295
Middle Zone	0·459	91	1·94	0·810
Lower Zone	0·151	86	1·93	0·250
Total .	0·802			1·355
4. *Microminor Schemes* (Less than 150 acres each)				
	0·533	100	1·5	0·829
5. *Pumying Schemes*				
Upper Zone	0.031	112	2.2	0.0763
Middle Zone	0·436	111	2·4	1·1161
Lower Zone	0·183	112	3·0	0·6148
Total .	0·650			1·81
Grand Total	7·070			17·21

(The average intensity of irrigation is based on the intensity suggested by me. The average delta for projects at S. No. 1 to 3 are as per Statements 9, 10, 11, 12 of the MP/712. For pumping schemes (S. No. 5) the delta are as planned for medium schemes (Page 47—52 of Volume II of MP/312). For Microminor schemes, an average intensity of 100% with a delta of 1.5 ft. is assumed.

5.4.5 Madhya Pradesh has estimated 0.8 MAF for its total consumptive use for domestic water supply and industry to be served by Narmada waters.

5.4.6 The realistic need of Madhya Pradesh of the Narmada waters for consumptive use of irrigation and domestic and industrial supplies in the Narmada basin in Madhya Pradesh will be (17.21 + 0.8) = 18.01 MAF.

Water Requirement of M.P. Outside the Basin

5.4.7 The three project reports of Madhya Pradesh viz. Upper Narmada Diversion Project (MP/390). Upper Burhner Diversion Project (MP/391) and Bargi Diversion Project (MP/161) and Plan 1972 (MP/312) give the relevant details. A statement on the GCA CA, area proposed to be irrigated (CCA) and water requirement etc. as per Master Plan 1972 (MP/312) and project reports is tabulated and appended in CMP 269 of 1976. I have examined this statement and find that the water requirement of 1.82 MAF is agronomically sound because cropping pattern and delta proposed are justified on climatic and edaphic considerations.

EXAMINATION OF CLAIMS OF GUJARAT

The claims of Gujarat have been summarised in para 2.2. Irrigation water requirement of Gujarat will be discussed under the following broad heads:—

1. In Zone I to XI
2. In Mahi Command
3. In Banni and Ranns.

Gujarat's Written Submission 1A during opening of the case. Madhya Pradesh's Written Submission (Volume IV, V and VI) during opening of its case and Maharashtra's Note on topic (5). Water requirement of Gujarat throw light on different aspects of the problem. In technical assessment of the water requirement different aspects are involved in the above mentioned heads. First Gujarat's claim on Mahi Command and Banni and Ranns will be examined.

Mahi Command

Water requirement of Mahi Command was not submitted by Gujarat before Khosla Committee (Ex. G/369) for any waters of Narmada to irrigate any area in Mahi command covered under the Mahi Right Bank Canal Project, but Khosla Committee, however, recommended that the area under Mahi Command should be transferred to Narmada and Mahi water so released by Narmada should be transferred to Rajasthan for areas too high to be irrigated from the Narmada system (Ex. G-83). In G-630-A/1 Gujarat has shown that existing Mahi Command having an area to be irrigated of 6.33 lakh acres and utilising 1.56 MAF from Mahi is proposed to be commanded by FSL 300 canal. To me it is purely a legal question and the Tribunal will consider it from that angle. In my calculation of Gujarat's Water requirement I have not taken it into consideration.

Water Requirement for Areas in Great Ranns and Little Ranns and Banni

Madhya Pradesh (Written Submission of Madhya Pradesh during the opening of its case Vol. VI Part A & B) and Maharashtra (Maharashtra's Notes of Argument Topic (5) (III) have exhaustively examined the documents filed by Gujarat on this topic. I had made field visit in these areas, saw their general features and examined several profiles *in*[6] *situ* in January, 1975. I was also shown the pilot plot in Banni and the pilot projects at Umrath near Navsari. State Government officers were requested to place all the data for my examination. I discussed a few technical points at College of Agriculture, Anand. I have also examined the fresh reappraisal report of Dr. M. R. Dutta Biswas and Dr. R. R. Aggarwal with regard to the prospect of reclamation of Banni area (Gujarat's Written Reply No. 4—Appendix I).

Based on a study of the documents and field visit I have arrived at the conclusion that Rann's area is characterised by high salinity, a very low horizontal permeability, a vertical permeability of nearly nil, a high ground water table and impervious layer near the ground water and low rainfall. From this description it could be easily understood that reclamation of the area, even if possible, will be a very difficult task. It has not been established till now whether or not desalinization of soil is possible. Neither the pot experiments conducted at the Soil Research Institute, Baroda, nor the experiments conducted at Umrath in 36 acres of land could be extrapolated to this area. More information, for example, about the effect of solid salts on the permeability, the alkali hazards, the permeability after the application of sub-soiling etc. yet remain to be investigated. The Pilot plots in Banni area on light soils of Banni have, no doubt, shown the possibility of growing crops but they have not investigated and generated data from which design parameters for effective reclamation of the area could be derived.

Even if it is assumed for argument that the area could be reclaimed and developed with the quantity of water indicated, the return of investment will be prohibitive for undertaking such a venture. A field delta of 6.24 ft. has been proposed for the area.

Taking into consideration 50% transit losses, (6.24 + 3.12) = 9.36 ft.

With this delta at canal head

$$\frac{(9.36)}{2.40} = 3.9 \text{ acres of}$$

good land could be irrigated within or outside the basin which will generate more yield per acre of land.

In view of the above, I am in full agreement with the conclusion arrived at by Maharashtra on pages 32—34 in its Notes on Argument (topic 5 III). Gujarat's claim of 6.36 MAF of water for irrigating 11 lakh acres in the Ranns and Banni does not merit consideration in the equitable apportionment of waters in Narmada River.

Zones I to XI

In examining the claims of Gujarat for this area, I proposed to follow the same procedure as was adopted by me in examining the claim of Madhya Pradesh. I am accepting the CCA proposed by Gujarat. The delta and cropping pattern are also reasonable. Gujarat has proposed a cropping pattern which is nearer its existing cropping pattern. Intensity of annual irrigation, in my view should not be more than 65%. (This intensity has been suggested in view of the paucity of water and soil conditions).

Gujarat in its Ex. G-908 has furnished statements giving zonewise details of areas proposed to be irrigated, proposed cropping patterns and irrigation water requirement at field for each month at canal head for entire command.

In Statement 1 of Ex. G-908 the CCA, intensity of irrigation (percentage to CCA) and annual irrigation in acres have been given. If we add serial No. 1 to 25 we get the value for Zone I to XI.

The values are

(1) CCA in lakh acres—54.434

(2) Average intensity (% of CCA)—63.37

(3) Annual irrigation lakh acres.—34.492

A study of the intensity of irrigation will show that it varies from 77.18% in Zone IX A to 42.10% in Zone II. These intensities are in line with the soil survey data and land irrigability class of the areas. I have also examined the fresh land irrigability classification for Zones I to XI carried out by Dr. M. R. Datta Biswas and Dr. R. R. Aggarwal on behalf of Gujarat (Exs. G/1081, and Nos. G/1039 to G-1046 and G/1057, G/1058, G/1063 to G-1069). My recommendation is that Tribunal should accept the cropping pattern suggested by Gujarat in this document (Serial No. 1 to 25 of Statement 2) should also be accepted because they are based on edaphic data furnished in the soil survey reports filed by Gujarat. I have examined Statement 3/1 to 3/25. They are also technically sound.

The irrigation water requirement for these zones could be calculated from Statement 4 of Ex. G-903 by totalling serial No. 1 to 25. This gives a total water requirement of 5.98 MAF at field head. Adding losses in transit at 50% the total irrigation water requirement of Gujarat works out (5.98 + 2.99) = 8.97 MAF.

In this context Maharashtra's Note 7 Validity of Gujarat's claim for a CCA of 71.38 lakh acres without reference to pre-Tribunal claim may be seen. According to Maharashtra's calculations (Serial No. 19 of the Note) water requirement at field comes to be 5.73 MAF. If 50% transit losses are added, the water requirement at canal head will be (5.73 + 2.86) = 8.59 MAF. If main canal, branches and distributories upto 100 cusecs capacity are lined then 50% transit loss is an over-estimation. Under such conditions transit losses are not expected to be more than 33.3%.

The total claim of Gujarat on Narmada water will depend on 3 other assessments, namely:—

(1) Assessment of its domestic and industrial use,

(2) Assessment of availability from *en route* rivers, and

(3) Assessment of Gujarat's claim for releases below Navagam.

After assessing these, a reasonable estimate of Narmada water to be allocated to Gujarat can be made.

CAMP: ZARIA
15-10-1977

Sd/-
(AMBIKA SINGH)
15-10-1977

CHAPTER VII

WATER RESOURCES OF MAHI AND OTHER RIVERS CROSSED BY NAVAGAM CANAL IN GUJARAT

The Rivers

7.1.1 The Navagam Canal with FSL +300 proposed by Gujarat crosses number of rivers. The surplus water available in these after meeting the requirement of existing and proposed use can be utilised in Narmada command to the extent it is feasible. The names of these rivers and tributaries are given in Statement 7.1. In Exhibit G-1033 (October 1976), ten daily average observed flow data are given for the more significant ten rivers for a recent period of 12 years from July 1, 1964 to June 30, 1976. The gauge sites are shown on a map in Exhibit G-1034.

7.1.2 The Navagam Canal with FSL +300 proposed by Gujarat is 310 miles long upto Rajasthan border and has a gradient of 1 in 10,000 upto the off-take of Banni Branch at mile 262 and 1 in 6,000 thereafter. We have proposed a flatter gradient of 1 in 12,000 upto mile 180 and 1 in 10,000 thereafter. The change does not significantly affect the availability of water resources from *en route* rivers for Navagam Canal command.

Master Plan of Gujarat

7.2.1 In July, 1971, Gujarat submitted to the Tribunal, its Master Plan of the water resources of the *en route* rivers which the proposed +300 Level Navagam Canal would cross (Exhibit G-186). The Master Plan gave basinwise information in respect of existing and proposed storage dams, weirs and other diversion works and the total utilisation possible in the canal command from these schemes, estimated at 0.383 MAF (Enclosure I of Exhibit G-186). In its Statement of the Case submitted to the Tribunal in February 1970, Gujarat had given the same figures, *vide* Annexure GA-15 of the Statement of the Case, Volume II. In 1972, Madhya Pradesh filed C.M.P. No. 209 requiring further information from Gujarat in respect of its Master Plan for the *en route* rivers. Accordingly, Gujarat after making further studies revised the Master Plan in 1974 and submitted it as Exhibit G-462. In the Revised Plan, the availability for use in the canal command is indicated as under:—

(Million CFt)

	Main Canal	Saurashtra Branch	Total	
Reservoirs	3,018	1,483	4,501	(0·1033 MAF)
Weirs	5,983	140	6,123	(0·1406 MAF)
Level Crossings	6,799	562	7,361	(0·1690 MAF)
Total .	15,800	2,185	17,985	
	0·3622 MAF	0·0500 MAF	0·4122 MAF	

The availability was thus revised upwards from 0·383 MAF to 0·4122 MAF.

Estimate by Madhya Pradesh

7.2.2 Madhya Pradesh contended that Gujarat had grossly under-estimated the water available from the *en route* rivers. It stated that more schemes were possible in the area and that the actual diversion possible from weirs and level crossing would be more than that assumed by Gujarat. Also, Gujarat had not taken into account the availability due to regeneration from upstream water use. It stated that additional water to the extent of 4.03 MAF could be utilised in Navagam Canal command from the *en route* rivers *vide* Exhibit MP-626 dated 1975, pp. 23-24. Gujarat offered its comments on these contentions of Madhya Pradesh in Exhibit G-1032 of October, 1976. In its rejoinder to the comments of Gujarat, Madhya Pradesh further raised its figure from 4.03 MAF to 5.22 MAF. It gave a break up of these figures in Exhibit MP-1063 of June, 1977 at page 66, as under: —

S. No.	Particulars	Extra use possible from the en route rivers		
		As per MP/626 MAF	As per MP/1063 MAF	
(i)	By remodelling Wanakbori weir	0·91	1·86	Additional use possible from Mahi
(ii)	By new schemes. . .	0·85	0·85	

(iii)	Due to regeneration from :		
	(a) Irrigation use on the upstream . . .	0·46	0·80
	(b) Use for industrial & domestic water supply .	0·31	0·21
(iv)	By rationalising canal losses	0.13	0.13
(v)	By check dams & pumping schemes	1·00	1·00
(vi)	Water saved in the transit losses in the Navagam Canal	0·37	0·37

Thus, according to Madhya Pradesh 5.63 (5.22+ 0.41) would be available from the *en route* rivers for Navagam command.

Estimate by Maharashtra

7.2.3 Maharashtra gave only a provisional estimate of the water available from the *en route* rivers on grounds of lack of full details and alleged inaccurate assumptions made by Gujarat, Maharashtra stated that Gujarat had left out yield of certain areas in Rajasthan and Madhya Pradesh, had adopted in appopriate rainfall-runoff coeffic cient or yield ratio, had not given as account of the use upstream of Kadana dam and had not taken into account contribution from regenerated flow from upstream use. Taking these into consideration, Maharashtra estimated that an extra yield of 1.338 MAF should be added to the yield of 0.4122 MAF shown by Gujarat. Thus, according to Maharashtra, the total amount of water available from the *en route* rivers for Navagam Canal Command would be about 1.75 MAF as under *vide* Maharashtra Note 5 of February 1977, page 20:—

S. No.	Brief cause of availability	Extra diversion possible (MAF)
1	Extra yield from areas left out in Madhya Pradesh and Rajasthan . . .	0·137
2	Extra yield by adoption of appropriate RRC and/or yield ratio . . .	0·167
3	Extra yield due to their being no account of use upstream of Kadana . .	0·524
4	Extra yield due to regeneration from—	
	(a) Irrigation use	0·39
	(b) Industrial & domestic use . .	0·12
	Total extra yield available . . .	1·338
	Add available yield as shown by Gujarat .	0·4122
		17502MAF
	Total yield available for diversion into Narmada command	Say 1·75

7.3.1 From the contentions of the party States it would be seen that there is a great disparity in the estimate of water available from the *en route* rivers of 0.4122 MAF by Gujarat, 5.63 MAF by Madhya Pradesh and 1.75 MAF by Maharashtra. In making a proper appraisal of this availability, we have to keep in view certain policy and technical considerations.

Policy considerations

7.3.2 Within the boundary of Navagam Canal command certain areas are covered by existing or proposed schemes. It is the contention of Madhya Pradesh that such area should be excluded from the command of the canal *vide* Written Submission of Madhya Pradesh, December 1976, Volume VII, page 64. Gujarat on the other hand has stated that the water available from the *en route* rivers should be deducted from the total water requirement of the area under the entire canal command. Gujarat has pointed out that exclusion of overlapping command area would be proper where irrigation is firm from a storage scheme, but not so in the case of weir schemes which provide only protective irrigation. Gujarat has argued that if the overlapping command area of the latter schemes is excluded from the Navagam Canal command, that area would continue to receive only protective irrigation whereas the adjoining area which would come under Navagam Canal command would get firm irrigation. (Gujarat's Written Reply No. 10 dated April 1977, page 8). There is force in the above argument of Gujarat. It would be inequitable to provide only protective irrigation in an area and provide perennial irrigation in the contiguous area. Therefore, the policy should be that:—

(i) in respect of projects which provide perennial irrigation, the overlapping command should be excluded from the command of Navagam Canal; and

(ii) an area which receives only non-perennial irrigation should be included in the canal command and the water being delivered for it from an *en route* river added to the Narmada water for the canal.

Certain Technical Considerations

7.3.3. Such considerations are:—

(i) Utilisable portion of inflows.

(ii) Contribution by regenerated inflows.

(iii) Level crossings—their feasibility and problems.

Utilisable Portion of Inflows

7.3.4 For apportionment of Narmada water between the party States, inflow of 75% dependability has been considered. Likewise, in estimating water available from *en route* rivers for Navagam Canal command, inflows of 75 per cent dependability have to be considered.

7.3.5 Bulk of the inflows accrue during the period from July to October. For example, the percentage post-monsoon flow has been stated to be only 3.2 per cent, 4 per cent and 6 per cent of the monsoon flows in the case of the Panam, the Harnav and the Watrak respectively vide Gujarat's Written Reply No. 10 of April 1977, page 32. There is a wide variation in the day to day discharge in the *en route* variation in the day to day discharged in the *en route* rivers during the monsoon period as is apparent from Exhibits G-1077 (i) to (xi). The flood flows which contribute most of the inflows cannot be fully availed of without storage reservoirs. Where these inflows cannot be stored, only a portion of them can be utilised in the canal command.

7.3.6 In the revised Master Plan, Exhibit G-462, Gujarat assumed that without storage reservoirs only 30 per cent of the 75 per cent dependable flow available at a site can be used through low weirs or level crossings. Madhya Pradesh pointed out that Gujarat has not given any basis or study in support of this assumption *vide* Exhibit MP-626 of 1975 page 4, paragraph 5. In compliance with the direction given by the Tribunal in April-May 1976, Gujarat filed a study, Exhibit G-981 dated July 1976, based on observed flow data of the rivers Orsang, Deo, Mahi, Sabarmati and Banas for the period 1966 to 1970, both inclusive. According to this study, the weighted average percentage of base flow in these rivers varies from 18.85 per cent to 43.98 per cent of the annual flows vide Exhibit G-1032 page 22.

7.3.7 Many canals are regulated on 10 day basis. During this period of 10 days an assured steady contribution from an *en route* river should be available for at least eight days for regulating satisfactorily. In December,1976, the Tribunal directed Gujarat to prepare studies of water available from eleven selected *en route* rivers on the basis of ten daily observed data with minimum discharge available for (a) seven days (b) eight days in each ten day period corresponding to:—

(i) 75 per cent reliable year;
(ii) the year next above it, and
(iii) the year next below it.

Gujarat filed these studies in January, 1977 vide Exhibits G-1077 (i—xi). In these studies, available discharge data have been analysed for period from 12 years for Heran to 23 years for Banas. The result is given in Statement I of Exhibit MP-1063. It shows that in a year of 75 per cent dependability, the available flow on the basis of avaiability in eight days in 10-daily period ranges between 16.45 per cent for Heran to 68.33 per cent for Khari of the year's flow. Considering the large variation from river to river it would be inappropriate to apply a uniform percentage, like 30 per cent, to all the rivers. It would be reasonable to adopt the percentage for each river as in the above referred Statement for a year of 75 per cent dependability and for a flow, available for eight days in 10-daily period. These percentages are given below:—

River	Percentage
1. Mahi	60·81
2. Watrak	30·09
3. Meshwa	48·42
4. Khari	68·33
5. Sabarmati	42·98
6. Banas	24·44
7. Men	28·85
8. Heran	16·45
9. Orsang	34·94
10. Dhadhar	51·54
11. Deo	18·16

Contribunation from Regenerated Inflows

7.3.8 Commenting on Gujarat's Master Plan for *en route* rivers. Exhibit G-462, Madhya Pradesh has pointed out that in drawing up the plan, Gujarat had not taken into account contribution of regenerated inflows from upstream irrigation or water supply schemes, vide Exhibit MP-626 page 11. Madhya Pradesh has further pointed out in its Written Submission Volume VII of 1976, page 161 that in its own Master Plan, Exhibit MP-312, it had provided for water availability from regeneration to the extent of 10 per cent of irrigation use. In Exhibit MP-1063 at page 66, Madhya Pradesh showed that there would be a regenerated inflow of 0.80 MAF from upstream irrigation use and 0.21 MAF from domestic and industrial water supply. Maharashtra contended that at least 20 per cent of water used would be returned as regenerated inflow for

reuse vide Exhibit MR-130 page 18. In Statement V of this Exhibit, it gave a figure of 85.798 mcft (1.97 MAF) as the utilisation from the existing and proposed projects taken together. Regeneration at 20 per cent of this net use was shown to be 0.39 MAF. But Gujarat argued that the phenomenon of regeneration was highly uncertain and erratic. that the irrigation proposed was extensive and not intensive and that the percolation losses which which would augment the ground water in the command or adjoining area would be utilised for irrigation through lift. Therefore, there was little scope for any regeneration taking place vide Gujarat's Written Reply No. 10, page 47. As regards regeneration from domestic and industrial water use, Gujarat stated in Exhibit G-1032 pp 74-75 that return flow available from planned water supply in the cities of Ahmedabad and Baroda was being used in the swage farms of these cities and, hence, there would be only a negligible surplus available from return flow from domestic water use. In the case of industrial waste water, only that part which is not harmful to the soils can be utilised in sewage farms and the rest wasted. Madhya Pradesh has adopted the view that use in sewage farms is also a use for irrigation and that it should be incumbent to treat industrial waste water and use it for irrigation before making demands on the waters of another basin vide Exhibit MP-1063 pp. 60-61.

7.3.9 That there would be some regeneration from irrigation use of water is beyond doubt. The percentage of such regeneration, however, is debatable as it depends upon a number of factors which vary from project to project. It may be noted the Narmada Water Resources Development Committee did not take any regeneration into account in its report (Ex. MP/166). The Krishna Water Disputes Tribunal has held in its Report dated 27th May 1976 that regeneration should be taken as 10 per cent of use from projects using 3 TMC or above. In respect of *en route* rivers crossed by Navagam Canal, it is, in our opinion, reasonable to assume that 10 per cent of irrigation use on major, medium and minor projects would be available as regenerated flow. As regards domestic water, the return water would be utilised in sewage farms which need not form part of Navagam Canal command. The industrial use of water would be mostly at Ahmadabad, Baroda and Kandla. The return water suitable for irrigation use from industrial utilisation would be relatively small and may be ignored, considering that not much of it can be utilised at these towns because of their locations (see paragraph 7.7.9).

Level Crossings

7.3.10 In the revised Master Plan for *en route* rivers, Exhibit G-462, Gujarat proposed diversion of some water of these rivers into the main canal. Madhya Pradesh has averred that in the interest of utilising as much water of the *en route* rivers as possible the main canal should have been aligned in such a way that level crossings could be constructed for crossing the rivers, but this has not been done in the case of nine rivers, vide Exhibit MP-626 page 12. Gujarat has contended that Madhya Pradesh's suggestion for realigning the main canal so as to have level crossing at all *en route* river crossing is technically not feasible. It has pointed out that the main canal being a contour canal, its alignment is generally governed by the contours of the region through which it passes and that the type of cross-drainage work to be provided at a crossing depends upon the level of the river vis-a-vis that of the canal. It has further stated that the shifting of the alignment in the vicinity of a crossing to provide level crossing would entail deep cutting with sharp S-curves on either side of the crossing. The length of the canal would thus be increased and it would not only cost more but would result in more loss of head vide Exhibit G-1032 pp 37-38.

7.3.11 Level crossing is not the best means of taking a canal across a river or stream. Apart from the aruguments advanced by Gujarat, level crossing make regulation of canal difficult during the rainy season and larger the number of such crossing the greater is the difficulty in regulation. With a level crossing, unavoidably flood water gets mixed with canal water and, therefore a good deal of silt brought by floor water enters the canal. During the non-monsoon period, the river bed remains submerged upto canal water level for a long distance upstream thereby causing substantial seepage and evaporation losses and in some cases waterloging in adjacent lands.

7.3.12 In Exhibit G-1078 Gujarat has given a statement showing the full supply and bed levels of +300 level Navagam Canal (head discharge 42,700 cusecs and river bed level and normal monsoon flow level at the crossings of the more important ten rivers. This is reproduced in Statement 7.2.1. It will be noticed that in each case the canal level is considerably higher than the normal monsoon flow level of the river. It is thus evident that in most of thse cases the waters of the *en route* rivers cannot be passed into the canal by gravity flow through level crossings. The Navagam Canal is a contour canal with a flat gradient and in consequence will

have poor silt carrying capacity. The off-taking branch canals and distributaries on the other hand would traverse land having a slope of 3 feet per mile or more. The steep land slope would enable the branch canals and distributaries to be designed with sufficient gradient to carry silt laden water without getting silted up. It would thus be advisable to take the water of en route rivers to the extent feasible into branch canals and distributaries and avoid level crossing on the main canal.

Thirty Five Schemes Proposed by Madhya Pradesh

7.4.1 In its Master Plan of June, 1971 for the en route rivers, Gujarat, while discussing the feasibility of constructing minor tanks in the Narmada command, stated that tanks had been built there on small streams mostly as scarcity works. Most of these tanks catered to the water suuply needs of the villages around them. However, the area commanded by them was excluded from the area proposed for irrigation from Navagam canal. Gujarat stated that there was hardly any scope of building more irrigation tanks. In its revised Master Plan, Exhibit G-462, Gujarat stated that a study of topo sheet showed that further sites for utilising waters of the en route rivers were not available. Madhya Pradesh undertook a study of available topo sheets to locate such sites. In Exhibit MP-626, it gave a list of 35 schemes which it had located, some outside the canal command and some within it. Of these, four pertained to ponds, twentyone to storage reservoirs and ten to weirs or barrages. It stated that with these schemes 0.85 MAF of water of 75% dependability could be utilised (Ibid Statement 3) Gujarat has commented on these schemes one by one and concluded that there would be no additional water available for diversion in the Navagam Canal command from these schemes vide Exhibit G-1032 page 53. In their subsequent statements in Exhibits G-1032 page 53 and MP-1063 page 42, Gujarat and Madhya Pradesh have persisted in their respective positions. These schemes are dealt with in the following paragraphs Scheme numbers correspond to serial numbers in Statement 3 of Exhibit MP-626.

7.4.2 *Schemes Nos.* 1 *to* 4—The inflow from the catchment area of these schemes amounting to 433 mcft or 0.01 MAF of 75 per cent dependability drains into ponds upstream of the Navagam canal head regulator where water let into the cannal is to be measured. The inflow, therefore, does not pertain to en route river.

7.4.3 *Scheme No.* 5—In its Technical Memorandum before the Khosla Committee, Exhibit G-369 Gujarat had indicated that there was a site suitable for constructing a weir on the Narmada near village Nani Sanjrauli, nine miles downstream of the Sardar Sarovar dam site Madhya Pradesh has suggested that 910 mcft or 0.021 MAF out of the inflows into the pond of the weir from the catchment area between the dam and the weir can be utilised in Navagam Canal Command. Gujarat has pointed out that this availability of water is meagre and confined only to a period of three months, vide Exhibit G-1032, page 27. The Narmada is a large river and the construction of a weir across it would be quite expensive. Therefore, unless the wier is justified for pump storage for power, which is uncertain, it would not be feasible to build it for utilising only 0.021 MAF. No contribution from this scheme for the Navagam Canal command need, therefore, be taken into account.

7.4.4 *Storage Schemes No.* 6 *to* 14, 16 *to* 19, 24 *to* 27, 31 *and* 34—These 19 schemes are proposed by Madhya Pradesh to be constructed in a more or less flat area as shallow tanks which are generally constructed in water scarcity areas as relief works and mostly provide irrigation for one crop only. Many of the proposed tanks lie outside the Navagam Canal command and those that lie within it are hardly feasible Madhya Pradesh has furnished maps of reservior areas of Schemes No. 6.12 and 16 in support of these schemes in Exhibit MP-1063. It is noticed that the tanks of Schemes Nos. 12 and 16 submerge habitation. None has any significant storage. The feasibility of all the 19 schemes is quite doubtful and, therefore, no contribution from them for Navagam Canal command may be taken into account.

7.4.5. *Storage Schemes Nos.* 22 *and* 23—Both these lie close to Gujarat-Rajasthan border well away from the Navagam Canal command. Gujarat has proposed use of the water of these schemes in higher areas. Therefore, nothing would be available from them for the canal command.

7.4.6 *Schemes Nos.* 15, 20, 21, 28 to 30, 32,33 *and* 35—These nine schemes are diversion schemes envisaging construction of weirs or barages. In assessing the utilisable quantity of water in each case the upstream schemes and water use have to be considered. These schemes are dealt with in basinwise consideration of water availability from the en route rivers.

Pumping Schemes

7.5.1 In addition to the 35 schemes proposed by Madhya Pradesh to utilise 0.85 MAF, it has stated that it should be possible to utilise at least one MAF of water with pumping schemes in the command area of Navagam Canal (Exhibit MP-626, page 9 and MP-1063 page 23), Gujarat has pointed out that the rivers in the areas are flashy and that the discharge in them is practically nil after the monsoon period. The river banks are not well defined and the rivers have large width compared to the width of the channel carrying base flow which shifts every year. According to Gujarat, therefore, there is no scope for developing any lift irrigation schemes there (Exhibit G-1032, page 28). It would appear that while farmers may utilise some river water by means of small pumps to irrigate areas along the streams or rivers during kharif season, it may not be ecomomically feasible to have any sizeable permanent pumping schemes in the command area for only seasonal use as these would require fairly expensive control works besides pumping installations. The water which the farmers may use with their own pumps for irrigation fields along the banks would be either in the nature of supplemental irrigation in areas at the tail end of distributaries or outside the command.

Consideration of Individual River Basins

7.6.1 Of the rivers mentioned in Statement 7.1 the Men and Orsang with its tributary the Heran fall into the Narmada. These are considered individually. The Deo is a tributary of the Dhadhar and the two are considered together. The Mahi is the largest en route river and has a number of tributaries. The Mahi basin is, therefore, dealt with separately. The tributaries of the Sabarmati are considered along with it. The Rupen, Saraswati and Banas are independent rivers and are dealt with separately. The Rel is small river in low rainfall area and has poor yield but has been considered.

The Men

7.6.2 This sub-basin of the Narmada has a catchment area of 117 square miles. In its Master Plan for the en route rivers. Exhibit G-462, Gujarat has proposed a storage dam near Bilgaon to intercept inflows from 52 square miles and utilise this water fully for irrigating areas upstream of the Navagam Canal crossing. Gujarat has stated that there is no possibility of constructing a weir or diversion scheme downstream of the canal crossing (Ibid p. 33). It has however, envisaged diversion of 171 mcft (0.0039 MAF) into the Main Canal from the free catchment below the Bilgon storage dam by means of a level crossing. This should be taken into account.

The Heran

7.6.3. This is a tributary of the Orsang. There is the existing Rajwasna weir on it which irrigates 13.400 acres vide Exhibit G-462 p. 42 two storage schemes, the Rami on its tributary of that name and the Lalpur dam, and two minor schemes, all on the upstream of Rajwasna weir are planned. These would utilise supplies in their direct command except that Lalpur scheme would provide 1280 mcft (0.029 MAF) for firming up irrigation in the command of Rajwasna weir (Ibid p. 41). The Navagam Canal is expected to cross the Rajwasna command. As this command will get firm irrigation on construction of Lalpur dam, approximately 13,000 acres should be excluded from the command of Navagam Canal, No other contribution is expected from the Heran to the canal command.

The Orsang

7.6.4 The Master Plan for en route rivers, Exhibit G-462 envisages construction of two major storage project in Orsang basin, viz. the Sukhi project and the Jamla project. Both these projects are planned to utilise all their water in their own command upstream of Navagam canal. The existing Jojwa weir lies a short distance downstream of the crossing of +300 Level Canal and has a command area of 16,000 acres. The utilisable inflow, estimated at 30 per cent of the 75 per cent dependable flow, from the river reach between the two dams and Jojwa weir is 2642 mcft or 0.0605 MAF vide Exhibit G-462 p. 57. It should be possible to utilise 35% of the inflow of 75% dependability as indicated in paragraph 7.3.7 ante, instead of 30 per cent proposed by Gujarat. The utilisable quantity in that case would be 0.0706 MAF. With this water availability, the command area of Jojwa weir will have its full requirement for firm irrigation and, therefore, no part of it should be included in the Navagam Canal Command.

7.6.5 The catchment area of the Orsang below Jojwa weir upto its confluence with the Narmada is 112.60 square miles with yield of 1525 mcft (0.035 MAF) of 75 per cent dependability. Gujarat has stated that owing to flat terrain in this reach, there is no possibility of constructing any diversion scheme there and, therefore, it would not be possible to utilise this water, vide Exhibit G-462, p. 54.

The Dhadhar and Deo

7.6.6 The Deo and the Vishwamitri are the more important of the tributaries of the Dhadhar. The total catchment of the Dhadhar upto its mouth is 1622 square miles. On the Vishwamitri there are two tanks, Ajawa and Pratappura, whose storage is used for water supply to Baroda city. On the upstream side of Navagam Canal, the Master Plan Exhibit G-462, envisages two minor irrigation schemes in addition to an existing one as also a medium storage irrigation scheme on the Deo. The command of the proposed Deo scheme overlaps that of Navagam Canal command and this being a storage scheme which will provide firm irrigation, its CCA of 18.370 acres (Exhibit G-458 p. 12) should be excluded from the command of the Navagam Canal. Gujarat does not consider any utlisation possible of the yield of 13400 mcft (0.307 MAF) of 75 per cent dependability available from the catchment area of Dhadhar basin below the Navagam Canal, besides the existing Ajawa and Pratappura tanks *vide* Exhibit G-462, p. 65. Madhya Pradesh has proposed four storage schemes and one barrage scheme in the basin *vide* Schemes 11 to 15 in Exhibit MP-626 Statement 3. The storage schemes are in the nature of shallow tanks. Gujarat has indicated that all the five schemes are not feasible *vide* Exhibit G-1032, pp. 116—119. While the four storage schemes do not appear attractive, the barrage scheme may be worthy of further investigations. But unless its feasibility is established, it would not be proper to take credit for any utilisation of water from it.

The Mahi Basin

7.6.7 The Mahi is an inter-state river which drains an area of 13,000 square miles. It rises in Madhya Pradesh, passes through Rajasthan and traverses Gujarat to fall into the Gulf of Cambay. A tributary of the river, the Anas with a small catchment in Gujarat, flows through Madhya Pradesh and joins the Mahi in Rajasthan. On the main stem of the river, Bajajsagar (Banswara) Project in Rajasthan and Kadana Project in Gujarat near Rajasthan border are under construction. The Wanakbori weir further downstream is an existing structure. The Navagam Canal will pass some distance downstreams of this weir. Rajasthan has a proposal to construct a dam on the main river below the confluence of the Baneshwar with the Mahi. There is no major project existing or under construction on the river in Madhya Pradesh but one is proposed.

7.6.8 In Gujarat, the Mahi has seven sub-basins. The various projects in the sub-basins are indicated in Gujarat's Master Plan. Exhibit G-462 at pp. 71.72, as under:—

Sl. No.	Name of sub-basin	Name of project in the sub-basin	Major Medium Minor	Existing/under construction proposed in Gujarat
1	2	3	4	5
1	Karad sub-basin . .	Karad Project	Medium	Existing storage scheme
2	Goma sub-basin . .	Nil	Does not arise	Does not arise
3	Meshri . . .	Nil	Does not arise	Does not arise
4	Kan	Nil	Does not arise	Does not arise
5	Anas	(i) M.I. tanks	Minor	Existing and proposed
		(ii) Pata Dungari	Medium	Existing
		(iii) Machhan Nalla	Medium	Proposed
6	Bhadar . . .	Bhadar reservoir	Major	Proposed
7	Panam . . .	(i) Percolation tanks and M.I. Schemes	Minor	Existing and proposed
		(ii) Hadaf	Medium	Proposed
		(iii) Wankleshwar Bhey	Medium	Proposed
		(iv) Panam Reservoir	Major	Under construction
8	Mahi . . .	(i) Kadana	Major (Multi-purpose)	Under construction
		(ii) Wanakbori Weir	Major	Existing

The commands of all these schemes are located above the Navagam Canal excluding that under the Wanakbori weir. The schemes are known in the attached index map of Mahi River (Plate VII. 1).

7.6.9 The Narmada Water Resources Development Committee (Khosla Committee) considered Rajasthan's requirements from Mahi river to be 1.5 MAF and that of Madhya Pradesh 0.3 MAF. The Tribunal directed these States, in December, 1976 to furnish details of their proposed use. In compliance, Rajasthan furnished details in Exhibit R-284. It showed its requirement of 1.03 MAF for medium and minor projects, existing and under construction and 0.85 MAF for new major and medium schemes and other uses. Thus, its requirement has been shown to be 1.88 MAF of water of 75 per cent dependability. Madhya Pradesh gave the required information in Exhibit MP-1032 and placed its requirement as 22.64 TMC or 0.52 MAF. It however, stated that since it had entered into an agreement with Rajasthan in 1961 to use only 13 TMC (0.30 MAF) in its area above Bajasagar dam, the requirement above 13 TMC would be met by utilising flows of lesser dependability than 75 per cent upto average flows.

7.6.10 In Exhibit G-1032 Annexure 2 page 93, Gujarat has shown the following utilisation in Rajasthan upto Kadana dam:—

(a) From Banswara net utilisation	0.17MAF
Lake losses	0·13MAF
Gross utilisation	0·30MAF
(b) Other schemes in Rajasthan	1·50MAF
(c) Lake losses at Baneshwar & Anas reservoirs	0·47MAF
Total for Rajasthan	2·27 MAF

Madhya Pradesh has adopted the same figures in its Statement 79. Gujarat has indicated its own utilisation above Kadana as 0.061 MAF (*vide* Exhibit G-1032 page 93) and 0.10 MAF directly from Kadana in the proposed Left Bank Canal. Thus, the total utilisation upto Kadana including that of Left Bank Canal works out to 0.30 MAF in Madhya Pradesh, 2.27 MAF in Rajasthan and 0.161 MAF in Gujarat, making a total of 2.731 MAF Rajasthan, however, has given its revised requirement for medium and minor schemes as 1.88 MAF *vide* Exhibit R-284, instead of 1.50 MAF considered above. On this basis, the total utilisation becomes 3.111 MAF. This does not include 0.14 MAF lake loss at Kadana.

7.6.11 The total yield of 75 per cent and 50 per cent dependability at Kadana has been shown by Gujarat to be 3.384 MAF and 6.07 MAF respectively *vide* Exhibit G-1000. This is based on revised rainfall—runoff relationship for the period from 1959 to 1974. According to Madhya Pradesh, the yield of 50 per cent dependability is 7.05 MAF *vide* Exhibit MP-685.

7.6.12 With the utilisation indicated in paragraph above and the yield of 3.384 MAF of 75 per cent dependability, only 0.133 MAF (3.384—3.111 0.14) remains available from Kadana for downstream use. However, with carry-over capacity at Baneshwar and Anas, this availability gets increased. Also the requirement of 2.27 MAF indicated for Rajasthan includes a large number of new projects. It may be mentioned that the Khosla Committee had indicated the total irrigation, industrial and municipal requirements of water in Rajasthan to be 1.5 MAF only (Exhibit MP-166).

7.6.13 The toal yield of the Mahi basin below Kadana upto Wanakbori is 0.623 MAF of 75 per cent dependability. Of this yield, the Bhadra and Panam projects are shown to have a requirement of 0.502 MAF *vide* Exhibit G-1032 page 96. This leaves 0.121 MAF for use at Wanakbori. While the Panam project is under construction, the Bhadar project is only at a proposal stage. With 0.133 MAF available from Kadana and 0.121 MAF from the catchment below it, the total amount of water available at Wanakbori comes to 0.254 MAF.

7.6.14 It has been contended by Madhya Pradesh that since the en route rivers flow through a low rainfall zone, the available water should be conserved and utilised to the maximum. It has proposed the use of water of these rivers on the basis of 50 per cent dependability. Gujarat has stated that "irrigation schemes are normally planned for 75 per cent reliability and hence what is relevant for planning of water resources for irrigation is not the average flow nor the 50% dependable flow but the utilisable quantum at 75 per cent reliability." This is in consonance with our decision that for the equitable apportionment of water of the Narmada between the party States, water of 75 per cent dependability should be considered.

7.6.15 The Kadana Reservoir Project was sanctioned in December, 1966. The sanctioned project envisaged the construction of Kadana dam with FRL + 419 and irrigation ex-Wanakbori weir lower down in a command area of 6,50,000

acres, and 51,350 acres under direct command. In Exhibit G-630 A/1, Gujarat has given the revised figure of command area for Vanakbori as 6.33 lakh acres and its water requirement as 1.56 MAF. This is in excess of the available water of 0.254 MAF of 75 per cent dependability. The Kadana Reservoir Project is a committed project and its requirement has to be met in full in preference to any later or new use. The total yield of the Mahi of 75 per cent dependability from its entire catchment at Wanakbori is 4.007 MAF (3.384 at Kadana and 0.623 below it). With 1.56 MAF taken out for use ex-Wanakbori, the water available for use above Wanakbori is 2.447 MAF plus 0.171 MAF being 10 per cent of net use at regeneration flow, that is, a total of 2.618 MAF. Against this availability, the requirements indicated are 3,251 MAF upto Kadana (paragraph 7.6.10), and 0.502 MAF upto Wanakbori (paragraph 7.6.13), a total of 3.753 MAF. There is thus a shortfall of 1.135 MAF which can be covered by providing carry-over capacity in reservoirs, curtailing new projects and putting up with water of lower dependability than 75 per cent. It is obvious that no water is available ex-Wanakbori for use in Navagam Canal command beyond the Mahi Right Bank canal command.

7.6.16 The Karad is a tributary of the Gomo which in turn falls into the Mahi downstream of Wanakbori weir. The Karad project will utilise all its water in its own command. Gujarat's Master Plan, Exhibit G-462, envisage diversion of 0.0162 MAF from the Karad and 0.0084 MAF from the Como into Navagam Canal through level crossings. This is not feasible as levels are not suitable.

7.6.17 In Exhibit MP-626, Madhya Pradesh has proposed a storage scheme (Serial No. 16) at Bahutha to utilise 340 mcft (0.008 MAF), a barrage at Vasad (Serial No. 20) to utilise 200 mcft (0.005 MAF) and a weir at Lachanpura (Serial No. 21) to utilise 1601 mcft (0.037 MAF). All the three schemes lie in the command of Navagam Canal. Gujarat has rightly pointed out (Exhibit G-1032 page 120) that the Bahutha storage scheme envisaging a very shallow tank is not feasible in view of the levels of the ground at the site. As regards the other two schemes, the utilisation proposed by Madhya Pradesh is on the basis of 30 per cent of the inflows of 75 per cent dependability. As will be noticed from paragraph 7.37, a higher utilisation upto 61 per cent of the inflows, that is 3660 mcft would be possible Even after meeting the water supply requirement of Baroda of 1500 mcft. therefore, it should be possible to utilise 2160 mcft (0.050 MAF) from these schemes in the Navagam Canal command.

7.6.18. In the light of what has been stated in the foregoing paragraphs, an area of 6.33 lakh acres pertaining to Mahi project should be excluded from the command of Navagam Canal. Also, 2160 mcft. (0.050 MAF) should be considered available from the Mahi for use in the canal command.

The Sabarmati Basin

7.7.1 The Sabarmati river has a total catchment area of 8522 square miles of which an area of 1410 square miles is in Rajasthan. It has six main tributaries, four of which, the Shedi, the Watrak, the Meshwa and the Khari cross Navagam Canal. Gujarat's Master Plan Exhibit G-462, gives information in respect of projects in the various basins as under:—

Sl. No.	Basin	Name of project	Present position (1974)
1	Shedhi	No Project	Does not arise
2	Watrak	(i) Watrak Project (Medium)	Under construction
		(ii) Waidy Project (Medium)	Proposed
		(iii) Mazam Project (Medium)	Proposed
3	Meshwa	(i) Meshwa Project (Medium)	Existing
		(ii) Meshwa Pick-up weir at Raska	Existing
4	Khari	(i) Khari cut canal project at Raipur	Existing
		(ii) Karoi Dam (Medium)	Existing
5	Hathmati	(i) Hathmati Reservoir Project (Medium)	Existing
		(ii) Hathmati Weir at Himatnagar	Existing
		(iii) Guhai Scheme (Medium)	Proposed
6	Harnav	(i) Harnav Reservoir Stage II (Medium)	Proposed
		(ii) Harnav Weir Stage II	Existing
7	Sabarmati	(i) Dharoi Reservoir Project (Major)	Under construction
		(ii) Fatehwadi Canal system	Existing Irrigation Scheme

The commands of Raska Weir, Raipur Weir on the Khari and Fatehwadi canal system lie below Navagam canal and overlap its command. The schemes are shown in the attached index map of Sabarmati River (Plate VII. 2).

7.7.2 Gujarat's Master Plan Exhibit G-462. does not envisage any project in the Shedhi sub-basin. It proposes to divert 0.0266 MAF being 30 per cent of 75 per cent dependable flow into Navagam Canal through a number of level crossings. A study of the levels shows that the feasibility of this diversion is doubtful.

The Watrak Sub-basin

7.7.3 There are three storage schemes in the sub-basin as under:—

(i) Watrak—under construction	CCA 48300 acres
(ii) Waidy—proposed	CCA 4975 acres
(iii) Mazam—proposed	CCA 16250 acres

Gujarat has stated in the Master Plan that these schemes will utilise all their water in their own command above Navagam Canal and nothing would be available from them for the Navagam Canal. The Watrak joins the Meshwa downstream of Raska weir. The total catchment area of Watrak is 1310 square miles. The area intercepted by the above storage dams is 588 square miles. The yield of 75 per cent dependability from the remaining catchment area of 722 square miles would be about 6450 mcft. Though the water of Watrak cannot be put into Navagam Canal because of unsuitable levels, it should be possible to utilise 30 per cent of the yield of 6450 mcft, that is, 1935 mcft (0.045 MAF) in the distributaries of the canal.

The Meshwa Sub-basin

7.7.4 In this sub-basin there is a storage dam in the upper reach with a net utilisation of 1259 mcft. At present only 1013 mcft is being utilised in its own command and the balance 246 mcft is passed down for use at Raska weir located at the lower end of the sub-basin. The yield of 75% dependability from the catchment area of 570 square miles between Meshwa dam and Raska weir is 3572 mcft (see page 118 of Exhibit G-462). In the absence of adequate storage backing, irrigation from Raska weir is not firm and is mostly seasonal. This will have to be firmed up from Navagam Canal. The small quantity of water, 246 mcft, at present being released for it from Meshwa dam should continue to be available for it. Under these circumstances, the command of Raska weir should be included in the command of Navagam canal and the utilisable water available at Raska weir deemed to be available for Navagam Canal command. The water of 75% dependability available there would be 3572 mcft. The utilisable portion may be taken to be 48% of it as per paragraph 7.3.7 ante. This comes to 1715 mcft which together with 246 mcft would be 1961 mcft or 0.045 MAF.

The Khari Sub-basin

7.7.5 The Khari joins the Meshwa a short distance upstream of Raska weir. There is an existing Khari cut weir at Raipur which provides Kharif irrigation in an area of 26,000 acres. The Navagam Canal is proposed to cross the Khari at this weir. The yield from the catchment above the weir at 75 per cent dependability is stated to be 2080 mcft. Gujarat has proposed in its Master Plan that 624 mcft, being 30 per cent of 2080 mcft, should be diverted into Navagam Canal and the Khari cut weir area taken on the canal for firm irrigation. The arrangement is in order except that the water available for diversion into the canal or utilisation in the canal command would be 68% of 2080 mcft. that is, 1414 mcft or 0.033 MAF as per paragraph 7.3.7.

The Hathmati Sub-basin

7.7.6 The Hathmati river joins the Sabarmati above Navagam crossing on the Sabarmati. There is the Hathmati weir with Hathmati Reservoir higher up the river. Another medium storage scheme above the weir is proposed on the Guhai which is a tributary of the Hathmati. The entire water of these schemes, according to the Master Plan, would be utilised in their own command and nothing would be available from them for Navagam Canal command.

The Harnav Sub-basin

7.7.7 The Harnav is a small tributary of the Sabarmati and joins it in its head reach. There is a weir across the Harnav and a reservoir is proposed on the upstream of it. The surplus water from these schemes and from the free catchment area below the weir would be taken in by Dharoi reservoir on the Sabarmati.

The Sabarmati Sub-basin

7.7.8 On the main stem of the river, 2½ miles downstream of the Ahmedabad City, take off two inundation canals, the Nani Fatewadi Canal and the Moti Fatehwadi Canal. The Dharoi Reservoir Project (1965) on this river provided for a dam at Dharoi, 95 miles upstream of Ahmedabad city and a barrage at Vasna just downstream of the city. The project envisaged assured water supply to the city and the new Capital at Gandhinagar, irrigation of 70,000 acres in direct command and firming up of irrigation under the Fatehwadi Canal System also to the extent of 70,000 acres. The Dharoi project as finally approved in 1971, envisaged a net utilisation of 0.337 MAF for the following purposes:—

(i) Irrigation of 91,000 acres in a CCA of 1,43,100 acres in direct command.

(ii) Firming up of 62,000 acres under Fatehwadi Canal command of 70,000 acres.

(iii) Water supply for Ahmedabad and Gandhinagar:—

As there will be assured irrigation in the Fatehwadi Canal command of 70,000 acres on completion of Dharoi Project, this area should be excluded from the command of Navagam canal.

7.7.9 The yield of 75 per cent dependability available from the free catchment at Vasna is 6710 mcft vide Exhibit G-462 page 139. Of this 2885 mcft (0.066 MAF) being 43% of the yield as per paragraph 7.3.7, and not 30 per cent assumed in the Master Plan, should be assumed to be utilisable. To this should be added 10 per cent regeneration of upstream use of 0.177 MAF, that is, 0.177 MAF. On the available quantity, about 0.054 MAF will be utilised for Ahmedabad water supply in three months during the monsoon period. The net quantity available for Navagam Command, therefore, comes to 0.03 MAF (0.066 + 0.018—0.054). The return flow from the water supply to Ahmedabad and Gandhinagar will be utilised in sewage farms. Some regeneration will occur from this water use but most of it will take place below the Vasna barrage and is, therefore, not utilisable. The insignificant and indeterminate quantity that would appear above the barrage can be ignored.

7.7.10 In Exhibit MP-626, Madhya Pradesh has suggested a barrage at Girand (Serial No. 33) to utilise inflows from the catchment area below the Vasna barrage Gujarat has stated that the site is not feasible. We consider that the Fatewadi Command should be excluded from the Navagam Canal Command and 0.030 MAF deemed as available for Navagam Command.

The Rupen

7.8.1 In Gujarat's Master Plan Exhibit G-462, a level crossing has been proposed on this river, but the water being saline its utilisation has not been considered desirable. The yield of 75 per dependability at the crossing has been stated to be 1395 mcft, 30 per cent utilisation of which would be 418 mcft. This is a small quantity and when mixed with large volume of good quality water in the canal would get its salinity diluted to a useable extent. Therefore, 0.001 MAF may be considered as available for Navagam Canal command.

The Saraswati

7.9.1 In Gujarat's Master Plan, Exhibit G-462, it is mentioned that Bhakhari and Mukteshwar storage schemes are under investigation and part of the water available there would be utilised at Saraswati barrage at Palam upstream of canal crossing. The catchment area below the barrage upto the canal crossing is very small and the yield would be negligible. No contribution from the Sarswati basin would, therefore, be available for the Navagam Canal command.

The Banas

7.9.2 The total catchment upto the mouth of this river is 2800 square miles of which 1109 square miles lie in Rajasthan. The existing Dantiwada reservoir intercepts a total catchment area of 1105 square miles. The Sipu reservoir project is contemplated on the Sipu which is a major tributary of the river and joins it below Dantiwada. A barrage at Khakhal is proposed about 55 miles downstream of the two dams. The water of Dantiwada and Sipu reservoirs are ultimately proposed to be utilised in their own commands with nothing to spare for Khakhal command. The yield from the free catchment below the Dantiwada and Sipu dams upto Khakhal is estimated to be 2800 mcft of which 1050 mcft is considered to be utilisable in Khakhal command. This would be available only during the rainy season. Therefore the Khakhal command should be included in the Navagam Canal command for firm irrigation and 1050 mcft or 0.024 MAF deemed to be available for diversion in to Navagam Canal command. Hardly any regeneration from upsteam use is ex-

pected in this case due to low rainfall and over exploitation of ground water there. Nothing is utilisable from the yield below Khakhal

The Rel Basin

7.9.3 The Rel has a catchment area of 180 square miles of which 88 square miles lie in Rajasthan. The Rainfall in the area is very low. A medium scheme, to be investigated, is mentioned in the Master Plan. This would utilise inflow from 100 square miles and irrigate about 2600 acres upstream of the Navagam Canal crossing. This basin is not expected to provide any utilisable water for Navagam Canal command.

Rivers of Saurashtra Region

7.9.4 A large number or relatively small rivers cross or enter the proposed Navagam Canal command in the Zonal areas in Saurashtra. On the Western periphery of the command is the Machhu river with two medium and one minor schemes existing on it. Their command, however, does not overlap the Navagam Canal command. On the Brahmani river, there is an existing storage reservoir. The project was planned for 60 per cent dependable yield for irrigating 27,000 acres. The Master Plan, Exhibit G-462, page 193, indicates the net possible utilisation, as reappraised in 1966, to be 978 mcft which will irrigate 9500 acres. The net utilisation at 75% dependability is given as 588 mcft. The command of this project overlaps the Navagam Canal command. But considering the insufficiency of available water to adequately cover the project command, the project command should be included in the Navagam Canal command and 588 mcft deemed as available for the command from the Brahmani river, there being no other utilisable inflow from it. The Master Plan of Gujarat gives the total utilisable quantity of water in Navagam Canal command from rivers of Saurashtra region as 0.05 MAF. This includes the water from the Brahmani river. The figure appears to be reasonable.

Kutch Region

7.9.5 According to the Master Plan of Gujarat, no water is available for utilisation in Navagam Canal command in Zonal areas from the rivers of Kutch region.

Conclusion

7.9.6 The following areas should not form part of the CCA of the Navagam Canal in the Zonal areas:—

River Basin	Area in acres	Vide paragrah
Heran	13,000	7.6.3
Orsang	16,000	7.6.4
Dhadhar (Deo)	18,370	7.6.6
Mahi	6,33,000	7.6.18
Sabarmati	70,000	7.7.8
Total	7,50,370	
say	7·50 lakh acres	

7.9.7 The quantity of water of 75 per cent dependability available from en route rivers for use in Navagam Canal command should be taken as under:—

River	MAF	Vide paragraph
Men	0·004	7.6.8
Mahi	0·05	7.6.18
Watrak	0·045	7.7.3
Meshwa	0·045	7.7.4
Khari	0·033	7.7.5
Sabarmati	0·030	7.7.9
Rupen	0·001	7.8.1
Banas	0·024	7.9.2
Rivers of Saurashtra	0·050	7.9.4
Total	0·282	

7.9.8 Gujarat, in the Master Plan for en route rivers Exhibit G-462, had estimated the availability of water from these rivers for Navagam Canal command to be 0.4122 MAF. It had included in the Navagam Canal command all the areas mentioned in paragraph 7.9.6 above excepting that pertaining to the Mahi aggregating to 1,11,070 acres (7,44,070—6,33,000). The requirement of water for this area is of the order of 0.25 MAF Allowing for this, Gujarat figure of 0.4122 MAF gets reduced to 0.162 MAF. Against this, our assessment of the availability of water from en route rivers for Navagam Canal is 0.282 MAF.

Advice of the Assessors

7.10.1 We have consulted our Technical Assessors Dr. M. R. Chopra, Shri Balwant Singh Nag and

hri C. S. Padmanabha Aiyar with regard to the bject matter of this Chapter. They have advis- d us that they all agree with the conclusion reach- d in paragraph 7.9.8 and also the reasoning given y us in the previous paragraphs.

STATEMENT 7.1

n route Rivers/Streams Crossed by the Proposed Navagam Main Canal (+300)

(Reference Exhibit G-462, pp. 1-3)

S. No.	Name of the basin	River/Stream crossed by proposed Narmada Ma in Canal (+300)
1	2	3
	Narmada	1. Sukhli Khadi including Kothi and Sangam Khadi
		2. Men
		3. Ashwin
		4. Heran
		5. Uach
		6. Orsang
II	Dhadhar	1. Dhadhar
		2. Deo
		3. Rangai
		4. Vishwamitri
III	Mahi	1. Karad
		2. Goma
		3. Meshri
		4. Kan
		5. Mahi (Main)
IV	Sabarmati	1. Shedi incuding Maher
		2. Watrak
		3. Meshwa
		4. Khari
		5. Sabarmati (Main)
V	Rupan	1. Rupan including Pushpawati & Khari
VI	Saraswati	1. Saraswati
VII	Banas	1. Banas
VIII	Rel	1. Rel

STATEMENT 7.2

Statement showing full Supply Level and Bed Level of +300 Level Navagam Canal and River Bed Level and Normal Monsoon Flow Levels for the Rivers Crossed by Navagam Main Canal at the Crossing

(Reference Exhibit G-1078) RL in feet

S. No.	Name of River crossing	Navagam canal FSL at crossing	Navagam canal bed level at crossing	River bed level at crossing	River water level for normal monsoon flow at crossing
1	Men.	293·52	267·61	263·00	266·00
2	Heran	288.49	263·29	258·30	259·50
3	Orsang	280·68	255·77	249·00	250·00
4	Deo	267·68	243·09	216·51	217·50
5	Mahi	238·78	216·09	144·89	153·50
6	Watrak	218·77	194.78	138.06	141·00
7	Meshwa	214·80	192·31	172·90	174·50
8	Khari	211·81	189.50	180·65	183·50
9	Sabarmati	205·91	183·13	150·14	151·50
10	Banas	153·20	130·00	141·00	143·00

PLAN SHOWING THE PROJECTS ON MAHI-RIVER

PLATE-VII 1

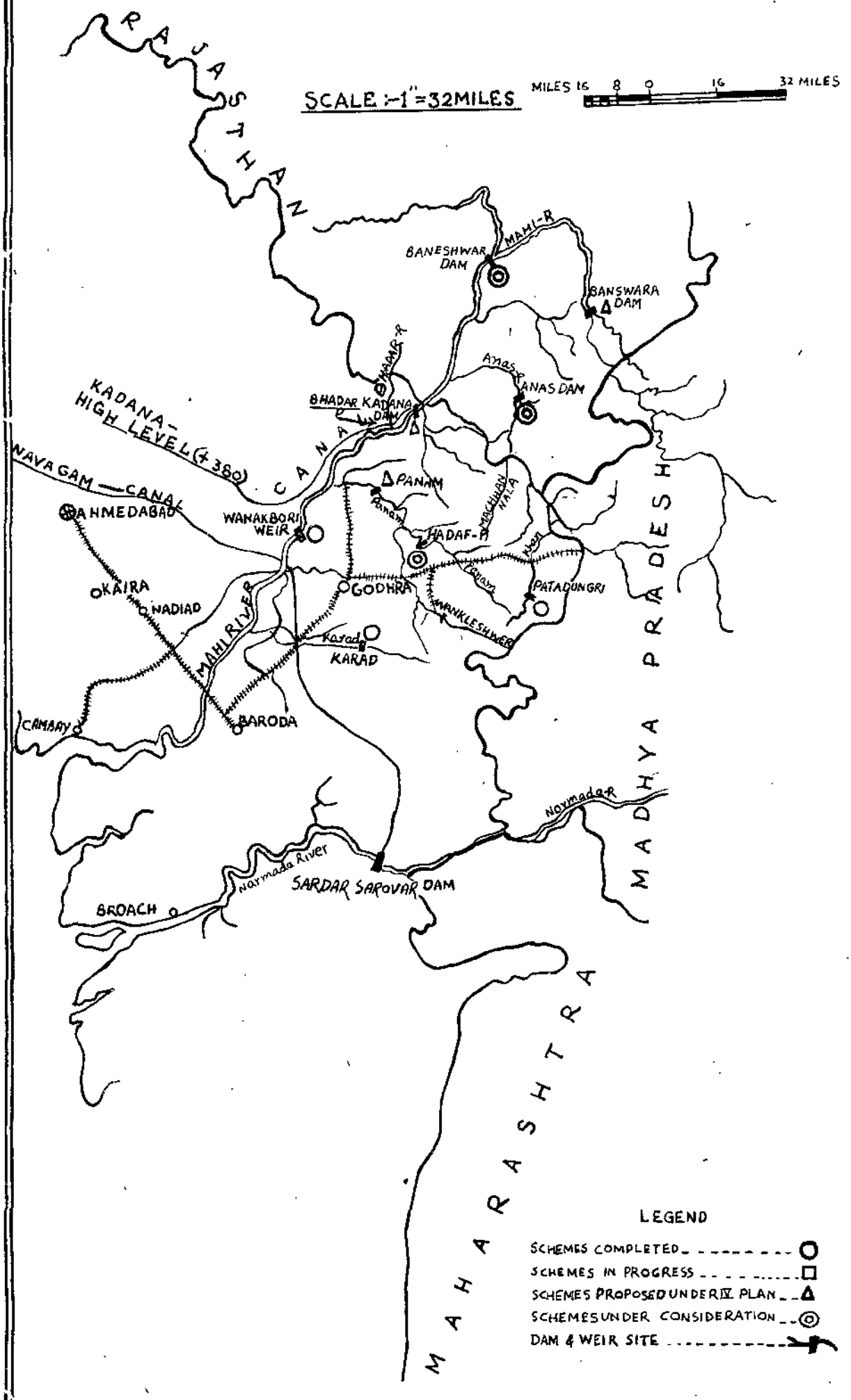

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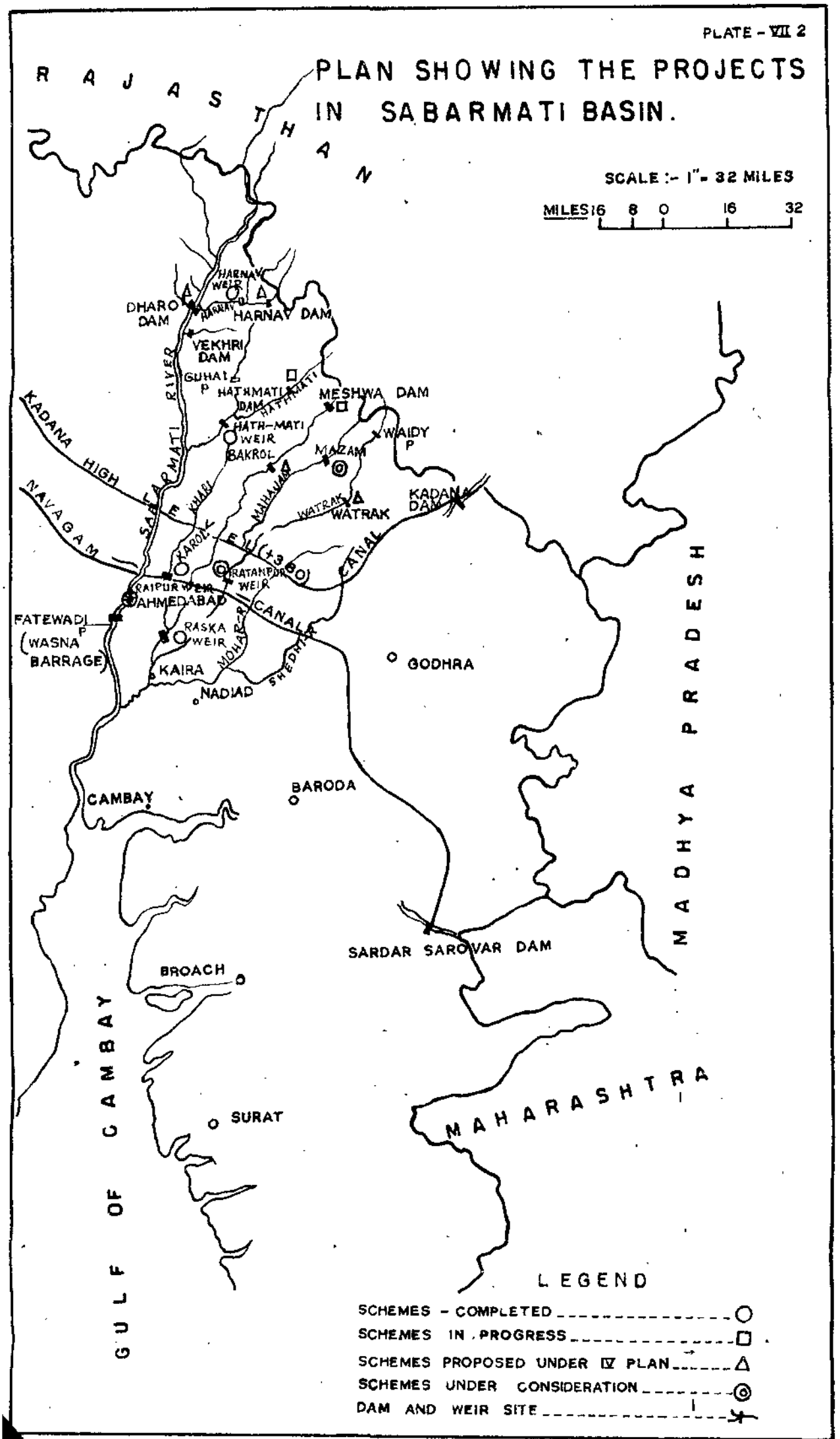
PLATE - VII 2

PLAN SHOWING THE PROJECTS IN SABARMATI BASIN.



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CHAPTER VIII

LAW RELATING TO EQUITABLE APPORTION MENT OF THE WATERS OF INTER-STATE RIVERS IN INDIA

Doctrine of Absolute Territorial Sovereignty

8.1.1 What is the legal principle which governs the apportionment of the waters of an inter-State river in India? Broadly speaking, three different views have been expressed on the subject. The first view proceeds on what is called the doctrine of absolute territorial sovereignty. According to this view, every State has, in virtue of its sovereignty the right to do what it likes with the waters within its territorial jurisdiction, regardless of any injury that might result to a neighbouring State. Pushed to its logical conclusion, this means that a State in which the headwaters of a great river are situated can abstract any quantity of water and make a desert of the State situated lower down that river. This view known as the 'Harmon Doctrine' found its basis in the opinion of an United States Attorney General that the rights of United States as the upper riparian on the Rio Grande river were unlimited by any effect the unbridled exercise of those rights might have on the flow of the river into Mexico[1]. The doctrine was expressly reserved in the American-Maxican Treaty of 1906[2] and it continued to receive lip service by the United States until 1939[3]. But it was expressly disclaimed as a principle of municipal law in 1922 by the United States Supreme Court[4]. The doctrine has not been applied by the United States during its negotiations with Mexico since 1944[5]. The United States also assumed a radically different attitude and repudiated the doctrine when as a lower riparian on the Columbia River the application of the doctrine would have operated to its distinct disadvantage[6]. The doctrine has also been rejected by Professor Smith—"The doctrine of absolute supremecy of the territorial sovereign is essentially anarchic..... permitting every State to inflict irreparable injury upon its neighbours without being amenable to any control save the threat of war."[7]

English Common Law Principle of Riparian Right

8.1.2 A second view that has sometimes been urged is the rights of riparian States should be determined by the common law principle which applies to individual riparian owners in England. This principle is that every riparian proprietor is entitled to the water of the stream in its natural flow without sensible diminution and without sensible alteration in its character or quality. Pushed to its logical conclusion this principle would enable a State at the mouth of a big river to insist that no State higher up shall make any sensible diminution in the water which comes down the river. There may be desert areas in the upper State needing irrigation and there may be vast quantities of

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1. See I Moore, International Law 654 (1906).

2. Convention Providing for the Equitable Distribution of the Waters of the Rio Grande for Irrigation Purposes, May 5, 1905, 34 Stat. 2953 (effective December 26, 1906).

3. See discussions in the Report of American Section of the Int' l Water Comm'n. US & Mexico, H.R. Doc. No. 359, 71st Cong 2d Sess. (1930); Simsarian, op. cit. supra note 2.

4. Wyoming v. Colorado, 259 U. S. 419, 466 (1922);

Arizona v. California, 373 U.S. 546, 562, 565 (1963);

Nebraska v. Wyoming, 325 U. S. 589 (1945);

Colorado v. Kansas, 320 U.S. 383 (1947).

5. Treaty with Mexico Respecting Utilization of Waters of the Colorado and Tijuana Rivers and of the Rio Grande, February 3, 1944 arts. 8, 9, 59 Stat. 1219. T.S. 994 (effective November 8, 1945).

6. Hearings before the Senate Foreign Relations Committee on Treaty with Mexico Relating to the Utilization of the Waters of certain rivers, 79th Cong., 1st Sess., Pt I, at 19—21, pt. 5 at 1738-55 (1945); State Department Memorandum, Legal Aspects of the Use of Systems of International Waters, S. Doc. 118, 85th Cong., 2nd Sess. 91 (1958); The United States Position—Diversion of Columbia River Waters, 1956 PAC, N.W. Regional Meeting, Am. Soc. Int. Law 16—18, 21, 35.

7. Smith, The Economic Uses of International Rivers 144-45 (1931).

waters running waste to the sea past the lower State; nevertheless on the application of this common law principle a lower State can insist that the water shall flow down the river without sensible diminution, even if this means that the upper desert areas shall for ever remain desert.

Doctrine of Equitable Apportionment

8.1.3 A third principle that has been advocated is that of "equitable apportionment", that is to say, that every riparian State is entitled to a fair share of the waters of an inter-State river. What is a fair share must depend on the circumstances of each case, but the river is for the common benefit of the whole community through whose territories it flows, even though those territories may be divided by political frontiers. According to this doctrine the factors to be taken into account for apportionment of the waters are (1) examination of the economic and social needs of the co-riparian States by an objective consideration of various factors and conflicting elements relevant to their use of the waters, (2) distribution of the waters among the co-riparian in such a manner as to satisfy the needs to the greatest possible extent, (3) accomplishment of the distribution of the waters by achieving the maximum benefit for each co-riparian consistent with the minimum of detriment to each.

Legislative History of Article 262 of the Constitution

8.2.1 Which of these three principles applies to the apportionment of the waters of an inter-State river in India? In the approach to this question, it is necessary to keep in view the legislative history of Article 262 of the Constitution and the 1956 Act enacted in pursuance of that Article. Under the Government of India Act, 1935, entry No. 19 of List II—"Water, that is to say, water supplies, irrigation and canals, drainage and embankments water storage and water power" was a subject falling in the Provincial Legislative List. Section 49(2) of that Act provided that the executive authority of the province was co-extensive with its legislative authority. If there were no other limiting or restrictive provisions in the Act, each Province could, by virtue of entry 19 of List II read with section 49, sub-section (2), be entitled to do what it liked with all water supplies within its territories. But Sections 130 to 132 of the Government of India 1935, imposed certain important restrictions on the Provinces in the matter. If any legislative or executive action taken or proposed to be taken by one Province affected or was likely to affect prejudicially the interests of another Province or any of its inhabitants, the Government of the latter Province may complain to the Governor General under Section 130. Thereupon, after appointing a Commission of Investigation and considering its report, the Governor General may make such orders as he may deem proper in the matter. Under section 131, sub-section (6) of the Act, the orders of the Governor General were binding upon the Provinces affected. Section 131 also provided that if, before the Governor General has given any decision, the Government of any Province or the ruler of any State requests him to do so, he shall refer the matter to His Majesty in Council and His Majesty in Council may give such decision and make such order in the matter as he deems proper.

8.2.2 Articles 239—242 of the draft Constitution of India appeared under the heading, "Interference with Water Supplies".

Draft Article 239: complaints as to interference with Water supplies:

> If it appears to the Government of any State for the time being specified in Part I or Part III of the First Schedule that the interests of that State or of any of the inhabitants thereof in the water from any natural source of supply in any State have been, or are likely to be affected prejudicially by:
>
> (a) any executive action or legislation taken or passed or proposed to be taken or passed; or
>
> (b) the failure of any authority to exercise any of their powers with respect to the use, distribution or control of water from that source, the Government of the State may complain to the President.

Draft article 240: decision on Complaints

(1) If the President receives such a complaint as aforesaid, he shall, unless he is of opinion that the issues involved are not of sufficient importance to warrant such action, appoint a Commission consisting of such persons having special knowledge and experience in irrigation, engineering administration, finance or law as he thinks fit, and request that Commission to investigate in accordance with such instructions as he may give to them, and to report to him on the matters to which the complaint relates, or such of those matters as may refer to them.

(2) A Commission so appointed shall investigate the matters referred to them and present to the President a report setting out the facts as found by them and making such recommendations as they think proper.

(3), (4), (5) x x x x x

(6) After considering any report made to him by the Commission, the President shall, subject as hereinafter provided, make orders in accordance with the report.

(7) If upon consideration of the Commission's report the President is of the opinion that anything therein contained involves a substantial question of law, he shall refer the question to the Supreme Court under Article 119 of this Constitution and on receipt of the opinion of the Supreme Court thereon shall unless the Supreme Court has agreed with Commission's Report, return the report of the Commission together with the opinion and the Commission shall thereupon make such modifications in the report as may be necessary to bring it in accord with such opinion and present the report as so modified to the President.

(8) Effect shall be given, in any State affected, to any order made under this article by the President, and any Act of the Legislature of a State which is repugnant to the order shall, to the extent of the repugnancy, be void.

Draft Article 242: *jurisdiction of Courts Excluded*

Notwithstanding anything in this Constitution, neither the Supreme Court nor any other Court shall have jurisdiction to entertain any action or suit in respect of any matter, if action in respect of that matter might have been under any of the three last preceding articles by the Government of a State or the President.

8.2.3. In the Constituent Assembly on 9th September, 1949 Dr. Ambedkar proposed an amendment inserting draft Article 242 (a) in the draft Constitution:—

"242(a). Adjudication of disputes relating to waters of inter-State rivers or river valleys—

(1) Parliament may by law provide for the adjudication of any dispute or complaint with respect to the use, distribution or control of the waters of, or in, any inter-State river or river valley.

(2) Notwithstanding anything contained in this Constitution Parliament may, by law, provide that neither the Supreme Court nor any other Court shall exercise jurisdiction in respect of any such dispute or complaint as is referred to in clause (1) of this Article."

8.2.4 The reasons which Dr. Ambedkar gave for the amendment are as follows:—

"Sir, originally this article provided for Presidential action. It was thought that these disputes regarding water and so on may be very rare, and consequently they may be disposed of by some kind of special machinery that might be appointed. But in view of the fact that we are now creating various corporations and these corporations will be endowed with power of taking possession of property and other things, very many dispute may arise and consequently it would be necessary to appoint one permanent body to deal with these questions. Consequently, it has been felt that the original draft or proposal was too hide-bound or too stereo-typed to allow any elastic action that may be necessary to be taken for meeting with these problems. Consequently, I am now proposing this new article which leaves it to Parliament to make laws for the settlement of these disputes."

Article 262 *of the Constitution*

8.2.5 Article 262 of the Constitution reproduces draft Article 242(a) quoted above under the heading: "Disputes relating to Waters". The other relevant provisions of the Constitution are entry 17, List II of the Seventh Schedule and entry 56 of List I of the Seventh Schedule.

Entry 56, *List I, Seventh Schedule*:—

"Regulation and development of Inter-State rivers and river valleys to the extent to which such regulation and development under the control of the Union is declared by Parliament by law to be expedient in the public interest."

Entry 17, *List II, Seventh Schedule*:—

"Water, that is to say, water supplies, irrigation and canals, drainage and embankments, water storage and water power subject to the provisions of entry 56 of List I."

Enactment of the Inter-State Water Disputes Act (*Act* 33 *of* 1956)

8.2.6 In 1956, Parliament enacted the Inter-State Water Dispute Act (Act 33) 1956. The Act is entitled as "an Act to provide for the adjudication of disputes relating to waters of inter-State

rivers and river valleys." Section 2(c) of the Act defines as "Water Dispute" to mean:—

"any dispute or difference between two or more State Governments with respect to—

(i) the use, distribution or control of waters of, or in, any inter-State river or river valley; or

(ii) the interpretation of the terms of any agreement relating to the use, distribution or control of such waters or the implementation of such agreement ; or

(iii) the levy any water rate in contravention of the prohibition contained in Section 7."

In Section 3 of the Act, the following provision is made:—

"If it appears to the Government of any State that a water dispute with the Government of another State has arisen or is likely to arise by reason of the fact, that the interests of the State, or of any of the inhabitants thereof, in the waters of an inter-State river or river valley have been, or are likely to be, affected prejudicially by—

(a) any executive action or legislation taken or passed, by the other State; or

(b) the failure of the other State or any authority therein to exercise any of their powers with respect to the use, distribution or control of such waters; or

(c) the failure of the other State to implement the terms of any agreement relating to the use, distribution or control of such waters, the State Government may, in such form and manner as may be prescribed, request the Central Government to refer the water dispute to a Tribunal for adjudication."

Section 4 prescribed as follows:—

"(1) When any request under section 3 is received from any State Government in respect of any water dispute and the Central Government is of opinion that the water dispute cannot be settled by negotiations, the Central Government shall, by notification in the Official Gazette, constitute a Water Disputes Tribunal for the adjudication of the water dispute."

Section 5 deals with adjudication of water disputes between States.

Sub-section (1)—When a Tribunal has been constituted under section 4, the Central Government shall, subject to the prohibition contained in section 8, refer the water dispute and any matter appearing to be connected with or relevant to, the water dispute to the Tribunal for adjudication.

(2) The Tribunal shall investigate the matters referred to it and forward to the Central Government a report setting out the facts as found by it and giving its decision on the matters referred to it.

(3) If, upon consideration of the decision of the Tribunal, the Central Government or any State Government is of opinion that anything therein contained required explanation or that guidance is needed upon any point not originally referred to the Tribunal, the Central Government or the State Government, as the case may be, may within three months from the date of the decision, again refer the matter to the Tribunal for further consideration; and on such reference, the Tribunal may forward to the Central Government a further report, giving such explanation or guidance as it deems fit and in such a case, the decision of the Tribunal shall be deemed to be modified accordingly.

Section 6 reads—

"The Central Government shall publish the decision of the Tribunal in the Official Gazette and the decision shall be final and binding on the parties to the dispute and shall be given effect to by them."

Sections 8 and 11 are as follows:—

Section 8—Bar of reference to certain disputes to Tribunal: Notwithstanding anything contained in section 3 or section 5, no reference shall be made to a Tribunal of any dispute that may raise regarding any matter which may be referred to arbitration under the River Boards Act, 1956.

Section 11—Bar of jurisdiction of Supreme Court and other Courts: Notwithstanding anything contained in any other law, neither the Supreme Court nor any other Court shall have or exercise jurisdiction in respect of any water dispute which may be referred to a Tribunal under this Act."

8.2.7 It is manifest that Act 33 of 1956 was enacted by Parliament in exercise of the powers contained in Article 262(1) of the Constitution and the bar of jurisdiction of the Supreme Court and of other Courts contained in section 11 of the Act was made in pursuance of the express powers conferred on Parliament under Article 262(2) of the Constitution.

8.2.8 Article 73 of the Constitution provides that the executive authority of the Union is co-extensive with its legislative authority in respect of matters covered by List I and Article 162 similarly provides that the executive authority of the State is co-extensive with its legislative authority. Article 162 reads as follows:—

> *Article* 162—Subject to the provisions of this Constitution, the executive power of a State shall extend to the matters with respect to which the legislature of the State has power to make laws: Provided that in any matter with respect to which the Legislature of a State and Parliament have power to make laws, the executive power of the State shall be subject to, and limited by, the executive power expressly conferred by this Constitution or by any law made by Parliament upon the Union or authorities thereof.

8.2.9 If the constitutional powers under Article 162 and item 19 of List II had stood alone, the power of the State Legislature and of the State Government to do what they liked with reference to the waters of inter-State rivers would be unrestricted, but just as section 130 to 132 of Government of India Act, 1935 placed important shackles on that power, article 262 of our Constitution contemplates that fetters should be put on the State Legislative power by law to be enacted by Parliament Article 262 recognises (as sections 130 to 132 of the Government of India Act, 1935. recognised) that it is not open to a State Government to take legislative or executive action in respect of an inter-State river which would prejudicially affect the rights of other States of the same inter-State river. Section 3 of the Inter-State Water Disputes Act, 1956, sub-clause (a) and (b) reproduces substantially the provisions of section 132 of the Government of India Act 1935. The law governing the rights of the States in respect of the waters of inter-State rivers under the Constitution is therefore almost identical with the law under the provisions of the Government of India Act 1935. Article 262 recognises the principle that no State can be permitted to use the waters inter-State river so as to cause prejudice to the interests of another riparian State or of a State in the river valley or of the inhabitants thereof.

INDUS COMMISSION REPORT (1942)

8.3.1 The main question for consideration is: What is the law or legal principle in the light of which it can be said that a State has taken legislative or executive action which has affected or is likely to affect prejudicially the interests of another State or any of its inhabitants in the waters of an inter-State river. The same question arose before the Indus Commission which expressed the view that in the absence of an agreement between the parties, the rights of several States must be determined by applying the doctrine of "equitable apportionment" and not the doctrine of sovereignty or the doctrine of riparian rights. At page 10 of its report, the Indus Commission states:

> 14. General principles suggested for consideration by parties—With a view to saving time, we propounded on the first day of the session certain general principles for distribution of the water of inter-Provincial rivers, which seemed to us to emerge from a study of the practice in other countries and which we desired the parties to comment upon in due course. The statement which we made is quoted below:—
>
> "Subject to correction in the light of what you may have to say, the following principles seem to emerge from the authorities:—
>
> (1) The most satisfactory settlement of disputes of this kind is by agreement; the parties adopting the same technical solution of each problem, as if they were a single community undivided by political or administrative frontiers. (Madrid Rules of 1911 and Geneva Convention, 1923, Articles 4 and 5).
>
> (2) If once there is such an agreement, that in itself furnishes the 'law' governing the rights of the several parties until a new agreement is concluded. (Judgement of the Permanent Court of Inter-national Justice, 1937, in the Meuse Dispute between Holland and Belgium).
>
> (3) If there is no such agreement, the rights of the several Provinces and States must be determined by applying the rule of 'equitable apportionment', each unit getting a fair share of the water of the common river (American decisions).
>
> (4) In the general interests of the entire community inhabiting dry, arid territories,

priority may usually have to be given to an earlier irrigation project over a later one: 'priority of appropriation gives superiority of right' (Wyoming *v.* Colorado, 259 U.S. 419, 459, 470).

8.3.2 The important issues before the Indus Commission were:—

1(a) What is the law governing the rights of the several Provinces and States concerned in the present dispute with respect to the water of the Indus and its tributaries?

1(b) How far do the orders of the Government of India annexed to and explained in their letter of March 30, 1937, themselves constitute the law by which the rights in question are to be determined?

8.3.3 The answer given to these issues by the Indus Commission was in the following terms:—

"*Issue* 1(*a*)—All parties have accepted the general principles which we tentatively formulated on the first day after examining the practice in other parts of the world. It follows from them that the rights of the several units concerned in the dispute must be determined by applying neither the doctrine of sovereignty, nor the doctrine of riparian rights, but the rule of 'equitable apportionment', each unit being entitled to a fair share of the waters of the Indus and its tributaries."

"*Issue* 1(*b*)—The orders of the Government of India dated March 30, 1937, proceeding, as they did for the most part, on the consent of the units concerned, must be regarded as having secured the most equitable apportionment then possible. If owing to material errors in the original data, or a material change in river conditions, or other sufficient cause, those orders are now found to be inequitable and if a more equitable arrangement can be discovered in present circumstances, with due regard to the interests of all the units concerned, the original orders may properly be modified. This implies of course that a modification of the orders in one particular may necessitate consequential modifications in other particulars by way of redressing the balance between the several units."

8.3.4. The Indus Commission further enquired into the question as to when a State could be said to have taken legislative or exercise action which was likely to "prejudicially affect" the interest of a neighbouring State or of its inhabitants. Paragraph 30 of the report reads as follows:—

"*Limits of Permissible Action*—What then can it legitimately claim to do? And when can we say that it oversteps the limits of permissible action? Until we have found some law or principle which would furnish an answer to these questions, we cannot determine the extent, if any, to which any proposed action "prejudicially affects" the interests of a neighbouring Province or State; nor can we recommend to what extent that action should be permitted or restrained."

8.3.5 The answer of the Indus Commission was that no State could use the water of an inter-State river so as to prejudicially affect another State or of its inhabitants, and the latter State was prejudicially affected as a matter of law when it was deprived of its equitable share of waters of the inter-State river on the application of "the doctrine of equitable apportionment." As we have already said the legal position under the Government of India Act 1935, is substantially the same as under Article 262 of the Constitution read with the 1956 Act except for the concept of the river vally and the procedural variation contained in section 4 of the Inter-State Water Disputes Act 1956. In other words, the theory underlying Article 262 of the Constitution and the Inter-State Water Disputes Act 1956 is the theory of equitable distribution of waters of an inter-State river between the riparian States or States in the inter-State river vally. As a necessary corollary of this proposition, it follows that the legislative or executive action of a State prejudicially affects the interests of another riparian State or a State in the river valley or its inhabitants, if such legislative or executive action injuriously affects the equitable apportionment of the waters to which the latter State is entitled.

Principle of Equitable Apportionment is Accepted by all the Party States

8.4.1 At the time of hearing the preliminary issues, Shri Nariman on behalf of Maharashtra and Shri Thakore, Advocate General of Gujarat, expressly said that the correct legal principle applicable in the pressent dispute is the Doctrine of Equitable Apportionment as enunciated by the Indus Commission. Shri Chitale appearing on behalf of

Madhya Pradesh also made an express concession to the same effect.

8.4.2 At the subsequent hearing of the substantive issues in this case, the Learned Counsel appearing on behalf of Madhya Pradesh, Gujarat and Maharashtra made express statements to the same effect.

Proceedings of the Indus Commission

8.4.3 The main proceedings of the Indus Commission were those relating to the Bhakra Project. Broadly speaking Sind's first complaint was that the effect of the Bhakra Dam Project and the other projects contemplated by Punjab when super-imposed upon the full effects of the Thal and Haveli projects and certain older projects already executed would be "to cause such lowering of water levels both in upper and lower Sind during the months of May to October inclusive as would seriously affect the efficient working of Sind's inundation canals." Sinds second complaint in substance was that the Thal and Haveli Projects when taken in conjuction with certain orders passed by the Government of India in 1937 would create a serious shortage of water at Sukkur in the Rabi or "winter" season (October to March inclusive) and would interfere with the proper working of the Sukkar Barrage Project in Sind.

8.4.4 The Indus Commission came to the conclusion that the Punjab interests were likely to cause material injury to Sind's inundation canals. Punjab should therefore allow Sind sufficient time to take necessary remedy for avoiding damage to inundation canal and Punjab should be prohibited from beginning work on its projects for three years. The Commission that Punjab should pay compensation for any damage caused to inundation canals. The Commission also noted that "A final apportionment or the Indus System, to be practicable would probably require the construction of two new barrages in Sind, at Gudu and Hajipur (both have since been built) although the Hajipur site was superseded by that at Kotri-Hyderabad". That being so, the Commission recommended that Punjab in particular should make a contribution towards the cost of these works.

8.4.5 In formulating the law, the Indus Commission placed much reliance on the decisions of the Supreme Court of United States. The doctrine of equitable apportionment was first enunciated by that Court in the case of Kansas *v.* Colorado.[8] In that case Kansas claimed the water of the Arkansas River "as it was wont to flow, no portion of it being appropriated in Colorado for purposes of irrigation". But Colorado took the extreme position that by virtue of her sovereignty, she could legally use the entire flow leaving no water for Kansas. The Supreme Court held that the contentions of both the States were without merit. Statistics showing increases in population, number of acres cultivated and the value of farm production in Colorado countries irrigated from the river were considered by the Court. The evidence disclosed that irrigation in Colorado resulted in a reduction of the flow of the river in Kansas and had worked some detriment to the south-western part of Kansas. The Court found that Kansas "recognised the right of appropriating the waters of a stream for the purposes of irrigation, subject to the condition of an equitable division between the riparian proprietors", although it was fundamentally a riparian State. In the course of its judgement, the Court stated:

> "Whatever has been effective in bringing about this development is certainly entitled to recognition and should not want only or unnecessarily be destroyed or interfered with. That this development is largely owing to irrigation is something of which from a consideration of the testimony there can be reasonable doubt. It has been a prime factor in securing the result, and before, at the instance of sister state, this effective cause of Colorado's development is destroyed, or materially interfered with, it should be clear that such sister state has not merely some technical right, but also a right with a corresponding benefit."

The conclusion of the Court was that:

> ".....when we compare the amount of this detriment (to Kansas) with the great benefit which has obviously resulted to the countries in Colorada, it would seem that the equality of right and equity between the two States forbids any interference with the present withdrawal of water in Colorado for purposes of irrigation."

A Weighing and Balancing Process

8.4.6 It is clear that the Court went through a weighing and balancing process in reaching its decision.

8. 206 U.S. 46 (1907).

Wyoming v *Colorado,* 259 *U.S.* 419 (1922)

8.4.7 In Wyoming *v.* Colorado[9]. Wyoming file a bill seeking to enjoin a proposed diversion of water from the Laramie river on Colorado for use in Colorado but outside of the watershed of that river. An examination of the evidence as to stream flow and other relevant factors convinced the Court that the supply of water in the stream would not satisfy both the existing appropriations between Colorado and Wyoming and also the proposed diversion in Colorado. But considering the factors which might be regarded as controlling in the decision of case, the Court found that "the doctrine of prior appropriation furnished the only basis consonant wtih the principle of right and equity applicable to such a controversy". Having announced the doctrine of prior appropriation as controlling in that particular case, the Court proceeded to formulate its decree so as to depart measurably from the recognised principles of that doctrine. The decree was entered on the basis of what was found to be the "fairly dependable and continuous" flow. After recognising certain senior Colorado priorities and allowing water for them, the Court decreed to Wyoming 2,72,500 acre feet of water per annum. The remaining water was found to amount to 15,500 acre feet of water per annum and this was awarded to the proposed Colorado diversions. In years in which the water supply might be in excess of the amount determined to be the "fairly dependable and continuous flow", appropriations in Wyoming junior in time to the proposed Colorado diversions in question would receive the benefit of the additional water. In years in which the supply might be less, the proposed Colorado diversions would receive water although certain Wyoming appropriators senior in time would be forced to go without.

Wurtemberg v *Baden* (1927)

8.4.8 A federal case of importance where the balancing process was applied is the judgement rendered by the German Staatsgerichtsh of June 18, 1927, in a controversy between Wurtemberg and Baden concerning the use of upper water of the Danube.* Between the towns of Hufingen in Baden and Fridengen in Wurtemberg the bed of the river is porous, with the result that a large quantity of water percolates away under-ground and ultimately emerges to form the sources of the little river Aach, which flows into Lake Constance. By reason of this phenomenon, known as the Doua versinkung, the water of the Aach is rich in mineral solutions and is of special value for industrial purposes. Of this Baden gets the benefit. On the other hand, Wurtemberg suffers by the loss of water, the river being frequently dried up altogether for considerable periods. The dispute arose out of the fact that each state had constructed works designed to protect its own interests, Baden seeking to increase and Wurtemberg to diminish the percolation of the river. Each party now sought an injuction to restrain the activities of the other.

8.4.9 Since the constitutional and municipal law of Germany afforded no solution, the Court was compelled to rest its judgement upon international law. The German Supreme Court first decided that in the absence of muncipal and constiutional law, the decision must be based upon international law. It was pointed out that "modern international law restricts the application of the doctrine of territoral sovereignty by the principle *sie utere tuo ut alienum non laedas".* Broadly speaking, neither state is entitled to make artificial alterations in the flow of the river which cause injury to the other. The application of this principle must be governed by the circumstances of each particular case, and the conflicting interests must be weighed equitably against each other. The German Supreme Court added the significant observation. "The interest of the states in question must be weighed in an equitable manner against one another. One must consider not only the absolute injury caused to the neighbouring state but also the relation of the advantage gained by one to the injury caused to the other."

Relevant Factors in the Balancing Process

8.5.1 In the application of the balancing process to any particular case, it may be relevant to corsider the nature of the land along the banks of the river, the extent of the dependence of the riparians on the river's flow, the volume of diversion[10], the size of the river's watershed or drainage area and the possibility of maintaining a sustained flow through the controlled use of flood waters[11]. Of course, an emergency may require special consi-

9. 259 U.S. 419 (1922).

*Entscheidungen des Reichsgerichits in Zivilsachen, Vol. CXVI, App.

10. Where the total diversion approximated 2 percent of the water at the state line and 94 percent of the diversion occurred when the river was at its height, the Court found no appreciable injury to the lower riparian. Connecticut *v.* Massachusetts, 282 U.S. 660 (1931).

11. Kansas *V.* Colorado, 185 U.S. 125, 147 (1902).

deration and extraordinary measures for its duration[12]. There are numerous other factors: *inter alia* the quality of the waters after use by the upper riparian, the seasonal variations in diversions, the contribution of water by each riparian, the availability of storage facilities or the ability to construct them, the availability of other resources, the extent to which water is or could be returned to the river after use (return flow), and the suitability of the water for the purpose desired[13]

8.5.2 In Nebraska *v.* Wyoming [14], the Court Characterised the process by which the waters are apportioned as follows:

> Priority of appropriation is the guiding principle. But physical and climatic conditions, the consumptive use of water in the several sections of the river, the character and rate of return flows, the extent of established uses, the availability of storage water, the practical effect of wasteful uses on downstream areas, the damage to upstream areas as compared to the benefits to downstream areas if a limitation is imposed on the former—these are all relevant factors. They are merely an illustrative, not an exhaustive catalogue. They indicate the nature of the problem of apportionment and the delicate adjustment which must be made.
>
> *** *** ***

Relevancy of dependable flow, not Average Annual flow

8.5.3. In examining the problem of apportionment, the possibility of maintaining a sustained flow through storage facilities is a relevant factor. The Volume of water in any stream varies from year to year. By the use of a high volume of water as the basis for apportionment, the upstream state in a controversy will be favoured as against a lower state in years in which the volume is below the amount used as the basis for the apportionment. In the dispute between Wyoming and Colorado before the Supreme Court, Colorado urged that the average yearly flow was the proper measure of apportionment of the river waters. Wyoming claimed that the lowest annual stream flows which do not come....." [15/1] .Consewas held by the Supreme Court that the average annual flow was not a proper measure because "crops cannot be grown on expectations of average flows which do not come....."[15/1] . Consequently the Supreme Court arrived at a volume which it regarded as a "fairly constant and dependable flow materially in excess of the lowest" but below the average[15/2].

At page 484 of the Report, the Supreme Court states:

> "We have already indicated that as to such a stream as this, the average flow of all years, high and low, cannot be taken as proper or reasonable measure of what is available for practical use. What then is the amount which is available here? According to the general consensus of opinion among practical irrigators and experienced irrigation engineers, the lowest natural flow of the years is not the test. In practice they proceed on the view that within limits, financially and physically feasible, a fairly constant and dependable flow materially in excess of the lowest may generally be obtained by means of reservoirs adapted to conserving and equalizing the natural flow; and we regard this view as reasonable." (See Wyoming *v.* Colorado 259 US, 419, 484).

Irrigation Commission Report (1972)

8.5.4 The Irrigation Commission has also pointed out in its Report [15/3] that "the farmer should be assured of getting the designed supply in 75 per cent of the years, and the existing practice in Indian conditions of planning irrigation schemes on the basis of 75 per cent dependability should continue. Where a carryover is provided, the 75% dependability can be figured out, taking into account the carryover water."

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12. Cf. Connecticut V. Massachusetts, 282 U.S. 660 (1931).

13. See Smith, The Chicago Diversion, 10 B.Y.I.L. 144, 155 (1929), where the author considers necessity, justification, n ot and material injury in determining whether the diversion was lawful.

There may be instances where monetary compensation will solve an apportionment problem. Cf. Connecticut *v.* Massachusetts, 282 U.S. 660, 667 (1931): treaties between U.S. and Canada, January 17, 1961 art. VIII, (1965) 2 U.S.T. & O.I.A. 1555, T.I.A.S. 5638 p. 8 (1964); U.K & Egypt, 207 U.N.T.S. 277, 280 (1955) (exchange of notes); Italy and U.K. June 12 and 15, 1925, 38 L.N.T.S. 189, 199 (1925). However, such compensation could only be had for the displacement of a beneficial use since apportionment is based wholly on such actual use and not on rights in the abstract. Compensation is not however, always adequate. Laylin & Bianchi, The Role of Adjudication in International River Disputes, 53, Am. J. Intl' L. 30, 31(1959).

14. 325 U.S. 589, 618 (1945).

15. Wyoming *v.* Colorado, 25 US 419 (1922).

15/1. Id. at 476.

15/2. Id. at 484; see also Nebraska *v.* Wyoming, 325 US 589, 620 (1945).

15/3. Irrigation Commission Report, 1972, Volume I, p. 125.

8.5.5 The general climate of the contending States must also be given proper weight. Accordingly, in Nebraska *v.* Wyoming [16], the Court traced the flow of the North Platte River and analysed the position as follows:—

> "The river basin in Colorado and Wyoming is arid, irrigation being generally indispensable to agriculture. Western Nebraska is partly arid and partly semi-arid. Irrigation is indispensable to the kind of agriculture established there. Middle Nebraska is subhumid. Some crops can be raised without irrigation. But the lack of irrigation would seriously limit diversification. Eastern Nebraska, beginning at Grand Island, is sufficiently humid so as not to justify irrigation."

8.5.6 No apportionment of water was, therefore, made to Nebraska from the North Platte River except for use on the lands in the extreme western part of that State. East of that, it was either sufficiently humid or local supplies and return flow were adequate to meet the requirements.

8.5.7 The Indus Commission also had to resolve a similar question. The Province of the Punjab proposed to store flood waters used by the Province of Sind for its inundation canals. The canals were not deep enough to take off water at the lower levels to which the river would be reduced, but the supplies would be adequate and usable if diversion dams were constructed just below the intake of the canals. The Indus Commission expressly applied the principle of equitable apportionment when it determined that the Punjab would be acting within its rights in storing certain flood supplies upstream. However, it provided that the Punjab should reimburse Sind for that portion of the cost of building diversion dams necessary to effect replacement of the flood supplies previously relied upon to raise the river level. If the diversion dams would also serve to provide additional supplies, the portion of the total cost attributable to the new benefits was to be borne by Sind.

Imperative Need For Avoidance Of Waste

8.6.1 The doctrine of Equitable Utilisation is also not concerned with the protection of abstract or hypothetical rights of riparian States. To be protected, the use must be of a beneficial nature (Article IV of Helsinki Rules: also see Washington *v.* Oregin, 297 U.S. 517, 527 (1936). This does not however, mean that the use must be the most beneficial to which the water must be put or that the method of utilisation must be maximally efficient. But the rule does mean that the States will not be permitted to waste inter-State river waters. The rule certainly enjoins upon the riparian States the duty of efficiency in the use of such waters which is commensurate with their respective financial resources. There is hence little doubt that an inter-State Tribunal would not countenance waste due to wilfulness or indifference by a riparian State where the waters of the river are insufficient to meet the needs of all riparian States (See Nebraska *v.* Wyoming, 325 US 589, 618 (1945).

8.6.2 It is important to note that Article V(2)(i) of the Helsinki Rules is emphatic that a relevant factor to be considered in determining the reasonable and equitable share of the riparian States is "the avoidance of unnecessary waste in the utilisation of waters of the basin."

8.6.3 Where, however, inefficiency stems not from misfeasance but from limitations of technical and financial resources, the result must be different. It may be unreasonable to except and to require an under-developed State to meet the standards of efficiency for the utilisation of irrigation waters prevalent in parts of highly developed countries. The Indus Commission reasoned on similar lines when faced with the dilemma of determining whether to grant protection to the province of Sind in its admittedly wasteful practice of utilising inundation canals dependent on flooding by the river. The Commission cited Punjab's argument that such irrigation required wasting to the sea half the supplies of the river. At page 51, the Commission states:

> "The Punjab contends that in the arid conditions existing in the areas to be benefited by the Schemes under contemplation—areas which are visited at periodic and frequent intervals by all the horrors of famine—Sind has no right to demand that half the available supplies of the Indus shall be wasted to the sea and (that) it is incumbant on Sind to carry out at her own expense the works necessary to prevent such waste. It is the duty of Sind to take all such measures as may be necessary for enabling Sind to utilize the water available to her."

The Indus Commission at page 52 of its report stated:—

> "There is, however, another side to the picture. Undoubtedly inundation canals are a wasteful anachronism and the sooner they are replaced by weir-controlled system, the better. But many miles of such canals are still in

16 325 U.S. 589 (1945).

existence (Sind has over 3,000 miles including distributaries) and large numbers of people have for generations depended upon them for their livelihood. It may be that they and their Province cannot yet afford to instal a better and, in the beginning more expensive system of irrigation. In the meantime, are they to be deprived of their living merely because an Upper Province needs the water? If the Upper Province wishes to take the water, let it pay adequate compensation in cash or in kind."

The Commission concluded as follows:—

"No new project, however, beneficient in other ways, should be allowed to impair existing inundation canals without payment of compensation. Equally important is the implication that in other respects inundation canals are not to retard the progress of irrigation"

The Commission pointed out that a similar conclusion had been reached by the Nile Commission of 1925, which had recommended a gradual transition from flood irrigation on the lower Nile and a corresponding delay in the development of conservation works in the Sudan.

Manual of River Planning (Flood Control Series No. 7) (United Nations)

8.6.4 In its Manual of River Basin Planning (Flood Control Series No. 7), the United Nations has also stated:—

"The waste of water resources is particularly inexcusable in underdeveloped countries of Asia and the Far East where there is not sufficient balanced food supply to go around and not enough power to develop industries. Huge areas are damaged by floods almost every year in one flood plain or another of this region, which contains half the population of the world." (Page 1).

8.6.5 The doctrine of "Equitable Apportionment" cannot therefore, be put in the narrow straight jacket of a fixed formula. In determining the just and reasonable share of the interested States, regard must be paid in the first instance to whatever agreements, judicial decisions, awards and customs are binding upon the parties. As to any supplies not controlled by these factors, the allocation may be made according to the relative economic and social needs of the interested States. The other matter to be considered include the volume of the stream, the water uses already being made by the States concerned, the respective areas of land yet to be watered, the physical and climatic characteristics of the States, the relative productivity of land in the States, the Statewise drainage, the population dependent on the water supply and the degree of their dependence, alternative means of satisfying the needs, the amount of water which each State contributes to the Inter-State stream, extent of evaporation in each State, and the avoidance of unnecessary waste in the utilisation of the water by the concerned States.

8.6.6 The weight to be given to any of the relevant factors is a matter of judgment on the pertinent facts of the particular case and no hard and fast rule can be laid down. The relevant factors emphasised in the 1959 Egyptian Sudanese Treaty were the arable areas easily irrigated in each country, the population of the States, the existing uses and in a less degree the financial contribution of each to the development projects. The State's contribution to the available river flow was not the crucial factor in the apportionment of the Nile Waters.[19] In the North Platte river litigation.[20] Nebraska was allotted about 75% of the river flow, though it contributed 43% of the flow. In the same case, Wyoming was allotted 25% of waters though the contributed 57% of the flow. The needs of the riparian States in this context means and connotes all their economic and social requirements, which cause them to be dependent to a greater or lesser degree on the river water. Varying degrees of dependence on water in arid and humid climates create varying degrees of need.[21] Scarcity areas are heavily dependent on river water for irrigation and the needs of such areas should receive special consideration.

Inter-State Agreement Of 1955 Between Punjab, Rajasthan, Kashmir and Pepsu

8.7.1 It is also important to notice that by the Inter-State Agreement of 29th January, 1955 (para 10), the surplus waters of Ravi and Beas were allocated between the undivided Punjab, Rajasthan Kashmir and Pepsu in the following proportion:—

Punjab	...	... 5.90 MAF
Rajasthan	...	... 8.00 MAF
Kashmir	...	... 0.65 MAF
Pepsu	...	... 1.30 MAF
Total		... 15.85 MAF

(*Vide* Exhibit Rs./10)

19 Rolet Chi-Shih Chen, The Non-Navigational Uses of International Rivers (1965), p. 156.

20 Nebraska v. Wyoming 325 US 589, 592 f.n. 621, 665.

21 A.H. Garretson and Others, The Law of International Drainage Basins (1967), pp. 44, 55-56.

The catchment area of undivided Punjab (in thousand acres) was 5696, of Kashmir 800 and of Rajasthan and Pepsu nil (see Ex R/288). It is obvious that the quantum of allocation to these States by the Inter-State Agreement had no relation to the catchment area of the respective States or to the contribution of the States to the flow of Ravi and Beas. Later on, in the year 1976, by a decision of the Government of India dated 4th March, 1976 under Section 378 of the Punjab Re-organisation Act, 1966 (Act No. 21 of 1966), the flows of Ravi and Beas allocated to undivided Punjab were again divided between Punjab and Haryana. The decision of the Central Government was that the divided Punjab should be allocated 3.5 MAF and Haryana should be allocated an equal quantity of 3.5 MAF. The balance of 0.2 MAF (out of 7.2 MAF allocated to undivided Punjab) was recommended as an additional quantum of water for Delhi Water Supply for acceptance by both the Governments of divided Punjab and Haryana. The order of the Central Government (Ex R/275) indicates that in coming to this decision, the Central Government expressly took into account the extent of arid tracts and of drought prone areas in Haryana. It is important to note that the catchment area of divided Punjab (in thousand acres) is 3360 and of that of Haryana is nil. The drought area (in thousand acres) in divided Punjab is nil and in Haryana 1911.5 (See Exhibit R/289). It is obvious that in coming to its determination the Central Government did not attach much importance to the contribution of divided Haryana and divided Punjab to the flows of Ravi and Beas but mainly took into account the existance and extent of drought areas in the two concerned States.

No Right Of Ownership In Running Waters

8.8.1 As a matter of law, no State has a proprietary right in a particular volume of water of an inter-State river on the basis of its contribution to the available flow or drainage area. It is well-established that the waters of a natural stream or other natural body of water are not susceptible of absolute ownership as specific intangible property. Wiel has stated the three 'first principles'[22] of the law of running waters as follow:—

> (1) Running water in a natural stream is not the subject of property, but is a wandering, changing thing without an owner, like the very fish swimming in it, or like wild animals, the air in the atmosphere, and the negative community in general.
>
> (2) With respect to this substance the law recognises a right to take and use of it, and to have it flow to the taker so that it may be taken and used,—a usufructuary right.
>
> (3) When taken from its natural stream, so much of the substance as is actually taken is captured, and, passing under private possession and control, becomes private property during the period of possession.

8.8.2 In the Institutes of Justinian it is declared concerning things: "They are the property of someone or no one.[23] As further expressed in the Institutes, "By natural law these things are common to all, *viz., running water,* the sea and as a consequence the shores of the sea."[24] Commenting on this Vinnius says: "Things are such because, while by nature being things everyone has use for, they have not, as yet, come into the ownership or control of anyone."[25] That is they are the property of no one, within the first quotation from the Institutes.

Principle Of "Negative Community"

8.8.3 This classification of running water with what has been called "the negative community", such as the air runs through the civil law authorities Potheir's exposition of it is as follows:[26]

> "Toutes ces choses, qui sont demurrees dans l' ancient etat de communaute negative, sont appellees res communes, par rapport au droit que chacun a de s'en emparer, Elles sont aussi appellees res nullius, parce qu' aucun n'en a la propriete, tant qu'elles demeurent en cet etat, et ne peut l' acquerir qui, n'appartiennent a personne, en tant

22 Wiel, Running Water. 22 Harvard Law Review 190 (1909).

23 "Vel in nostro patrimonia vel extra nostrum partimonium" As translated in Lux v. Haggin, 69 Cal. 315, 10 Pac. 674.

24 "Et quidem naturali jure, communia sunt omnium haec : ser et aqua, profluens, etc. mare, et per hoc. littora maris" Institutes of Justinian, lib 2, tit 1, sec 1 Mr. Ware (Ware's Roman Water Law) gives chiefly the Pandects or Digest, and does not give this passage in the Institutes.

25 "Communia sunt quea a natura ad omnium usum prodita, in nullius adhuc ditionem aut dominium pervenerunt" Quoted in Mason v. Hill, 5 Barn & Adol, 1, 110 Eng. Reprint, 692.

26 Pothier, Traite du Droit de Propriete, No 21.

qu'elles sont restees dansla communaute negative, qui sont susceptibles 'd l' acquisition qui se fait a titre d' occuption."

8.8.4 The Civil Law Principle that running water was in the "negative community" passed into English Common Law. In Embrey *v.* Owen[27] Parks B observed:

> "The right to have the stream to flow in its natural state without diminution or alteration is an incident to the property in the land through which it passes; but flowing water is *publici juris*, not in the sense that it is a *bonus vaccans*, to which the first occupant may acquire an exclusive right, but that it is public and common in this sense only, that all may reasonably use it who have a right of acess to it, that none can have any property in the water itself, except in the particular portion which he may choose to abstract from the stream and take into his possession, and that during the time of his possession only... .....But each proprietor of the adjacent land has the right to the usufruct of the stream which bows through it."

Principle Of Equality Of Right

8.9.1 The principle of equitable utilisation is truly speaking, one aspect of the application of the principle of equality of right of different States. For instance, the United States Supreme Court observed in Kansas *v.* Colorado [28] that the dispute must be adjusted "upon the basis of equality of rights as to secure as far as possible to Colorado the benefits of irrigation without depriving Kansas of the like beneficial effects of a flowing stream." The equality sought as a basis for settlement of such controversies has been defined to require:

> .....that the principles of right and equity shall be applied having regard to the "equal level or plane or which all the States stand in point of power and right, under our constitutional system" and that, upon consideration of the pertinent laws of the contending States, and all other relevant facts, this Court will determine what is an equitable apportionment of the use of such waters.[29]

Meaning Of That Principle

8.9.2. But the principle of equality of right does not mean that there must be an equal division of the water resources. Since water resources are not divisible into pieces like land lots, the equality to which the parties are entitled does not mean equal division. It means equality of consideration, it means equality of economic opportunity which very often may not result in the same quantity of water.

> As observed by Laurent: "Mais d'apres quel principe? Lls ont tous un titre egal; on serait donc tente de decider que leur droit doit etre regle d'apres la stricte loi de l'egalite, c'est-a-dire d'apres l'etendue de leurs heritages. Mais il y a encore d'autres elements dont il faut tenir compte, le mode de culture, la nature du sol, le genre d'exploitation. Il est impossible d'etablir une regle absolue et une egalite mathematique: voila pourquoi la loi s'en est raportee a la sagesse des tribunaux, comme nous lo dirons plus loin. Tout le monde est d'accord sur se point; la question de propriete est indifferent dans ce debat, car ceux qui admettent la propriete des eaux au profit des riverains reconnaissent que c'est une propriete limitee.* (7 Laurent, Principles de Droit Civil Francaise (3d ed. 1878 (333)).

(But according to which principle? They have all an equal right; one would thus be tempeted to decide that their right must be settled according to the strict law of equality, that is to say according to their inheritance. But there are still other elements which must be taken into consideration, the mode of cultivation, the nature of the soil, the nature of exploitation. It is impossible to establish an absolute rule and a mathematical equality that is why the law relies on the wisdom of the tribunals as we will mention it later on. Everybody is in agreement about this point; the question of ownership is immaterial in this discussion, for those who admit the ownership of the waters to the profit of the riparians recognise that it is the limited[30] ownership.)

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27 1851 6 Exc. 35.

28 206 U.S. 46 (100).

29 Connecticut *v.* Massachusetts, 282 US 660-671 (1931).

*Demolombe, t. XI, p. 174 no. 143, Duranton, t. V., p. 204 no. 214, Ducaurroy, Bonnier et Roustain, T.II., p. 181, no. 127.

30 Demolombe, table XII, page 174, no. 143, Duranton, table V, page 204, number 214, Ducraurroy, Bonnier & Roustain, table II, Page 181, number 271.

International Law Association Dubrovnik Conference—Principle V (1956)

8.9.3 What are the primary factors to be considered in applying the doctrine of equitable apportionment of inter-State river waters? As the Indus Commission has pointed out, the doctrine of Equitable Apportionment is derived from the basic concepts of international law. According to this doctrine, each State in the drainge basin of an international river system is entitled to a just and reasonable share of the benefits. What is just and equitable depends upon all the relevant facts in each particular case.

At the Dubrovnik Conference held in 1956, the International Law Association adopted the report of the International Committee under Professor Eagleton's chairmanship which took the form of a statement of principles upon which to base the rules of law concerning the use of International rivers.

Principle V

In accordance with the general principle stated in Principle III above, the states upon an international river should in reaching agreements, and states or tribunals in settling disputes, weigh the benefit to one state against the injury done to another through a particular use of the water. For this purpose the following factors, among others, should be taken into consideration:—

(a) The right of each to a reasonable use of the water;

(b) The extent of the dependence of each State upon the waters of that river;

(c) The comparative social and economic gains accruing to each and to the entire river community;

(d) Pre-existent agreements among the States concerned;

(e) Pre-existent appropriation of water by one State.

This principle, as the International Committee recognises, serves to give content to Principle III.

International Law Association—Helsinki Rules (*August* 1956)

8.9.4 At the Fifty Second Conference held in Helsinki in August 1956, the International Law Association adopted the final report of the International Committee and formulated the following rules:

Article IV—Each basin State is entitled, within its territory to a reasonable and equitable share in the beneficial uses of the waters of an international drainage basin.

Article V—

(1) What is a reasonable and equitable share within the meaning of Article IV is to be determined in the light of all the relevant factors in each particular case.

(2) Relevant factors which are to be considered include, but are not limited to:

(a) the geography of the basin, including in particular the extent of the drainage area in the territory of each basin State;

(b) the hydrology of the basin, including in particular the contribution of water by each Basin State;

(c) the climate affecting the basin;

(d) the past utilisation of the waters of the basin, including in particular existing utilisation;

(e) the economic and social needs of each basin State;

(f) the population dependent on the waters of the basin in each basin State;

(g) the comparative costs of alternative means of satisfying the economic and social needs of each basin State;

(h) the availability of other resources;

(i) the avoidance of unnecessary waste in the utilisation of waters of the basin;

(j) the practicability of compensation to one or more of the co-basin States as a means of adjusting conflicts among uses; and

(k) the degree to which the needs of a basin State may be satisfied, without causing substantial injury to a co-basin State;

(3) The weight to be given to each factor is to be determined by its importance in comparison with that of other relevant factors. In determining what is a reasonable and equitable share, all relevant factors are to be considered together and a conclusion reached on the basis of the whole.

8.9.5 This Article provides flexible guidelines essential to insuring the protection of the "equal right" of all basin States to share the inter-State waters.

CHAPTER IX

APPORTIONMENT OF WATERS OF THE RIVER NARMADA

9.1.1 In this Chapter, we propose to examine the difficult question of the equitable apportionment of 27.25 MAF of waters of Narmada between the States of Madhya Pradesh and Gujarat.

9.1.2. This is the subject matter of issue 7(b) as modified by the Order of the Tribunal dated 8th October, 1974, and of Issues 9 and 9A.

9.1.3. There was a serious controversy between the party States as to what is the utilisable quantum of waters in Narmada at Sardar Sarovar Dam site on the basis of 75 per cent dependability. It was ultimately agreed between the party States on 12th July, 1974, that the net available quantity of Narmada waters on the basis of 75% dependability should be assessed at 28 MAF. By its order dated 8th October, 1974, the Tribunal accepted the agreement between the party States on this issue and gave its decision that the utilisable quantum of waters in Narmada at Sardar Sarovar Dam site on the basis of 75% dependability should be assessed at 28 MAF.

9.1.4 In para 4 of the agreement of 12th July, 1974, the party States also agreed that the requirements of Maharashtra and Rajasthan are 0.25 MAF and 0.5 MAF respectively and the Tribunal in determining the disputes referred to it may proceed on the basis that Maharashtra may be allotted 0.25 MAF and Rajasthan may be allotted 0.5 MAF for use in their respective territories without prejudice to the level of the Navagam Canal. By its Order dated 8th October, 1974, the Tribunal accepted the agreement of the parties in this regard also and decided that Rajasthan was entitled to a share of 0.5 MAF and Maharashtra was entitled to 0.25 MAF as their rightful share of the utilisable quantum of Narmada waters.

9.1.5 In view of clause 9 of the agreement dated 12th July, 1974, the party States prayed to the Tribunal to modify issue 7(b) as follows:—

> 7(b) How and on what basis should equitable apportionment of the 27.25 MAF of water be made between the States of Madhya Pradesh and Gujarat? What should be the allocation to either State?

The Tribunal accepted their prayer and modified the issue accordingly.

9.2.1 In the course of argument, Counsel for Gujarat and Madhya Pradesh agreed that in making apportionment of 27.25 MAF, the Tribunal may not go into the question of (a) evaporation loss; (b) regeneration or return flow; and (c) carryover storage. Reference was made in this connection to page 6 of Summary Record of Discussions dated August, 1966 of official level conference (Ex. G/73) which reads as follows:—

> *Utilisable Supply for Irrigation as at Navagam*
>
> Taking the 75% dependable flow as 27 MAF and allowing for:
>
> (i) evaporation losses for major and medium reservoirs, and minor tanks, say —4 MAF
>
> (ii) regeneration or return flow, say +2 MAF
>
> (iii) effect of carryover storage of 5 MAF, say +3 MAF
>
> "It was agreed that the net utilised flow* to be adopted for present planning may be taken as 28 MAF".
>
> "It must be stated, however, that on this basis, there would be shortages in some years. Shortages of 10% and more may occur in about 20% years, those of 20% and more in about 17% years those of 30% and more in about 8% years and those of 50% and more in about 3% years".
>
> Note. Aggregate of all annual withdrawals from the main river and its tributaries).

9.2.2 It was conceded by Gujarat and Madhya Pradesh in the present case that in fixing the quantity of 27.25 MAF in the modified issue 7(b) for equitable apportionment between Gujarat and Madhya Pradesh, the intention of the party States was that account had already been taken of (a) evaporation loss; (b) regeneration or return flow; and (c) carryover storage.

Claim of Gujarat

9.3.1 In its Statement of Case, Volume I, page 83, para 64, Gujarat gave its total water requirement as follow:—

	Water Requirement MAF
1. Irrigation	20.97
2. Domestic & Industries Uses	1·00
3. Releases below Navagam	0·70
Total	22.67
Deduct availability from en route rivers	0.38
Net Requirement	22·29

9.3.2 Gujarat later field a revised Master Plan (Ex. G-462) for reappraisal of the availability of waters from en route rivers. This revised Master Plan gives the total water available from en route rivers for diversion into Navagam Canal as 0.4122 MAF. As a result, Gujarat has revised its estimate of water requirement for consumptive use (exclusive of evaporation loss) as 22.02 MAF.

9.3.3 In the course of argument, Shri Thakore, on behalf of Gujarat, stated that the figure of 22.02 MAF may be taken as the total water requirement of Gujarat and no separate claim is being made by Gujarat for evaporation loss.

9.3.4 In its Rejoinder to the Statement of Case of Gujarat (Volume 10, page 62, para 5.28), Madhya Pradesh set out its water requirement for consumptive use as follows:—

Irrigation within the basin (Volume 10, page 60, para 5·22)	26·80 MAF
Domestic and industrial uses, (Volume 10, page 61, para 5·23)	2·00 MAF
Irrigation outide the basin (Volume 10, page 61 para 5·24)	3·40 MAF
	32.20 MAF

Claim of Madhya Pradesh

9.3.5 In the course of argument, Counsel for Madhya Pradesh said that the total water requirement of Madhya Pradesh from Narmada was 24.079 MAF and no separate claim was made for exaporation loss. It was stated in the alternative that if the Tribunal was of the view that trans-basin areas are entitled to Narmada waters, Madhya Pradesh would claim 2.165 MAF for the areas covered by the three projects, Upper Narmada, Upper Burhner and Bargi diversions (See CMP 269 of 1976).

Ground water

9.4.1 For equitable apportionment of the waters of an inter-State river system, the underground water resource of a State is a relevant factor. The reason is that underground water may furnish alternative means for satisfying the State's irrigation needs. But the difficulty is that groundwater flow cannot be accurately estimated from the technical point of view, and, therefore, not fully cognisable as yet from the legal point of view.[1] In view of this difficulty, we are of the opinion that groundwater should be omitted altogether in the consideration of legal problems of the river basin. As Teclaff states:

> "Groundwater drainage divides do not necessarily correspond to surface watersheds. An example is the subterranean ridge that runs beneath the basin of the Chenab river, a tributary of the Indus. This ridge affects the distribution of ground water, its direction of flow, and differences in the chemical composition of the water. The water beneath the basin's surface thus may drain into more that one river system and, conversely, not all the water which finds its way into a particular river is derived from precipitation on that river's catchment area. A case in point is the Upper Danube mainstream in Southern Germany: water lost from the Danube hereby percolation eventually re-emerges in the river Aach, which belongs to the drainage basin of the Rhine. The derivation of stream flow from underground sources is thus very complex and can often be traced only by detailed study of the geology of the basin. For this reason it has been recommended that groundwater be omitted altogether in the consideration of legal problems of the river basin." (River Basin in History & Law—1967, pp. 9-10).

9.4.2 The Irrigation Commission (1972) has also pointed out that no systematic quantitative assessment of groundwater has so far been made in India for the various river basins and that assessment can be made only on the basis of complete data (yet to be collected) on sub-surface geology, rainfall, evapo-transpiration, percolation zone, extent of saturation, hydraulic gradient, acquifer characteristics, geo-chemistry of water, etc.[2]

9.4.3 In view of this lack of data, the Krishna Tribunal made an Order on the 1st April, 1971, that "the underground water resources of the

1. A.H. Garertson & Others, The law of International Drainage Basins (1967), p. 312.
2. Report of the Irrigation Commission (1972), Vol. I, p. 54.

States concerned will not be regarded as alternative means of satisfying their needs and will not be taken into account for the purpose of equitable apportionment of the waters of the river Krishna"[2]. There was also an agreement among the party States filed before that Tribunal to the same effect.

9.4.4 We are, therefore, of the opinion that in the present case, groundwater estimates of the party States should be excluded altogether in examining the question of apportionment.

Equitable Apportionment is a Weighing and Balancing Process

9.5.1 As pointed out in Chapter VIII of this Report, the concept of equitable apportionment cannot be put in the narrow straight jacket of a precise formula.

One formulation of the principles governing the use of international rivers after stating the principle of equitable apportionment that "competing uses or their benefits must be shared on a just and reasonable basis", continues:[3]

> "In determining what is just and reasonable, account is to be taken of rights arising from agreements, judgements and awards, and from lawfully established beneficial uses, and of such considerations as the potential development of the system, the relative dependence of each riparian upon the waters of the system, and the comparative social and economic gains accruing from the various possible uses of the waters, to each riparian and to the entire community dependent upon the waters."

In the application of the balancing process, the Tribunal must take into account other important factors such as the hydrological, climatic and physical characteristics of the river basin, the volume of available supply, the statewise drainage area and contribution to the supply of water, the respective economic and social needs of the States, the population of the States dependent on water supply and the degree of their dependence, alternative methods of satisfying these needs, the extent of lawfully established uses and reasonable requirements for future use of each State, the relative value of different uses and avoidance of unnecessary waste of water. This list of relevent factors is illustrative and not exhaustive. The weight to be given to any relevant factor in any particular case is a matter of judgement and no hard and fast rule can be laid down. Some guidelines are furnished in Article V of Helsinki Rules.

9.5.2 Madhya Pradesh has applied the factors in Article V of the Helsinki, Rules and worked out the figures of allotment on the basis of its own statistics and of its own conception of the weightage to be given to the respective factors mentioned in that rule. The Statement of Madhya Pradesh is given below:—

TABLE 9.1

(M.P. Statement 2—Statement A-2 & A-3)

(Percentage for Allocation)

S. No.	Description	Narmada Basin	
		Madhya Pradesh	Gujarat
1	2	3	4
	ABSTRACT	Per cent	
Item	(A) Geography including drainage area	92·3	7.7
	(B) Contribution of water	99·5	0.5
	(C) Rainfall	32·6	67·4
	(D) Drought area	97·1	2·9
	(E) Economic & Social needs	91·9	8·1
	(F) Population	81·2	18·8
		494·6	105·4
	Average for A to F	82.4	17·6

Equitable Allocation Accoridng to Madhya Pradesh

	Madhya Pradesh	Gujarat
1. Allocation as per items (A) to (F)	84·4%	17·6%
2. Applying weightage as per items G, H and L of 2.16 : 1 to Madhya Pradesh and Gujarat (Refer Statement A-4).	say $\frac{4·7}{4·7 \times 2·16}$ $\frac{10·15}{}$	$\frac{1}{1 \times 1}$ $\frac{1}{}$
3. Applying the weightage of 2:1 to Madhya Pradesh and Gujarat as per items in MP/612 (Refer statement A-5).	say 91% $\frac{10·15 \times 2}{20·30}$	9% $\frac{1}{1 \times 1}$ $\frac{1}{}$
4. Thus out of 27·25 MAF, Madhya Pradesh should get 95% i.e., about 25·9 MAF and Gujarat 1·35 MAF.	say 95 %	5 %

[2] Report of the Krishna Tribunal, Vol. 1, (1973), p. 230.

[3] Principle II of the Statement adopted by the American Branch of the ILA, in Proceedings & Committee Reports of the American Branch of the International Law Association, 1957, 1958, at 101.

9.5.3 In a similar manner, Gujarat has worked out the allotment on the basis of its own parameters for basin, state and command area statistics :—

TABLE 9.2

Sl. No.	Factor/Parameter	Value of factor/Parameter		Percentage showing relative needs of	
		Gujarat	M.P.	Gujarat	M.P.
1	2	3	4	5	6
1	CCA in lakh acres	71·38	30·00	70·41	29·59
2.	Proportion of area under less retentives oils as percentage of GCA.	43·15	5·72	89·12	10·88
3	Relative water needs on acount of difference in in evapotranspirability by climate.	2·75	1·75	61·12	38·88
4	Proportion of area having rainfall less than 800 mm in June—September period.	84·60 % of GCA	31·20 % of Narmada basin in MP	73·05	26·95
5	Proportion of area identified as drought affected areas.	82·5 % of GCA	27·31 % of Narmada basin in MP	74·84	25·16
6	Population affected by drought in lakhs .	28·53 in GCA	15·70in Narmada basin in MP	64·50	35·50
7	Population depending on agriculture for 'livelihood in lakhs.	15·65 in GCA	20·11 in Narmada basin in MP	43·66	56·34
			Total	476·70	223·30
			Average	68·10	31·90
	Share of water out of 27·25 MAF (according to Gujarat)			18·56	8·69

(See Gujarat Statement 42)

9.5.4 It is manifest that there is great divergence in the basis of computation adopted by Madhya Pradesh and Gujarat. There is also no agreement between these States as regards the actual statistics of the important parameters to be adopted. Apart from the divergence between the two States in the matter of approach, it must be stated that the question of apportionment cannot be treated as if it is a mathematical question. The task of a Tribunal in handling such a question calls for a delicate and sensitive discrimination.

> "That solution of legal problems is by no means simple. Things are not black and white but have many varied shades of colour as the solar spectrum." (Augustus N. Hand in 62 Harvard Law Review 355). As observed by Holmes J. "the life of the law has not been logic; it has been experience; it cannot be dealt with as if it contained only axioms and corollaries of a book of mathematics." (Common Law, page 1).

Principle of Equality of Right

9.5.5 As stated in Chapter VIII of this Report, the corner-stone of "Equitable Utilisation" is the principle of equality of right. In the International Commission of the River Order Case[4] the Permanent Court of International Justice, in the course of determining the applicability of the Treaty of Versailles to certain navigable tributaries of the River Oder, referred to what it termed "international fluvial law in general[5]". Applying this law to the case on hand, the Court stated:

> "But when consideration is given to the manner in which States have regarded the concrete situations arising out of the fact that a single waterway traverses or separates the territory of more than one State, and the possibility of fulfilling the requirements of justice and the consideration of utility which this fact places in relief, it is at once seen that a solution of the problem has been sought not in the idea of a right of passage in favour of upstream States, but in that of a community of interest of riparian States. This community of interest in a navigable river becomes the basis of a common legal right, the essential features of *which are the perfect equality of all riparian States in the user of*

[4] PCIJ Ser. A, No. 23 (1929).
[5] Ibid at page 28.

the whole of the course of the river and the exclusion of any preferential privilege of any one riparian State in relation to the others."[6]

9.5.6 In this passage, the Court expressly stated the principle of perfect equality of all riparian States in the use of the whole of the course of the river and the exclusion of any preferential right of any one riparian State in relation to others. The same principle was enunciated by the Supreme Court of the United States in Connecticut *v.* Massachusetts[7] in which Connecticut sought to enjoin Massachusetts from diverting water from the watershed of the Connecticut River for domestic purposes. Both States recognised the Common Law Doctrine that riparian owners have the right to the undiminished flow of the stream free from contamination. In the course of its judgement, the Supreme Court said:

"For the decision of suits between States, federal, state and international law are considered and applied by this Court as the exigencies of the particular case may require. The determination of the relative rights of contending States in respect of the use of streams flowing through them does not depend upon the same considerations and is not governed by the same rules of law that are applied in such States for the solution of similar questions of private right .....As was shown in Kansas *v.* Colorado,.....such disputes are to be settled on the basis equality of right. But this is not to say that there must be an equal division of the waters of an inter-State stream among the States through which it flows. It means that the principles of right and equity shall be applied having regard to the "equal level or plane on which all the States stand, in point of power and right, under our constitutional system and that, upon the consideration of all the pertinent laws of the contending States and all other relevant facts, this Court will determine what is an equitable apportionment of the use of such waters."

Meaning of the Principle

9.5.7 An eminent authority, Professor Andrassy has suggested that "equality of rights should be construed to mean that riparian States have an equal right to use the waters of such waterway in accordance with their needs." The term "needs" in this context embraces *the economic and social requirements of the riparian States which cause them to be, to a greater or lesser degree, dependent on the waters.* (See Institut de Droit Internationale, Neuvieme Commission, Utilisation des eaux internationale non maritimes Rapport definitif presente par M. Juraj Andrassy—Salsburg Meeting—September 1961).

"II est assez natural de prendre la jroportion des besoins comme base pour la reparlition des benefices provenant de l'utilisation des eaux, Cette base est souvent adoptee, en formules variees, dans la pratique des des Etats, dans la jurisprudence et dans la doctrine, Deja la convention franco—espagnole de 1866 parle des (besoins reels). La Grande Bretagnea reconnu a L' Egypte un droit de priorite pour lesequantites d'eau necessaire a l' irrigation das terrains actuellement cultives et une proportion equitable des quantites supplementaires que les travaux futurs pourraient fournir. Dans les negociations qui se deroulent actuellement entre le Soudan et l'Egypte, les deux parties font des propositions ayant pour base le calcul des besoins respectifs. Le fait que, des deux cotes, il n'y ait pas accord sur les resultats de ces evaluations des besoins, ne nous authorise pas a conclure qu'un juge international ne pourrait pas determiner la juste proportion sur la base des donnees du cas d'espece. En dehors des cas de la jurisprudence nord-americaine adoptant le principe de l'equitable apportionment ils faut rappeler l'arret de la Cour internationale de Justice dans—l'affaire des Pacheries norvegiennes qui a pric en consideration les besoins economiques de la population de la Norvege."

(It is rather natural to take the proportion of the needs as the basis for the sharing of the benefits arising out of the utilisation of the water. This basis is often adopted in varied formulae, in the practical application by the States in jurisprudence and in doctrine. Already the Franco-Spanish Convention of 1866 speaks of "real needs". Great Britain has recongnised the right of priority of Egypt for the quantities of water necessary for irrigation of the land actually under cultivation and an equitable distribution of the suupplementary quantities that the future works could provide. In the negotiations which are taking place between Sudan and Egypt presently, the two parties are making proposals having as the basis, the calculation of the respective needs. The fact that there was no agreement of both sides on the result

[6] Ibid at 27.

[7] 232 U.S. 660 (1931).

of these evaluation of the needs, does not make us to conclude that an international judge could not determine the just distribution on the basis of the data of this kind. Besides the case of North American jurisprudence adopting the principle of equitable distribution, the Decree of the Inter-national Court of Justice may be recalled in the matter of Norwegian fishing ground which took into consideration the economic needs of the Norwegian population.)

9.5.8 Reference should be made to Article 3 of the Salzburg Resolution which states:—

"*Article* 3—If the States are in disagreement over the scope of their rights of utilisation, settlement will take place on the basis of equity, taking particular account of their respective needs, as well as of other pertinent circumstances."[8]

More Important Factors to be Considered

9.6.1 In the setting and background of these legal principles, we are of the opinion that in the present case the more important factors to be considered are:—

(a) the culturable area of the State:

(b) population dependent on the waters of the basin in each State:

(c) the drought areas in each State: and

(d) the economic needs including irrigation requirements of each State.

The following statement shows the Statewise figures of culturable area, net sown area, population dependent on agriculture and drought areas and population affected by drought:—

TABLE 9.3

Gujarat		%	Madhya Pradesh		%
*Culturable area (in lakh acres)	297·31	31·1	629·21	68·9
*Net Sown area (in lakh acres)	232·59	29·48	453·21	70·52
*Population dependent on agriculture (in thousnds)	5509	31·75	12147	68·25
@Drought area (In thousand acres)	17463	72·72	10102	27·28
@Population affected, by drought in thousands)	5480	72·16	30·70	21·84

9.6.2 The argument was stressed by Madhya Pradesh that the drainage area and contribution of water by each basin State are important factors and should be given *equal weight* along with the other factors mentioned in the Helsinki Rules. Madhya Pradesh has pointed out that the drainage area of Gujarat is 4410 sq. miles (11.72%) and of Madhya Pradesh 33.150 sq. miles (88.28%) and the contribution of Gujarat at 75% dependable flow is 2.68 MAF and that of Madhya Pradesh 26.40 MAF and at 90% dependable flow, the contribution of Gujarat is 1.70 MAF and of Madhya Pradesh 19.25 MAF. We are, however, unable to accept the argument of Madhya Pradesh on this aspect of the case. As we have indicated in Chapter VII, no State has a proprietary right in any particular volume of water of an inter-State river on the basis of its contribution to the available flow or on the basis of its drainage area. It is well-established in law that the waters of a natural stream or other natural body of water are not susceptible of absolute ownership as specific intangible property. On the contrary, flowing water is *publici juris* or *res communis* and not subject to individual ownership.

9.6.3. Historically speaking, water law has developed into three distinct types: (a) limiting the right of water use to the owners of adjacent land; (b) giving this right to the first user; and (c) placing the disposition of water in the hands of the Government or an administrative tribunal or authority.[9] These three types of law are based on different concepts of the legal nature of water. The first, or riparian rights doctrine, assimilated water to a greater or lesser degree to the land through which it flows; the second, or prior appropriation doctrine, considers water generally as *res nullius* until captured and made use of; and the third, or administrative apportionment doctrine, regards water as *res communis* not subject to individual ownership. According to the riparian doctrine, stream water may be used only on riparian land and riparian land is defined[10] as embracing only the land within the watershed. The Riparian Rights Doctrine hence tends to favour the retention of water for use within the river basin itself. But the riparian doctrine is not the basis of the administrative apportionment doctrine as contemplated under

[8]Institut de Droit International—Salzburg Meeing, September, 1961

*See MP/574.

@Thefigures are taken from the Irrigtion CommissionReport Volume I, p. 166, 1972.

[9]Teclaf—Private Water Right in France and the Eastern United States (1962) Americal Journal of Interntional Law pages 560 to 573.

10 Teclaff—The River vasin & Beyond, Changing Concepts on U.S. Water Resources & Planning (1968) Annulus Juris Aquarum Interntional Association of Water Law).

the Inter-State Water Disputes Act, 1956. The doctrine of administrative apportionment is, on the contrary, based on the theory that the natural stream of water is to be regarded as *res communis*, not subject to individual ownership.

Effect of Entry 17 of List II is to give the States Legislative Jurisdiction and not Proprietary Right

9.6.4 As we have pointed out in our decision dated 23rd February, 1972, the effect of Entry 17 of List II of the Constitution is only to give legislative jurisdiction and not proprietary right to the States concerned in regard to the waters of the inter-State rivers. We had emphasised that there is a broad distinction between proprietary right and legislative jurisdiction and the fact that such jurisdiction in respect of a particular subject matter is conferred on the state legislature affords no evidence that any proprietary rights with respect to it is transferred to the States concerned. To put it differently, there is no presumption that because the legislative jurisdiction in respect of entry 17 of List II is vested in the State legislature, the proprietary right in respect of the subject matter of that entry is also transferred to it. The principle is borne out by the decision of the Judicial Committee in ATTORNEY GENERAL FOR THE DOMINION OF CANADA v. ATTORNEY GENERAL FOR THE PROVINCES OF ONTARIO, QUEBEC AND NOVO SCOTIA[11], in which the Judicial Committee pointed out that Section 91 of the British North America Act, 1876, did not convey to the Dominion any proprietary rights with regard to fisheries and fishing rights although the legislative jurisdiction conferred by that Section enabled it to affect those rights to an unlimited extent short of transferring them to others. In other words, what is vested in the State Legislature under entry 17 of List II of our Constitution is not *dominium* but *imperium* that is to say, a power of sovereign regulation and control and not a proprietary right.

9.6.5 The watershed limitation cannot, therefore be imported into the question of administrative apportionment and in any event not much weight can be attached in the circumstances of the present case to the factors of drainage area and contribution of water. As an illustrative case, in the 1959 Egyptian Sudanese Treaty, the relevant factors emphasised were: the arable areas easily irrigated in each country, the population of the States, the existing uses and in a less degree the financial contribution of each State to the development projects. The contribution of Sudan and Egypt to the available river flow was not the crucial factor in the apportionment of the Nile waters. Similarly in the North Platte river litigation (Nebraska *v.* Wyoming)[12], Nebraska was allotted about 75% of the river flow though it contributed only 40% of the river flow. In the same case, Wyoming was allotted 25% of the waters though she contributed 57% of the flow.

9.6.6 It was also stressed on behalf of both Madhya Pradesh and Maharashtra that the question of equitable apportionment must be related exclusively to the area and people within the river basin and the extension of irrigation to adojoining, extra-basin areas cannot be justified on grounds of their dependence on use of the water or the easy commandability of such areas by the lower riparian State. In other words, the argument was that the drainage basin has become a "legal entity" and the question of equitable apportionment must be determined on parameters exclusively appurtenant to the river basin. Reference was made in this context to the first Agreed Principle in Resolution 1 of the New York Conference of the International Law Association (1959) which states:—

> The legal nature of the river basin has come to be increasingly recognised; the more so since the 1958 Conference of the International Law Association in New York. That "a system of rivers and lakes in a drainage basin should be treated as an integrated whole (and not piecemeal)" was the very first agreed principle in Resolution 1 of the New York Conference.

9.6.7 Reference was also made to Articles II and III of the Helsinki Rules (1966), which state:—

> "*Article II*—An international drainage basin is a geographical area extending over two or

11 1898 Appeal Cases 700.

12 325 U.S. 589 (592).

more State determined by the watershed limits of the system of waters, including surface and underground waters, flowing into a common terminus."

"*Article III*—A 'Basin State' is a State the territory of which includes a portion of an international drainage basin."

9.6.8. In our opinion, the argument of Madhya Pradesh and Maharashtra is not warranted. In the first place, the principle enunciated in 1958 New York Resolution was not treated as a legal command but as an exhortation by Professor Arnold W. Enauth the then Chairman of the Committee:[13]

'The Principle used the word "should". It does not use the words "shall" or "must". Thus it is not a rigid command, but rather a serious unanimous legal exhortation.....the idea of the river basin as an "integrated whole" is both proper and best suited to express what we do believe the *lex lata* to be."

9.6.9 But the principle, even as a legal exhortation, was not discussed again either in the plenary session at the Biennial Conference of the International Law Association or by the Association's Committee. It was not even mentioned in the Draft Article I and II of the Helsinki Rules dealing with the "introductory matters" and "equitable utilisation" respectively, which were placed before the Committee by its Chairman at its meeting in Harvard in September 1965 and were then approved in the final form. It is clear that Articles II and III of the Helsinki Rules do not purport either in their language or context to assert any principle of law. On the contrary, the express language of Article V clauses (e), (f), (g) and (k) shows that in determining what is the State's reasonable and equitable share in the beneficial use of the waters of the international river basin, the needs of the State as a whole are to be taken into account and not of merely the basin portion thereof Article V clearly does not contemplate narrow geographical limitations on States in apportioning the waters of an international river. The statement of the Committee's Chairman in the Working Paper of 1959, the absence of discussion of this theory in the Committee and Plenary Sessions and specially the provisions of Article V of Helsinki Rules all lead to the conclusion that the International Law Association retreated from its 1958 position and now regards the "integrated whole" approach as something less than a legal imperative.

9.6.10 On the contrary the need of diversion of water to another watershed be a relevant factor in any question of equitable apportionment.

The Inter-State Water Dispuutes Act, 1956:

9.7.1 The crucial question for determination under Section 3 of the Inter-State Water Disputes Act, 1956, is whether the interest of the State or of any of its inhabitants in the waters of the Inter-State river and river valley is prejuricially affected by the executive action of another State. The State is one integral unit and its interests include the well-being of its inhabitants within its territory including areas outside the river basin. Therefore, under the Inter-State Water Disputes Act. 1956, the relevant consideration is the interest of the State as a whole and all its inhabitants and not merely the interest of the basin areas of the State. There may be a situation in which there are arid or drought areas of a State, which though technically lying outside a basin, require for development waters from and inside the basin. It may also be that the inhabitants of such arid or drought areas of the State have no alternative source of water supply. Such arid areas may lie within the boundary of the complaining State under Section 3 of the Inter-State Water Disputes Act. It is manifest that in determining what is an equitable share of such a State in the waters of the inter-State river, a most relevant factor is the use that can be made of it by such State as a whole and so diversion to arid areas from the river system ought to be considered and the watershed line cannot be treated as a strict and impassable legal barrier.

9.7.2 It is necessary in this context to note that a proposal was made by Dr. Gamal M. Badr (Algeria) at the 52nd Conference of the International Law Association at Helsinki that diversions of waters beyond the geographical limits of the drainage basin was illegal. He proposed that draft Article IV of the Helsinki Rules should be amended to read: "Each basin State is entitled to a reasonable and equitable share in the beneficial

13 47 Canadian Bar Review (1969) p. 67.

uses within the part of the basin lying in its territory, of the waters of the international river basin." But Dr. J. L. Macallum (Canada) and Dr. Zarbrugg (Switzerland) and other participants of the Conference did not agree with Dr. Badr and the Conference finally approved of Article IV which reads: "Each basin State is entitled, within its territory, to a reasonable and equitable share in the beneficial uses of the waters of an international drainage basin."[14]

Lake Lanoux Case (1957)

9.7.3 The legality of utilising the waters of an inter-State river outside the limits of its basin is supported by adjudications of international and inter-State water disputes. In the Lake Lanoux Case[15]. France proposed to divert water from the Carol River for use in another river basin and then to return it, or an equal amount of water, to the Carol River before that river entered Spain. Spain strongly objected to the Project, arguing that the diversion would modify the "natural character" of the hydrographic basin of Lake Lanoux even though the water would be restored to it. The Arbitral Tribunal rejected this argument, and held that a diversion followed by restitution such as France proposed was lawful in the circumstances. At page 124 of the report, the Tribunal States:

> "The prohibition of compensation between the two basins, in spite of equivalence between the water diverted and the water restored, unless the withdrawal of water is agreed to by the other Party, would lead to the prevention in a general way of a withdrawal from a watercourse belonging to River Basin A for the benefit of River Basin B, even if this withdrawal is compensated for by a strictly equivalent restitution effected from a watercourse of River B for the benefit of River Basin A. The Tribunal does not overlook the reality, from the point of view of physical geography, of each river basin, which constitutes, as the Spanish Memorial .....maintains, "a unit". But this observation does not authorise the absolute consequences that the Spanish argument would draw from it. The unity of a basin is sanctioned at the juridical level only to the extent that it corresponds to human realities".
>
> "The state of modern technology leads to more and more frequent justifications of the fact that waters used for the production of electric energy should not be returned to their natural course. Water is taken higher and higher up and it is carried even farther, and in so doing it is sometimes diverted to another river basin, in the same State or in another country within the same federation, or even in a third State."

9.7.4 It is evident that the Arbitral Tribunal was of the firm opinion that the use of waters is not confined by law to the geographical limits of its drainage basin: and that a geographical unity does not automatically mean a legal unity because the law is determined not by geography but by "human realities". The Tribunal found support for this view in several decisions of the United States Supreme Court. In Wyoming *v.* Colorado[16] Wyoming sought to prevent two Colorado Corporations from diverting water from the Laramie River which rose in Colorado and flowed into Wyoming and alleged that the diversion would have taken a substantial part of the waters of that river for use in another drainage basin in Colorado and thus would have damaged prior users downstream in Wyoming. The Supreme Court dealt with the argument as follows:—

> "The objection of Wyoming to the proposed diversion on the ground that it is to another watershed, from which she can receive no benefit, is also untenable. The fact that the diversion is to such a watershed.....does not in itself constitute a ground for condemning it. In neither State does the right of appropriation depend on the place of use being within the same watershed. Diversions from one watershed to another are commonly made in both States and the practice is recognised by the decisions of their courts."

9.7.5 In subsequent litigation between these two States about the same river, the Supreme

14 The International Law Association Report of the 52nd Conference Helsinki,1966, pp. 448, 449, 461, 476 and 486.
15 Lake Lanoux Case (France-Spain) Award, of Nov. 16, 1957 (1957) 24 I.L.R. 101; (1957) 53 Am. J. Int'l. L. 156.
16 (1922) 259 U.S. 419

Court stressed the irrelevancy of geography in these disputes saying:[17]

> "We perceive no reason for thinking that it is in any wise material to Wyoming and her water claimants whether the water in question is diverted and conveyed to the place of use through the Sky-line ditch, the Wilson Supply ditch or the ditches of the Laramie-Poudre Tunnel Project. All are trans-mountain ditches and deliver the water in the Cache La Poudre Valley which is in another watershed." This conclusion was confirmed later by the Supreme Court in Nebraska *v.* Wyoming[18] in which the decree issued sanctioned not only the export of water out of the drainage basin but also the importation of water into it. This view has been consistently maintained by the United States Supreme Courts in several other cases.

9.7.6 The legal position is best summed up in the language of Mr. Justice Holmes,[19] speaking for the Court in New Jersey *v.* New York.:

> "The removal of water to a different watershed obviously must be allowed at times unless States are to be deprived of the most beneficial use on formal grounds."

Concept of Area of Origin Argued by Maharashtra and Madhya Pradesh

9.8.1 It was submitted in the alternative on behalf of Maharashtra that even if transfer of Narmada waters outside the basin limits is permissible, the legal principle applicable is that the needs of the basin, whether present or future, must be satisfied first before any water as allowed to be taken outside the basin. In support of its argument, Shri Nariman referred to the Water Resources Planning Act of 1965 which prohibits the Water Resources Council and Basin Commissions established thereunder from studying plans for water transfer out of the river basins. It was said that the Colorado River Basin Project Act of 1968 (Maharashtra Extract 23) provided in one of its Sections that the Secretary of the Interior must make provisions for adequate and equitable protection of the interests of the States and areas of origin, that he must ensure water supplies adequate to satisfy their ultimate requirements, and that these requirements, present or future, have priority or right in perpetuity as against users in the areas of import, unless otherwise provided by any inter-State agreement. Shri Nariman pointed out that protective measures have also been enacted in USA for intra-State situations. For instance, the California State has both a country-of-origin statute and watershed protection statute. Section 10505 of the California Water Code states —

> "No priority under this part shall be released nor assignment made of any application that will in the judgement of the Board deprive the country in which the water covered by the application originates of any water necessary for the development of the country."

Again the Taxas Legislature passed a statute in 1965 which requires that all reasonable needs for a period of 50 years be estimated before plans are made for out of basin export of surplus water. Section 8280-9(3b) (Supp. 1967) of Tex. Rev. Civ. Stat. Ann. states—

> ".....The Board shall not prepare or formulate any plan which contemplates or results in the removal from the basin of origin or any surface water to some other river basin or area outside of suuch basin of origin if the water supply involved in such plan or project will be required to supply the reasonably foreseeable future water requirements for the next ensuing fifty-year period within the river basin of origin, except on a temporary interim basis. The Board shall be governed in its preparation of said plan by a regard for the public interest of the entire state, and shall direct its effort to plan for the orderly development and management of water resources in order that sufficient water will be available at reasonable cost to further the economic development of the entire state."

9.8.2 The right of the State to retain waters for intra-State streams within its borders was also sustained by the U.S. Supreme Court in 1908 in Hudson County water Company *v.* McCarter, concerning the Passaic River in New Jersey[21] but

17 Wyoming *v.* Colorado (1936, 298 U.S. 573 at p. 584).

18 (1945) 325, U.S. 589 at pp. 665 and 671.

19 283 U.S. 336 In Wisconsin *v.* Illincis (1929) 278 U.S. 367 and (1965), 352 U.S. 945,at p. 983, the Court had to regulate the volume of water taken by the Chicago Diversion Canal from lake Michigan, which is part of the Great Lakes, a vast inernational drainge basin shared by Canada and the United States; it restrained only that part of the diverion in excess of the limits authorised by Congress, without any suggestion that a diversion from an international drainage basin is contrary to inernatio:al law.

20 42 U.S.C. Sec. 1962-1 : Suppl. II, 1965-66.

21 209 U.S. 349 at page 356.

how much of this right of the States remains since the later Supreme Court decision in Arizona *v.* California[22] is, open to doubt. The Supreme Court held in the latter case that the Congress had ultimate authority to allocate that portion of the water of the Colorado River Basin among the lower basin states through which the river flows. In addition the Supreme Court held that within each State the Congress gave to the Secretary of the Interior authority to distribute water to individual users according to principles of allocation he might determine *and that he is not bound to follow the State rules governing distribution among competitive users.* In Arizona *v.* California, 373 U.S. 546, the Supreme Court actually construed and held constitutional the Boulder Canyon Project Act* (under which the Hoover Dam was built) to authorise the Secretary of the Interior to impound 30 million acre-feet of water and deliver it pursuant to contract on Federal terms irrespective of *State law.* Among other contracts upheld by the decision was that between the Secretary and the Metropolitan Water District of Southern California (which embraces the City of Los Angeles) providing for an inter-basin transfer of Colorado river water.

The Doctrine of Area of Origin or of Basin Concept is not Applicable to Indian Law

9.9.1 We see no warrant for accepting the argument adduced by Shri Nariman on behalf of Maharashtra. The legal position in India with regard to inter-State and intra-State rivers is different and there is no justification for importing into our law the doctrine of area of origin expressly laid down in the American statutes. Shri Nariman referred in this connection to the River Boards Act, 1956 (Act 49 of 1956) but there is nothing in the language or context of the Act to support his contention that the American doctrine of area of origin applies to Indian Law. On the contrary, legislation in India from 1873 onwards shows that the right to use and control waters for irrigation had been vested in Central Government and after the commencement of the Government of India Act 1935 in the Provincial Governments and after the Constitution, in the State Governments. The Preamble of Northern India Canal and Drainage Act, 1873 (8 of 1873) states:

> "Whereas, throughout the territories to which this Act extends, the State Government is entitled to use and control for public purposes the water of all rivers and streams flowing in natural channels and of all lakes and other natural collections of still water; and whereas it is expedient to amend the law relating to irrigation, navigation and drainage in the said territories."

Section 5 of the Act provides:—

> "Whenever it appears expedient to the State Government, that the water of any river or stream flowing in a natural channel, or of any lake or other natural collection of still water, should be applied or used by (the State Government) for the purpose of any existing or projected canal or drainage work, the State Government may by notification in the Official Gazette, declare that the said water will be so applied or used after a day to be named in the said notification not being earlier than three months from the date thereof."

By the Adaptation of Indian Laws Order, 1937, the words "Provincial Government" were substituted for the words "the Government". Again by the Adaptation of Laws Order, 1950, the words "State Government" were substituted for the words "Provincial Government". Section 5 of the Bombay Irrigation Act, 1879, is similar in effect:—

> "Notification when water supply to be applied for purposes of Canal—Whenever it appears expedient to (the State Government) that the water of any river or stream flowing in a natural channel, or of any lake or any other natural collection of still water, should be applied or used by the (State Government) for the purpose of any existing or projected canal, the (State Government) may, by notification in the Official Gazette, declare that the said water will be so applied or used after a day to be named in the said notification, not being earlier than three months from the date thereof."

9.9.2 This Act applies to Gujarat after the reorganisation of the State of Bombay, Madhya Pradesh Irrigation Act, 1931 (M.P. Act 14 of 1931) also contains a similar provision. Section 2 of the Indian Easements Act, 1882, expressly saves from the operation of the Act any right of the Government to regulate the collection, retention and distribution of waters of rivers and streams flowing in natural channels. Section 2(a) of the Indian Easements Act, 1882 states:

> "2. Nothing herein contained shall be deemed to affect any law not hereby expressly repealed or to derogate from—
>
> (a) any right of the Government to regulate the collection, retention and distribu-

22 373 U.S. 546.

*Act of December 21, 1928, P.L. 642 70th Congress, 45 Stat, 1057, as amended, 43 USCA 617.

> tion of the water of rivers and streams flowing in natural channels and of natural lakes and ponds, or of the water flowing, collected, retained or distributed in or by any channel or other work constructed at the public expense for irrigation."

By the Adaptation of Laws Order, 1950, the word "Government" was substituted for the word "Crown" in this sub-section. In Secretary of State *v* Nageswara[22] it was pointed out by Varadachari J. that the right of the Government to control supply and distribution of irrigation waters was not merely a proprietary right *but was a sovereign right which the State possessed to regulate the supply of water in public stream so as to utilise it to the best advantage and in the best interests of the people.* We accordingly reject the argument of Shri Nariman on this aspect of the case.

9.9.3 It is manifest that the diversion of water of an inter-State river outside the river basin is legal and the need for diversion of water to another watershed may, therefore, be a relevant factor on the question of equitable apportionment in the circumstances of a particular case. But the question is what is the importance to be attached to this factor. Though out-of-basin diversions may be relevant in determining a State's equitable share the weight to be given to this factor depends upon the circumstances of each particular case. Each river basin has its own peculiar problems and there is no set of rigid rules that may be applied to all river systems alike in all circumstances.

9.9.4 Adopting this line of reasoning, it follows that the arguments of Madhya Pradesh and Maharashtra that the question of equitable apportionment in the present case must, as a matter of law, be determined by reference solely to the area of origin or solely with reference to the area and people within the river basin cannot be accepted as correct.

9.9.5 But it does not mean that the claim of Gujarat in the present case to irrigate the entire culturable command area of 71.38 lakh acres for the Navagam Canal FSL 300 is reasonable. In our opinion, the question of diversion of water of an inter-State river to areas out side the basin is not a question of law but is a question of fact to be determined in the circumstances of each particular case. It is, therefore, necessary for us to closely examine the claim of Gujarat from a factual aspect. Statement G-630A-1 shows the figures of GCA and CCA, and the water requirement of Gujarat for the various zones, Little Rann of Kutch, Mahi Command, Banni and Great Rann of Kutch.

(STATEMENT G-630-A-I)

Comparative Statement Showing Figures of Gross Commanded Area (GCA) Culturable Command ed Area (CCA) and Water Requirement Before Khosla Committee and before this Honourable Tribunal

S. No.	Particulars	Before Khosla Committee			Before this Honourable Tribunal					
		GCA in lakh acres	CCA in lakh acres	Water requirement in MAF	As per pleadings & project report		Water requirement in MAF	As per Exhibits G-425-& G-626		
					GCA in lakh acres	CCA in lakh acres	As per project Report	GCA in lakh acres	CCA in lakh acres	Water Requirements in MAF
1	2	3	4	4A	5	6	6A	7	8	
1	Zones I to XI . . .	78·64	50·51	8·33	82·46	54·05	12.83*	81·36	54·02	
2	Little Rann of Kutch	9·00	6.00		9·00	2·00		9·00	2·00	

22 A.I.R. 1936—Madras, p. 923.

*Figure in Column 6A against Sr. Nos. 4, 5 and 6 includes water requirement of little Rann of Kutch.

1	2	3	4	4A	5	6	6A	7	8	8A
3	Mahi Command .	N.A.	6·57	1·58	7·80	7·20	1·78	8.90	6·33	1·56
4	Banni . . .	N.A.	9.00	1·08	6·40	2·28	6·36	6·40	2.28	1·32
5	Great Rann of Kutch (Northern Border)	N.A.			13·20	4·50		13·20	4·50	5·04
6	Great Rann of Kutch (Eastern) fringe)	Not-considered	Non-considered	..	7.40	2.25	..	7·40	2.25	
	Total . .	N.A.	72·08	10·99	126·26	72·28	20·97	126·26	71·38	20·73

9.9.6 In the first place, we see no reason why the area under Mahi Command (6.33 lakh acres) should be included under Narmada Command. This area is already irrigated or intended to be irrigated by Mahi waters under the sanctioned Mahi Right Bank Canal Project, Stage I(Ex G-342 (IV)(i)). Stage I has already been completed by Gujarat which comprises a diversion weir at Wanakbori and Mahi Right Bank Canal Works. Gujarat made no proposal for including this area in Narmada Command originally before the Khosla Committee but Dr. Kholsa, on his own initiative, suggested that Mahi area should be brought under the Narmada Command so that 1.58 MAF of water may be released for the use of the border areas of Rajasthan. As regards the Great and Little Rann of Kutch and Banni area also, we see no justification for Gujarat's claim to irrigate these areas with Narmada water. Gujarat has claimed 6.36 MAF of water for this area on the basis of a CCA of 11.03 lakh acres and delta of 5.80 feet (per acre CCA). Gujarat made no claim for the Great Rann of Kutch and Banni area before the Khosla Committee. So far as the Little Rann is concerned, the Dutch Team was of the opinion that desalination was great problem and the soil studies made by Gujarat did not furnish sufficient basis to show that desalination was possible (see Ex G-349). In any case, these areas are admittedly barren and sparsely populated. The soil conditions in this area are characterised by very high salinity, a very low permeability, a vertical permeability of nearly nil, a high ground water table and an impervious layer near the ground water surface. The whole area is also subject to high evaporation and low rainfall. There is no adequate evidence produced by Gujarat that these areas are capable of being reclaimed at a reasonable cost. Neither the pot experiments conducted at the Soil Research Institute. Baroda nor the experiments conducted at Umrah on 36 acres of land could be extrapolated to this area. The pilot plot in Banni area on lights soils has no doubt shown the possibility of growing crops but Gujarat has not investigated or furnished data from which design parameters for effective reclaimation of the area could be derived. Even if it is assumed that the area could be reclaimed and developed with the quantity of water indicated by Gujarat, the project would be highly uneconomic. The delta at canal head would be 3.63 feet as stated by Gujarat. As we have already stated the accepted delta for Zones I to XI of Gujarat would be 2.57 feet and the weighted delta for all the zones of Madhya Pradesh would be 2.36 feet. We, therefore, accept the argument of Maharashtra and Madhya Pradesh that the claim of Gujarat for 6.36 MAF of water for irrigating 11 lakh acres in Ranns and Banni should be rejected. Our Assessor Dr. Ambika Singh has expressed the same view in his report. Exhibit C-5. For these reasons, we are of the opinion that the Mahi Command area, the Little and Great Ranns of Kutch and Banni area should be excluded from the computation of the equitable share of Gujarat.

As regards Zones I to XI, we have estimated in Chapter VI that Gujarat requires 10.927 MAF of Narmada waters for irrigation. So far as Madhya Pradesh is concerned, our estimate of water requirement as explained in Chapter VI is 17.891 MAF. We have already held in Chapter VII that the contribution of *en-route* rivers of Navagam Canal Command in Gujarat should be computed to be 0.282 MAF. Adding the requirement for domestic and industrial uses for the respective States, the total water requirement of Gujarat would be 11.694 MAF and the total water requirement of Madhya Pradesh would be 19.410 MAF. The combined total water requirement of Madhya Pradesh and Gujarat would, therefore, be 31.1 MAF: but the utilisable flow of water which is available for apportionment is 27.25 MAF.

9.9.7 If the water needs of Gujarat and Madhya Pradesh were the *only* factor for consideration, the

apportionment of Narmada waters should be in the ratio of 11.694: 19.410, i.e., 27.5 per cent to Gujarat and 62.41 per cent to Madhya Pradesh. As we have already emphasised, the most important factor is the water needs of each basin State. But in deciding the question of equitable apportionment, it is necessary to take into account other important factors mentioned in paragraph 9.6.1 and other paragraphs of this Chapter. It is also necessary to take into account the circumstance that the drainage area of Gujarat is 180 square miles (0.53%) and of Madhya Pradesh 33,150 square miles (97.59%) and that the contribution of Gujarat at 75 per cent dependable flow is 0.07 MAF (0.26%) and of Madhya Pradesh 26.647 MAF (98.75%)*. We have already rejected the argument of Madhya Pradesh that the drainage area and contribution of water by each basin State should be given *equal* weight along with other factors mentioned in Helsinki Rules. But, in our opinion, *some* weight should be given to the factors of drainage area and contribution of water by each basin State in the circumstances of this particular case. Having given anxious consideration to all the relevant factors, our conclusion is that out of the utilisable quantity of 27.25 MAF of Narmada waters at 75 per cent dependability (apportionable between these two States), Gujarat would be entitled to an equitable share of 9 MAF (33%) and Madhya Pradesh to an equitable share of 18.25 MAF (67%).

9.9.8 Issue 7(b) is answered accordingly.

Directions With Regard to Excess Waters and Sharing of Distress among the four party States

9.10.1 Issues 9 and 9A deal with the question of the equitable apportionment of excess waters and sharing of distress among the concerned States in the event of the waters of the Narmada falling short of the allocated quantum.

9.10.2 Issues 9 and 9A read as follows:—

9. What directions, if any, are required to be given for the equitable apportionment of the waters including excess waters of the Narmada river and of its basin?

9A. What directions, if any, are required to be given regarding the sharing of distress among the concerned States in the event of the waters of the Narmada falling short of the allocated quantum?

9.10.3 At page 31 of Written Submission 5, Gujarat states that surplus supplies would be needed partly to meet the carryover provided in the storage capacity of the various projects with a view to meet the planned utilisation of waters. As regards lean years, Gujarat states that distress should be shared "on the basis of the extent of the then existing irrigation needs of each State." In CMP 109 of 1977, Madhya Pradesh has submitted that the flows in excess years and in lean years whether for Gujarat, Madhya Pradesh, Maharashtra or Rajasthan should be shared in proportion to the waters allotted by the Tribunal to the respective States out of the utilisable quantum of 28 MAF. The case of Maharashtra is that the share of 0.5 MAF allotted to Rajasthan should not fluctuate in case of excess or scarcity (CMP 128 of 1977).

9.10.4 In CMP 119 of 1977, Rejasthan has also put forward additional claim that in case of excess, it should be allocated water to the extent of 2,500 cusecs out of the excess flows as and when available at Navagam.

9.10.5 The claim of Rajasthan was opposed by Madhya Pradesh and Maharashtra on the ground that there is no such provision in the Agreement of Chief Ministers dated 12th July, 1974, and Rajasthan being a non-riparian State cannot claim any Narmada waters in excess of the right granted to it by the Chief Minister's Agreement of 12th July, 1974. In CMP 132 of 1977, Gujarat, however, supports the claim of Rajasthan.

9.10.6 Having heard the various States in this matter, we are of the opinion that the flows of Narmada both in excess years and in years of scarcity should be shared between Gujarat and Madhya Pradesh in proportion to the allocated quantum of waters granted to each of them by our Order. In other words, the equitable apportionment of the excess waters and also sharing of distress would be in the proportion of 18.25:9 respectively for Madhya Pradesh and Gujarat.

Claim of Rajasthan for allocation of 2500 cusecs of excess flow of Narmada Waters

9.10.7 With regard to the claim of Rajasthan (CMP 119 of 1977) for allocation to the extent of

*In Ex C-4 (agreed to by the party States) the contribution of Gujarat and Madhya Pradesh for entire basin @ 75% dependability is 2.187 MAF and 26.647 MAF respectively. According to the agreed series Ex. C-3, the 75% dependable flow at Navagam is 27.01 MAF out of which contribution by Madhya Pradesh is 26·647 MAF and by Maharashtra 0.266 MAF and the balance of 0·07 MAF being contributed by Gujarat.

2500 cusecs out of the excess flow, we are of the opinion that such a claim cannot be entertained. As we have pointed out in our Order dated 8th October, 1974, the right of Rajasthan to share Narmada waters is based on the Agreement between the parties dated 12th July, 1974. Otherwise, Rajasthan, being a non-riparian State, is not entitled as a matter of law to any share in the waters of the inter-State river Narmada. The claim of Rajasthan must, therefore, be based on the Agreement of the Chief Ministers dated 12th July, 1974. Having closely examined the various clauses of that agreement we consider that as a matter of construction there is nothing in that agreement to suggest either expressly or by necessary implication that Rajasthan was granted any right to the waters to the extent of 2,500 cusecs out of the excess flows. We accordingly reject the claim of Rajasthan on this aspect of the case.

So far as the share of 0.5 MAF and 0.25 MAF respectively to Rajasthan and Maharashtra granted in the agreement dated 12th July, 1974, are concerned, we consider that on a proper interpretation of the agreement, the allocations should fluctuate in the case of excess or scarcity in the proportion of 0.5: 28 and 0.25: 28. In other words, equitable apportionment of excess waters and sharing of distress in the case of Rajasthan and Maharashtra also should be in the proportion of 1/56 and 1/112 respectively of such excess or shortage.

9.10.8 In conclusion, our directions on Issues 9 and 9A are as follows:—

(1) The utilizable flow of Narmada in excess of the 28 MAF of utilizable flow in any water year, i.e. from 1st of July to 30th of June of next calendar year is apportioned in the following ratios of allocation, i.e. 73 for Madhya Pradesh. 36 for Gujarat, 1 for Maharashtra and 2 for Rajasthan;

(2) In the event of the available utilizable waters for allocation in any water year from 1st of July to 30th June of the next calendar year falling short of 28 MAF, the shortage should be shared between the various States in the ratio of 73 for Madhya Pradesh, 36 for Gujarat. 1 for Maharashtra and 2 for Rajasthan;

(3) The available utilisable waters in a water year will include the waters carried over from the previous water year as assessed on the 1st of July on the basis of stored waters available on that date;

(4) The available utilisable waters on any date will be inclusive of return flows and exclusive of losses due to evaporation of the various reservoirs;

(5) It may be mentioned that in many years there will be surplus water in the filling period after meeting the storage requirements and withdrawals during the period. This will flow down to sea. Only a portion of it will be utilizable for generating power at Sardar Sarovar river-bed power-house, and the rest will go waste. It is desirable that water, which would go waste without even generating power at the last river-bed power-house, should be allowed to be utilised by the party States to the extent they can.

Gujarat is, therefore, directed that whenever water starts going waste to sea, without generating power, Gujarat shall inform the Narmada Control Authority proposed in Chapter XVIII, as may be set up under 'Machinery', with copies to designated representatives of all the concerned States; and Gujarat may also inform them when such flow cease. During the period of such flows, the party States may utilise them as they like, and such utilisation by the party States will not be counted towards allotment of supplies to them, but use of such water will not establish any presumptive right.

9.10.9. Issues 9 and 9A are answered accordingly.

Period of operation of the order of apportionment

9.11.1 It is necessary at this stage to consider the important question whether our decision regarding the apportionment of Narmada waters between the party States should be of unlimited duration or whether the duration of the decision should be limited so as to make it amenable to review only after a specified period. This is the subject matter of Issue 15 which states:—

"Should the apportionment of the water of Narmada be made amongst the concerned States so as to be binding on them for all times or whether any and if so what period should be fixed for which such apportionment shall remain binding."

It is evident that we are deciding the issue of equitable apportionment in this case on the basis of material placed by the party States, i.e. data regarding dependable flow and the return flow and also the present needs and future needs as envisaged by the party States and the manner in which these needs can be satisfied at present or in the near future. Many water resource development projects are designed to be effective for 50 to 100 years or longer, it being generally assumed that the available hydrological and meteorological records permits prediction of floods, droughts and water supplies for the coming 50—100 years without taking into account any climatic trends or fluctuations[23]. But long-term climatic trends and fluctuations are not predictable at present. Again, changes in vegetation precipitation, evaporation control, effects of urbanisation etc., have their own effect on the river flow. Even the course of the river and the pattern of flows may fluctuate. The pattern of population growth, engineering, economic, irrigation and other conditions constantly change and with changing conditions, new demands for water may arise. In determining the equitable share of the States, all the factors which create equities in favour of one State or the other have to be weighed as at the date when the current controversy is mooted. But a water allocation may become inequitable when the circumstances, conditions and water needs on which it is based are substantially altered.[24]

9.11.2 For these reasons, we consider that a review and modification of our decision regarding allocation may become necessary after a lapse of a reasonable period of time.

9.11.3 On behalf of Madhya Pradesh, it was contended that the allocation made by the Tribunal under Section 5 of the Inter-State Water Disputes Act, 1956, should be of unlimited duration and the Tribunal has no jurisdiction to say that the period of operation of the award should be limited so as to make it amenable to review after a specific period. Reference was made to Section 19(3) of the Industrial Disputes Act (Act 14), 1947, which provides that an award shall remain in operation for a period of one year from the date it becomes enforceable. It was pointed out that no such provision was made in the inter-State Water Disputes Act, 1956. In our opinion, there is no warrant for accepting the submission of Madhya Pradesh. There is no analogy to be drawn between a dispute between the States regarding inter-State rivers and a dispute between the employer and the employee regarding industrial conditions. The history of the legislation makes it manifest that the Industrial Disputes Act was introduced as an important step in achieving social and economic justice. That Act seeks to ameliorate the service conditions of workers and to provide a machinery for resolving the conflicts and encourage their cooperative effort in the service of the community. The purpose of the Inter-State Water Disputes Act, 1956 on the other hand, is to provide for adjudication of disputes relating to waters of inter-State rivers and river valleys. The objects of the two Acts are manifestly different and the provisions of the 1956 Act must be construed *subjectae materies*.

9.11.4 It is not hence possible to accept the argument that in the absence of a provision in the Inter-State Water Disputes Act similar to Section 19(3) of the Industrial Disputes Act, the Tribunal has no jurisdiction to limit the period of operation of the award to a reasonable extent. Under Section 4 of the Inter-State Water Disputes Act, the Central Government is empowered to constitute the Tribunal for adjudication of the water dispute. Section 5(1) states that the Central Government can refer the water dispute and any matter appearing to be connected with, or relevant to, the water dispute to the Tribunal for adjudication. Section 5(2) confers jurisdiction upon the Tribunal to "investigate the matters referred to it and forward to the Central Government a report setting the facts as found by it and giving its decision on the matters referred to it." The Act confers express jurisdiction upon the Tribunal to investigate into the water dispute and to give its decision on the water dispute and other matters referred to it. It is true that the Act does not in specific terms confer power to the Tribunal to give a direction with regard to the period of the decision. But Section 5(2) of the Inter-State Water Disputes Act 1956, is enacted in general terms and the language of the section conferring the power of decision on the Tribunal is wide and comprehensive. We are, therefore, of the opinion that the express power granted to the Tribunal by Parliament under this section to investigate water disputes and to give decision thereon involves by necessary implication that the Tribunal has the power to prescribe whether the decision

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23 Introduction to Hydrometeorology by Bruce & Clark, p. 293.

24 Felis Frankfurter and James M. Landis. The Compact Clause of the Constitution, Yale Law Journal, Vol. 34, pp. 685, 701. R.C. Martin and Other. The River Basin Administration and the Delaware, p. 145; Irrigation Commission, 1972, Vol. I, p. 347.

should be of permanent duration or whether the decision should be subject to review after a lapse of a reasonable period of time.

9.11.5 It was then submitted on behalf of Madhya Pradesh that the fixation of specific period of operation of the decision will cause hardship to the party States because within the period specified there may be such a fundamental change of circumstances as to disable one or more of the party States from performing the obligations imposed by our decision. Reference was made to Articles 61 and 62 of the Vienna Convention on the Law of Treaties (1969) in this connection.

Article 61(1) reads as follows:—

> "A party may invoke the impossibility of performing a treaty as a ground for teminating or withdrawing from it if the impossibility results from the permanent disappearance or destruction of an object indispensable for the execution of the treaty. If the impossibility is temporary, it may be invoked only as a ground for suspending the operation of the treaty."

But Article 61(2) states:—

> "Impossibility of performance may not be invoked by a party as a ground for terminating, withdrawing from or suspending the operation of treaty if the impossibility is the result of a breach by that party either of an obligation under the treaty or of any other international obligation owed to any other party to the treaty."

Article 62(1) reads as follows:—

> "A fundamental change of circumstances which has occurred with regard to those existing at the time of the conclusion of a treaty, and which was not foreseen by the parties, may not be invoked as a ground for terminating or withdrawing from the treaty unless
>
> (a) the existence of these circumstances constituted an essential basis of the consent of the parties to be bound by the treaty; and
>
> (b) the effect of the change is radically to transform the extent of obligations still to be performed under the—treaty."

Article 62(2) however states:—

> "A fundamental change of circumstances may not be invoked as a ground for terminating or withdrawing from a treaty:
>
> (a) if the treaty establishes a boundary; or
>
> (b) if the fundamental change is the result of of a breach by the party invoking it either of an obligation under the treaty or of any other international obligation owed to any other party to the treaty."

9.11.6 In its comments on these two Articles, the International Law Commission accepted that the doctrine of *rebus sic stintibus* did exist but was careful to suggest that its application should be limited to the "fundamental change of circumstances" which have been unforeseen by the parties at the time the treaty was concluded. However, to qualify as a "fundamental change of circumstances", the existence of the circumstances had to constitute " an essential basis of the consent of the parties to be bound by the treaty" and the effect of the change had to "radically" transform "the scope of obligation still to be performed under the treaty."[25] the reason for the cautious approach of the International Law Commission to the doctrine is that inter-national tribunals have avoided applying it in any particular case. Even in the Free Zones case,[26] in which the parties to the Treaty of Versailles had recognised that the 1815 and *subsequest instruments were no longer conistent with* present-day circumstances, the Permanent Court held that the facts did not justify the application of the doctrine. The Permanent Court added further doubt to the existence of the doctrine by expressly refusing to consider as unnecessary "any of the questions of principle which arise in connection with the theory of the lapse of treaties by reason of change of circumstances, such as extent to which the theory can be regarded as constituting a rule of international law, the occasions on which and the method by which effect can be given to the theory, if recognised, and the question whether it would apply to treaties establishing right such as that which Switzerland derived from the treaties of 1815 and 1816."[27]

9.11.7 With regard to *clausula rebus sic stantibus*, Dr. Brierly states:—

> "Such a doctrine, if it is to be accepted into the law, clearly needs careful definition. Other-

25 1966 Draft Article 59, Article 62 (1) is substantially the same.

26 (1932), P.C.I.J. Rep., Ser/A/B, No. 46.

27 Ibid, at pp. 156-158.

wise it is capable of being used, and it often has been used, merely to excuse the breach of a treaty obligation that a state finds it inconvenient to fulfil. For example, German controversialists, appealed to it to justify the violation of Belgian neutrality in 1914, in breach of the guarantee contained in the Treaty of London, 1831."

* * * *

"The clausula is not a principle enabling the law to relieve from obligations merely because new and unforeseen circumstances have made them unexpectedly burdensome to the party bound, or because some consideration of equity suggests that it would be fair and reasonable to give such relief. It bears no analogy to such a principle as that of *laesia enormis* in the Roman law. What puts an end to the treaty is the disappearance of the *foundation upon which it rests*....."[28]

9.11.8 In any case, the doctrine of *rebus sic stantibus* has no bearing on the question as to whether the Tribunal should make its decision under Section 5 of the Inter-State Water Disputes Act operative for a specified period of time or for an unlimited duration. As we have already pointed out, the exact scope and application of the doctrine is as yet uncertain. In any case it is, in principle, immaterial whether a treaty be perpetual or for a fixed term for the invocation of this doctrine since cataclysmic international changes may occur on the international scene even in months and one of the parties to the treaty may claim to invoke the doctrine for being unilaterally discharged from the treaty obligations. We accordingly reject the argument of Madhya Pradesh on this aspect of the case.

9.11.9 For the reasons already expressed, we think it necessary that our Order should expressly provide that the present allocations will be subject to review and modification after a lapse of a reasonable period of time. The case of Gujarat is that the allocations should be subject to review after a period of 40 years. But Madhya Pradesh considers that the period should be fixed at 35 years. However, in its revised Master Plan (1972) (MP-312) Madhya Pradesh has envisaged the completion of irrigation projects in the basin in a period of 35 years. To this period has to be added another 10 years for the actual development of irrigation. Madhya Pradesh would thus fully utilise its share of waters of the Narmada only in a period of 45 years from the date of commencement of construction of the Narmadasagar project. This assumption is supported by the Report of the National Commission on Agriculture (1976). In para 15.7.7 of Part V of its report, the Commission has visualised full development of irrigation only in the year 2025. In Table 15.7 of that paragraph, it is stated that Madhya Pradesh has the largest balance of irrigation to develop, next only to Uttar Pradesh and Bihar. The year 2025 would be 45 years from 1980 when we may reasonably expect the construction of Narmadasagar to be taken up. Having regard, therefore, to the planning envisaged by Madhya Pradesh and Gujarat, their Master Plans and the respective project reports, we are of the opinion that the allocation made should be subject to review any time after a period of 45 years from the date of the Order of the Tribunal.

9.11.10 Issue 15 is answered accordingly.

9.12.1 We have consulted our Assessors, Dr. M. R. Chopra, Shri Balwant Singh Nag and Shri C. S. Padmanabha Aiyar with regard to our directions in paragraph 9.10.8. They all advise us that they agree with these directions. They also agree with our conclusion in paragraph 9.4.4, 9.9.6, 9.9.7 and 9.11.9 and the reasons given in support of each of these conclusions.

28 Brierly—Law of Nations (5th Edition), pp. 261-262.

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