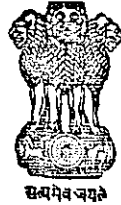


COPP/IP/1958/a

COMMITTEE ON PLAN PROJECTS
(Irrigation & Power Team)



SUPPLEMENT
TO
REPORT
ON
CHAMBAL PROJECT
(MADHYA PRADESH AND RAJASTHAN)
Showing
the details of Team's recommendations and observations
with comments of the Control Board and the
State Governments concerned

MARCH 1958.

**Statement of Team's recommendations and
observations along with comments
of the Control Board and the
State Governments
concerned**

Statement showing the observations, recommendations etc., of the Team and comments of Chambal Control Board, and Governments of Madhya Pradesh and Rajasthan with final remarks of the Team thereon.

Serial No.	Page and Para No. of Team's report	Observations & Recommendations made by the Team	Comments by Control Board	Madhya Pradesh Govt. & Rajasthan Government	Final remarks of the Team
1	2	3	4	5	6
I.—HISTORY AND SALIENT FEATURES OF PROJECT					
1	64—1·2	The project has undergone several changes before it was officially sanctioned in 1954 though the work was started in 1953. These changes were inevitable in view of the then existing princely states which were merged in different stages subsequently while active consideration was being given to the preparation of the project. No precise schedules of materials technical personnel, machinery and equipment could be drawn at the commencement of the project.	No comments.	<i>Madhya Pradesh : No comments Rajasthan : No comments.</i>	
2	64—1·1	The Chambal Project originally estimated to cost Rs. 77 crores would consist of three storage reservoirs with power houses and a barrage with attendant canal works. On completion, it would irrigate 14 lakhs of acres and generate 210,000	The Chambal Valley Development Scheme is to be executed in three stages spread over 2/3 Plan periods. By the end of the Second Plan, according to the Project Report for the First Stage Development, 11	<i>Madhya Pradesh : No comments. Rajasthan : No comments.</i>	

kw of electricity. By end of Second Plan, it is planned to achieve almost full irrigation benefits and to generate a maximum of 92,000 kw, power.

lakh acres of land will be irrigated and 92,000 kw of power generated.

II—ADMINISTRATION

- 3 2—1(a) It is of course the primary function of the State Government to think on this matter on an urgent basis. Agricultural Planning and digging of field channels are two pre-requisites for the proper utilisation of water. The former requires experimentation for at least 2-3 years ahead of the target date and the latter is a task of complex nature, the scheduling of which has to begin equally in advance. In neither case has anything been done tangibly so far. The Control Board consists of experienced personnel from the Centre and the States and in the opinion of the Team it should provide a motive force for thinking on this vital subject.

While the Board fully agrees that steps should be taken by proper authorities for agricultural planning and development, digging the field channels etc., it is of the opinion that according to the terms of the Resolution constituting the Board, this function does not fall within its purview. The Agricultural planning, digging of field channels etc. has to be done by the agriculture department of the State Government. The Community Projects should also be utilised by State Governments to enlist public cooperation through village panchayats and other voluntary bodies for digging field channels. In spite of this as the Board was anxious that the State Govts. should take necessary steps to achieve this object, it drew attention of the State Govts. to this important aspect at the very first meeting of the Board. The Board constituted as it is, cannot look to all

Madhya Pradesh : This relates to the planning for utilisation of the benefit of water having regard to the target fixed for the release of impounded water. The State Govt. generally agrees with the observations made by the Chambal Control Board. So far as the State Govt. is concerned it may be pointed out that the problem is already receiving their attention. In October, 1957, this Govt. constituted a Committee of the following to advise the Government on the utilisation of water that would be available from the Irrigation part of the Chambal Project :—

1. Commissioner, Gwalior Divn., Gwalior—Convener.
2. Chief Engineer, Chambal Project—Member.
3. Chief Engineer, Irrigation, M.P., Raipur—Member.
4. Director of Agriculture, M.P., Rewa—Member.
5. Deputy Director, Agriculture M.P., Gwalior—Secretary.

The Team notes with appreciation the steps that have been taken by the Madhya Pradesh Govt. for implementing some of its recommendations for preparing plans for utilization of water. This is likely to overtake, to some extent, the loss of time that has already occurred on the agricultural planning of the Chambal Project. What the Team wants to emphasise is that since there is a possibility of implementation not keeping in step in the two States as also of duplication of certain agricultural schemes there should be a coordinating link which should ensure that the schemes are worked out and implemented in a balanced way on both sides. It is for this reason that the Team has emphasised that the role that the Chambal Control Board has to play in this matter cannot merely be judged on the technical interpretation of its functions. The concrete suggestions of the Team are that the Board should take on it an Agricultural Adviser who should also be the *ex-officio*

these questions. If this function has also to be entrusted to the Board, some other machinery will have to be evolved, and the resolution constituting the Board suitably amended.

Some of the Officers of the Revenue, Irrigation, Public Works, Agriculture and the Land Record Departments were co-opted on the Committee.

Chairman of the two Committees that may be formed by the Government of Madhya Pradesh and Rajasthan for preparing plans and executing schemes relating to utilisation.

This Committee was charged with the following functions:—

1. To examine the phasing of the construction programme of the Chambal Project, and
 - (a) To suggest a programme for the timely utilization of water available from the Project, and
 - (b) to ensure that facility from irrigation is developed and utilised at the earliest practical date.
2. To review crop and agriculture pattern as will evolve finally and preparatory steps to be taken to develop the same.

The Committee has recently finalised its report and most of the suggestions made by the Team in this chapter as well as in Chapter V are covered by this Committee's report.

Rajasthan : The Chambal Control Board has been set up to expedite the construction of Project and has been placed in technical and financial charge of the scheme. The development of irrigation and

power after construction is the responsibility of the State Govt. and not of the Board. It will not be therefore appropriate to say that no action has been taken by the Board about digging of field channels and agriculture plans which fall outside its scope. Further, it may be mentioned that the digging of field channels can be taken up only after the construction of irrigating channels and not before. So far as Rajasthan is concerned, elaborate field maps showing drainages and watercourses are prepared before estimates for an irrigating channel are sanctioned and the division of outlets and watercourses are determined by the maps. It is not advisable to dig watercourses very much in advance otherwise there is a possibility of their being filled up or damaged during the rains. Actions will, however, be taken to encourage the cultivators to dig watercourses at the appropriate time so that proper use of irrigation water can be made.

4 Page 2
Para 1(b)

The functions of the Control Board also require that the preparation of detailed estimates and *schedules of rates

The estimates were prepared on the existing schedules of the participating states which were not comprehen-

Madhya Pradesh : No comments.
Rajasthan : The detailed estimates and schedules of water

The Team is glad to note that the revised estimates and schedules of rates are now ready.

should be expedited.

The Team found that such leeway remained to be made up in this matter. Most of the difficulties between the Chief Engineers and the Financial Adviser arise from lack of existence of these two documents in their proper form. In fact, the Control Board had to take decisions several times to condone some of the irregularities committed which could have been avoided had the preparation of the said documents been completed. A list of major irregularities of this type that were condoned is given in Appendix III.

5 Page 2
Para 1 (c)

Inordinate delay takes place in the implementation of the decisions taken by the Board. The Board has since evolved a suitable procedure to eliminate delays.

sive enough to cover all the items of the project. The Control Board, therefore, directed preparation of fresh schedules. The schedules of rates have now been completed, and have been scrutinized by the Central Water & Power Commission and the Financial Adviser to the Board separately, both for Rajasthan and Madhya Pradesh, and are under sanction.

The revised estimates of the Chambal Project also have been received from the Chief Engineers, and have been scrutinized by the Central Water & Power Commission and the Financial Adviser to the Board and are now recommended to the State Governments for sanction.

In the initial stages, delay is inevitable. The Accountant General, Madhya Pradesh, raised a point that the Control Board is not a legal entity. Suitable procedure has however since been evolved in consultation with the State Governments and the Central Ministries of Finance and Irrigation & Power and now the delays have been minimised.

rates have already been submitted and are under the consideration of the Control Board.

Madhya Pradesh

The Team has drawn attention to the inordinate delay caused in the implementation by the State Government of the decisions of the Chambal Control Board. The position in this behalf has already been explained in the comments of the Chambal Control Board. As stated therein, final decision in regard to the powers and functions of the Chambal Control Board *vis-a-vis* the State Government and the procedure to be adopted could be taken in August, 1956 *i.e.* about 15

The improvement in the position is noted.

*It is understood that estimates and schedules of Rates are now ready.

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months after the constitution of the Board. This was followed by dislocation of work as a result of the reorganisation of the States. These were mainly the reasons for the delay caused in the implementation of the decisions mentioned in the statement (Appendix III of the Report, enclosed with the Report. The position has since improved and actions on Chambal Control Board's decisions are being taken as expeditiously as possible barring a few cases in which some information is required for issue of orders.

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|---|----------------------|---|--|---|--|
| 6 | Page 3
Para 2 (1) | Finance Secretaries of the two States should be <i>ex-officio</i> Members of the Board. | Suggestion agreed to. | | |
| 7 | Page 3
Para 2(2) | Some arrangements are required by which the implementation of the designs is regularly subjected to check by an independent technical agency. | Dealt within Chapter III. | | |
| 8 | Page 3
Para 2(3) | An agricultural expert should either be made a Member of the Board or should act as its consultant and adviser. | The Control Board, as at present constituted with its functions specifically define in the Resolution, had no power to attend to the water utilisation aspect for development of Agriculture. The advantage of having better co-ordination between Agriculture and Irri- | <i>Madhya Pradesh:</i> No comments.
<i>Rajasthan:</i> Since the development of irrigation after construction is the responsibility of the State Government it seems unnecessary to have an Agricultural expert on the Control Board. | The team considers that the association of an Agricultural Expert with the Board is an advantage irrespective of whether the Constitution is changed or not. He will provide a link between the Board and the combined |

9 Page 3
Pa a 2(4)

The Board should set up machinery for studying questions relating to the following five functions assigned to it :-

- (i) to scrutinize the estimates of the Project prepared by the State Governments, advise necessary modifications and recommend the estimates for administrative approval of the Government concerned,
- (ii) to decide the programme of construction of different parts of the Project in the two States.
- (iii) to receive monthly progress reports both as to works and expenditure in a prescribed form from the Chief Engineers review the progress of different units of the project and lay down steps to be taken to expedite the work.
- (iv) to decide the programme of resettlement of persons displaced as a result of the

gation Department cannot, however, be denied, and if the functions of the Board are modified to include the study of agricultural aspects it will be advantageous to have an Agricultural Expert as a Member of the Control Board.

The estimates prepared by the States are scrutinized in the Central Water & Power Commission. The Board considers that a separate machinery is not required.

The programme of construction of different parts of the Project in the two States has already been laid down by the Control Board.

The monthly progress reports on work and expenditure are regularly received in the prescribed *proforma* and reviewed at meetings of the Board. They are also reviewed by the Control Room attached to C.W. & P.C. and their comments are also considered from time to time.

A Committee has been appointed for this purpose on 23-4-1956. Compensations

utilisation machinery, suggested by the Team for the two State Governments.

Madhya Pradesh : No comments.

Rajasthan : No comments.

The Board is at present taking decisions on issues raised before it by the two Chief Engineers. As each Chief Engineer functions in a compartment of his own, there is no occasion, nor an opportunity for him to take a co-ordinated view of the Project and its various financial, technical and economic implications. It is obvious that if the Board were to fulfil its functions adequately, it should make detailed studies of issues arising out of the functions outlined. This would enable the Control Board to prepare master schedule of the Project in all its aspects engineering, utilisation and rehabilitation. The Control Board is best fitted to do so even if it is not given direct responsibility for the execution of schemes other than those relating to construction it is the only body that has material for an overall assessment

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Chambal Project Works, scrutinise and approve the estimates of land reclamation and the expenditure incurred in the resettlement and rehousing of the displaced persons including land acquisition and connected charges.

to the extent of Rs. 98 lakhs approximately have already been paid.

(v) to decide on the stage* development of water power and the withdrawals of water from the reservoir during the construction period for irrigation and power purposes with a view to securing best use of water available.

This has been done in the programme approved by the Board. The water distribution and power transmission system will, to a considerable extent, be ready when water and power become available.

10 Page 4
Para 2(5)

The two Chief Engineers should set up machinery for the completion of detailed estimates and for preparing schedule of rates. Our concrete suggestion is that a specified Executive Engineer on each Project and A.F.A. should be made jointly responsible for completing the work subject to the overall supervision of the Chief Engineers within three-six months at the most.

The detailed estimates and schedules of rates have been prepared.

Madhya Pradesh : No comments.

Rajasthan : It is not necessary to create a special post to carry out the detailed estimates in Rajasthan as such work is almost complete and the revised schedule of rates is before the Board.

11 Page 4 Para 2 (6)	(i) Pending sanction to such detailed estimate we suggested that the present limits fixed for the Chief Engineers to obtain the concurrence of the Financial Adviser should be raised from Rs. 2 lakhs to 5 lakhs.	The powers of the Chief Engineers were not enhanced previously as schedule of rates were not ready. Now that the schedule of rates are ready the powers have been raised from Rs. 2 lakhs to 5 lakhs.	<i>Madhya Pradesh:</i> No comments. Recommendation implemented. <i>Rajasthan:</i> No comments.
	(ii) Limit in respect of acceptance of tenders should also be raised.	The limit in respect of acceptance of tenders was raised previously.	
12 Page 4 Para 2(7)	The agenda of the meetings of the Board should be issued a clear ten days before the meeting is due to take place.	Efforts were always made to issue the Agenda Notes a clear 10 days before the meeting. Unlike other Boards the meetings of this Board are being held every month and some-time it may happen that the Agenda Notes may not be issued strictly a clear 10 days in advance.	<i>Madhya Pradesh:</i> No comments, Recommendation implemented. <i>Rajasthan :</i> No comments.
13 Page 4 Para 2(8)	The implementation of the above recommendations will place a greater burden on the Chairman of the Board than hitherto. This will virtually be a whole time function as it will impose both arduous and continuous supervision on the incumbent concerned.	The necessity of a full time Chairman can be considered further in connection with the change in the constitution of the Board as a result of the responsibility for agricultural plan and development during construction being taken over by the Board.	
14 Page 5 Para 3(b)	The posts are temporary for the duration of the Project or the particular item of work. It will improve the prospects of getting more experienced persons if the strength of the State cadres was revised to include the post-Project re-	Both in Rajasthan and Madhya Pradesh, the present incumbents will be absorbed against permanent posts.	<i>Madhya Pradesh:</i> The question has been engaging the attention of the State Government for some time. The integration of the Chambal Personal with the P.W.D. & Irrigation which was considered by the State Govern-

*No stage development is envisaged in the project. However, progressive development is feasible even during construction period.

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15 Page 5
Para 3(a)
& (c)

quirements so that some of the temporary incumbents could look forward to a long term of appointment.

The supply of technical talent in sufficient numbers is beyond the capacity of an individual State by itself. The ultimate solution lies in pooling of the existing resources to the best advantage of all the Projects in the country by creating an All India Reserve of Officers who could be utilized to strengthen the Projects as and when necessary since each State cannot appreciate the overall situation.

This is a question of All India Policy, and the Ministry of Irrigation & Power has taken up this question.

ment as a solution of this problem is already in the final stages now.

Madhya Pradesh: No comments.

Rajasthan: In Rajasthan the Chemical Project forms a part of the irrigation branch and all the staff is borne on the cadres of that branch. The staff has been recruited for this work on this Project alone and all the men will in due course be entitled to be absorbed against permanent posts of the department according to their seniority and merit. Recruitment is at present made according to the rules of the State and the Public Service Commission has to be consulted in the case of gazetted and certain class of non-gazetted establishment. All this results in delay but there is no alternative unless the recruitment rules are changed. There is now no difficulty in obtaining Civil Overseers and Assistant Engineers but there is serious shortage of mechanical personnel experienced in earthmoving equipment. Certain posts sanctioned by the Board some months back have not yet been filled up for want of suitable candidates. It will certainly simplify matters if recruitment of a Committee consisting of En-

16 Page 6
Para 3(d)

The recruitment to the Project should be handled by a special committee consisting of two eminent engineers and a member of each of the Public Service Commissions as Chairman alternatively.

Will be communicated to the State Governments.

gineers with a member of the Public Service Commission as Chairman is permitted.

Madhya Pradesh: No comments.
Rajasthan: This suggestion is under the consideration of the Government. Technical Man-Power Committee of the State Government had made similar recommendations. Implementation of these recommendations will involve changes in the rules of recruitment and the methods of selection and also in the rules relating to limitations and functions of Public Service Commission rules. Concurrence of the State Public Service Commission will have to be obtained before such a procedure is finally adopted. The Govt. is, however, alive to the need for adopting a procedure for selection of technical personnel somewhat on the lines indicated by the Team and suitable action will be taken in due course.

17 Page 6
Para 3(e)

Training of personnel.

The State Governments have already started on the advice of the Ministry of Irrigation & Power courses for sub-overseers. Jodhpur has trained 100 overseers and Indore and Gwalior 40 each. But for full-fledged engineering training, it would not be possible to train engineers for this Project because by the time they are ready the Project might be complete.

The Team did not propose the training of full-fledged engineers but of developing lower personnel for non-gazetted assignments requiring knowledge of special techniques.

III.—FEATURES OF DESIGN & CONSTRUCTION

18 66—3·1 *Design of Katal Barrage.*—The design of the earthen dam which forms a part of the barrage has undergone a continuous evolution involving six designs in all. After discussing the 5th design with the C.W. & P.C., the Consultative Committee stressed the necessity of devising other methods of protecting the foundations as neither the clay grouting nor the sheet piles could be considered fully effective for which they were meant. The Consultative Committee considers that the design number six subject to modifications agreed upon on 15-1-58 is the most satisfactory and stresses the need to programme the work into its minutest detail including strengthening of personnel. The Report suggests that the retired Chief Engineers of the country should be given a proper retainer and distributed over various Projects costing more than 15 crores for consultations. Each such Project should have a Consultative Committee with the necessary specialised personnel. This device is specially relevant in our country so as to have an in-

The design of an earthen dam always undergo changes to fit in with the conditions when the work proceeds and to suit the available quantity of proper soil. The Central Water & Power Commission itself attached great importance to the construction of a positive cut off trench in the beginning and only when it was found that it is not possible in the deep section under the actual conditions that they provided a clay blanket. Sheet piles and clay grouting always serve as a second line of defence. The C.W. & P.C. before finalising the design consulted Dr. Terzaghi who is considered as the best authority on the subject and a French firm who are expert in clay grouting. There are no material or major differences between 5th and 6th designs of the C.W.P.C. The comments on the suggestion to have a Consultative Committee of retired Chief Engineers are given in next item.

Madhya Pradesh: No Comments.
Rajasthan: No comments.

(Comments for items 18 & 19). A close analysis of the facts given below reveals that none of the contentions of the Control Board stand scrutiny :—

- (i) The contention that C.W.P.C. were keen to provide a positive cut off right from the beginning is not borne out since none of the 6 designs (including the 5 designs of C.W.P.C.) provided a full positive cut off. Even the partial cut-off trench (upto 20' depth provided in the C.W.P.C.'s first two designs is eliminated from the subsequent designs. Therefore reliance has been placed on the clay blanket and sheetpiles throughout.
- (ii) Even assuming the efficacy of clay-cement-grouting, it is to be noted that it took about 2 1/2 years to think about its necessity, even though the existence of bouldery strata was known right at the beginning—actually the very first and 2nd designs of C.W.P.C. (i.e., namely 1-KT-54 and 1-KT-54 rev. 56) contain a note "sheet-piles to first layer of gravel or bedrock". Apparently

dependent and objective check over the designs on Irrigation and Power Projects prepared by the State authorities or the C.W. & P.C. in view of the fact that there are no consultants available in the private sector in this field unlike in the western countries.

C.W.P.C. was satisfied with the piles resting on gravels etc., without grouting the gravel strata, though the piles could not have served the purpose of even a second line of defence under these circumstances.

(iii) The first 2 changes (i.e. 1-KT-54 and 1-KT-54 rev. 56) were done before any execution was taken up. The 3rd change in design i.e., 1-KT-57 (May) was carried out when the only execution done was driving of sheet piles which did not bring to light any new factor, not known before. When the 4th and 5th changes i.e., 1-KT-57 (July) and 1-KT-57 (Sep.) were done no further execution had been done and hence no new factors that should have affected the design had been discovered. Thus, the contention that earthen dam designs always undergo changes during construction does not apply to this case where numerous changes have been effected, and these did not arise out of actual difficulties in execution.

(iv) Regarding the contention that the design No. 6 i.e., 1-KT-57 (Sep.) is not substantially different from design no. 5, (1-KT-1957) (July), it has to be pointed out that the final design

19 9-1-2 The history of the Barrage up-to date would appear to warrant the necessity of conducting a careful examination at consultative level of designs of such important structure as it is necessary that original designs should undergo an objective analysis, before being adopted and that their execution should be supervised by an authority other than that preparing them.

The practice recommended is not prevalent in other countries. It will lead to endless discussions and divided responsibility if all the detailed designs were checked wholesale by another organisation. The consultants are invited to advise only on specific points where doubts exist. C.W. & P.C. has always obtained such advice (second opinion) from competent consultants.

The C.W. & P.C. has always suggested utilisation of the services of retired engineers who may have experience in specific fields. The proposal of the Central Water and Power Commission is under scrutiny with the Ministry of Irrigation & Power and Finance.

Madhya Pradesh: No Comments. *Rajasthan:* The design and construction programme of this Barrage has been a subject of several meetings held in July, August and September, 1957 and final lines were settled in September, 1957. Work is in progress according to the programme decided upon. The site was inspected by Members of the Committee in January, 1958 and further instructions given by them are being followed. Shri A. N. Khosla and the Central Water and Power Commission are being informed from time to time about the state of work. Shri A. N. Khosla has since approved of the proposal to do clay-grouting below the sheet piles as an additional safeguard and the Central Water and Power Commission are taking action to entrust this work to suitable agency experienced in clay-grouting. The design of this Barrage has been done by the Central Water and Power Commission and the proposals have been examined and approved by the

now agreed upon is design No. 6, plus the features agreed to in statement II in Chapter III, plus the clay-cement-grouting now contemplated by C.W.P.C and agreed to by Dr. Khosla.

(v) The practice of consulting distantly located foreign consultant during the course of execution is neither economical nor very effective as they cannot undo what is already done. All that they can do is to propose modifications in the remaining work. As such even the technical suggestions that could be made by the team at this stage are also limited by this factor. Consultations, to be effective, expeditious and economical, must be arranged from the beginning and consultants selected preferably from local talent.

Thus, as proposed in the Report, the history of the Barrage up-to date does warrant a second opinion on important and complicated designs right from the beginning as a matter of course. The Team has suggested examination at a consultative level of designs of important structures only, such as Kotah Barrage. The practice of obtaining second opinion

eminent Engineers in the Committee on Plan Projects. Designs for other important works have already been finalised and it seems unnecessary at this stage to attach a Board of Consultants to the Chambal Project.

on important structures is not only wholesome but is also prevalent in other countries. The following quotation is taken from Page 39 of the Dexheimer's Report on the C.W.P.C., which was given at the instance of the latter.

Individual Consulting Engineers or Boards of consultants which might include engineers, geologists and others in specialised fields should be used on all difficult and costly works contemplated in order to get the best possible advice, the most practicable designs and the maximum savings in costs.

"The Consultants should be chosen for their outstanding ability and reputation in their specific fields. These consultants should be obtained from throughout the world wherever they are available.

"It would be very advisable to have a list of engineers and other experts in different fields (including administration) with a record of their training and accomplishments, available to all organisations which are planning and designing water and power projects. These engineers and others in India could very well be consultants on specific problem in which their training and experience qualify them as experts. Retired engineers and experts

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in other fields could perform very useful service in this regard. It is always advisable to have some members of a consulting board from areas outside the immediate area of the Project as they can bring wider experience and perhaps new proposals which would be very helpful.

"The Planning Commission or the Central Water & Power Commission could collect, maintain and distribute a list of such consultants together with their experience records to the planning and design agencies in India."

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At present consultation on any specific point is optional with the C.W.&P.C. while in the opinion of the Team a review of designs of important and complicated structures should be obligatory & there should be a panel of consultants for each major Project. It is also necessary that consultation level should be improved within the country and less reliance should be placed on outside consultants.

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13-14

The Committee suggests use of lime concrete for bed lining instead of cement concrete and thereby save Rs. 15 to 20 lakhs.

The hydraulic lime is not available within easy reach. The lining in the Chambal Main Canal is required to cover bed rock and withstand high velocities,

Madhya Pradesh: No comments.
Rajasthan: No comments.

Lime surkhi mortar is being used on masonry structures of the main canal in Rajasthan. The velocities in the flumed portion of the canal are not considered damagingly high,

For this cement concrete is the proper material. It has been contended by the Chief Engineer in charge of construction that the savings envisaged will not be realisable. There is however no harm in experimenting in some reaches of the canal.

21

14—2 *Designs Organisation*— Chief Engineer Madhya Pradesh gets all the designs from C.W. & P.C. It is the view of the Team that some of these designs which are not of a major character could with advantage and convenience be prepared by the Chief Engineer himself. For this purpose a special design cell with suitable staffing needs to be created under the control of the Chief Engineer.

The designs of more important works have been prepared by the Central Water & Power Commission while the others have been completed by the State Engineers themselves. Most of the minor designs are not referred to the Central Water & Power Commission. It is not necessary now to have any special Designs Organisation at this late stage.

As regards the other suggestions of the Team, the remarks of the Central Water & Power Commission are reproduced below :—

“It is not possible as visualised by the Team to send officers from the Central Water & Power Commission to fill the posts in the Chief Engineer’s offices as there are a number of Projects all over India it will be impracticable to distribute the C.W.&P.C. staff to the various Projects and maintain the efficiency of the designing organisation.

Madhya Pradesh : No comments.

Rajasthan : At this stage it does not seem necessary to have any Design Organisation in Rajasthan as the designs of the major works have been prepared by Central Water & Power Commission while those of the rest have been completed by the State Engineers.

The Chief Engineers agreed to this suggestion during discussion. The C.W.& P.C. however opposed it. It will be noticed that the practice in Madhya Pradesh and Rajasthan differs as regards the preparation of designs, the latter being more in line with the suggestion of the Team.

If it is not possible for the C.W. & P. C. to send out officers from its strength to the Projects, it is practicable to associate one of the Engineers from the Project Authorities with the preparation of designs so that the latter should form the nucleus of a Design Cell which could look after minor designs and such changes in major designs which may be of a minor character with reference to the C.W. & P.C. as is done at present.

It was not the intention of the Team to suggest that visits are made to Delhi unnecessarily. It is a fact that a considerable time of senior Project officials is spent at Delhi. The anxiety of the Team was to find out a way by which this demand on their time could be reduced

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It is also to be noted that a single officer or two cannot replace a Team of trained officers which alone can produce economic designs.

There has hardly been an occasion when any of the high placed personnel specially came to Delhi to discuss minor matters. On the contrary the officers whenever they attended the Control Board meetings at Delhi took the opportunity to discuss and settle the design problems with the Central Water & Power Commission.

so that they should remain for a longer period at the site than they are able to do under the present circumstances.

22 15-3 The Committee suggests a special inspection and control organisation to ensure quality control.

Masonry work which forms a major portion is given on contract and quality control work is exercised by the Department. Concrete work being done by the Department is very small. No separate organisation is, therefore, necessary.

Madhya Pradesh : No comments. Quality control of masonry work is at present being exercised by the personnel responsible for measurement. The essence of the proposal made by the Team is that these functions should be bifurcated which is possible without addition to staff and which is bound to result in obvious advantages. It is for this reason that similar bifurcation of functions has been made on Bhakra Nangal also.

Rajasthan: Almost all the work on the canals has been entrusted to contractors and the departmental Engineers are responsible for seeing that proper quality of work is executed. No special quality control staff is therefore, required on the canals. On the Kotah Barrage where the earth section and connected works will be carried out departmentally, it is proposed to have a separate quality control division to see that the special instructions are fully followed.

16-4 *Agency for construction of field channels* :—The correct course would be for field channels etc. to be constructed by the Project Authorities themselves and the cost recovered later from the villagers. To enthuse the cultivators in this connection, it may be a desirable expedient to constitute village committees for purposes of co-operation with the irrigation authorities for supplying as much of the labour needed locally as possible.

It is not usual in irrigation projects to place responsibility for construction of watercourses on the Project Authorities. This work is normally done by the cultivators who are given necessary technical advice by departmental staff if desired. There is no provision for this work in the Chambal Project estimate. The mileage of watercourses in Rajasthan alone will perhaps be about 6,000 miles and the execution of such a work departmentally will involve the creation of a big organisation besides requiring large additional funds. In view of lack of personnel and the need for large additional funds it does not seem desirable to entrust the work of the construction of watercourses to the Project Authorities. It is possible to get most of the works constructed through village panchayats.

Madhya Pradesh : As regards suitable time for construction of such channels, the Chambal Control Board has suggested with reasons that this work should be taken up only a year or so before the water is made available to the cultivators.

So far as introducing a law for enabling the construction of watercourses at the expense of Cultivators is concerned the matter is already under the consideration of the State Government.

Rajasthan : It is not usual in irrigation projects to place responsibility for construction of watercourses on the Project Authorities. This work is normally done by the cultivators who are given necessary technical advice by departmental staff if desired. There is no provision for this work in the Chambal Project estimate. The mileage of watercourses in Rajasthan alone will perhaps be about 6,000 miles and the execution of such a work departmentally will involve the creation of a big organisation besides requiring large additional funds. In view of lack of personnel and the need for large additional funds, it does not seem desirable to entrust the work of the construction of watercourses to the Project Authorities. It is possible to get most of the works constructed through village panchayats.

CHAPTER IV—PHASING OF PROJECT

- 24 Page 18
Para 2.1
- After careful consideration and study of the quantities of work involved in the completion of the canal system in Rajasthan and Madhya Pradesh, it is considered that the target date for the completion of the canal system (90 % to 95 % of the work) could be advanced provided the necessary funds are made available. We, however, realise the difficulty of allocating funds as it has to be done in the larger context of the Plan expenditure as a whole.
- Pre-requisite to early completion of the work is allotment of the required funds by the Planning Commission and allotment of the extra steel and cement. The allotment is only Rs. 18.69 crores whereas the expenditure envisaged is Rs. 35.49 crores.
- 25 Page 19
Para 2.2
- Construction of Rana Pratap Sagar Dam.* The integrated development of Chambal River Valley envisages construction of Rana Pratap Sagar Dam 20 miles below Gandhi Sagar Dam. Therefore the original intention was to start the construction of the dam in the winter of 1957. Although preliminary Project Report has been submitted by
- Rana Pratap Sagar Dam was included in the 1954 estimate but had been omitted at the instance of the Planning Commission. Detailed investigations for Rana Pratap Sagar Dam are now in progress. Designs and estimates are yet to be prepared. As per Team's suggestions the expenditure for Second Plan for
- Madhya Pradesh:* No comments.
- Rajasthan :* Extract of letter from Shri R. K. Vyas, Minister for Irrigation & Home, Rajasthan enclosing comments on the Chambal Report (Passed on by Chambal Control Board). "With regard to the acceleration or construction of Rana Pratap Sagar Dam, I may add
- Early construction of the Rana Pratap Sagar Dam is necessary in order to achieve the full projected irrigation development which would not be possible without balancing the power releases from Gandhisagar. It was for this main reason that the work was scheduled to be commenced in the winter of 1957. This urgency is all the more felt in view of the Team's

the Chief Engineer, Rajasthan, certain important investigations relating to power house remain to be done. The Team considers it necessary to expedite work on the remaining investigations and dovetail the construction of the Rana Pratap Sagar Dam with that of Gandhi Sagar Dam which would

- (a) facilitate installation of power plants at a short notice, as and when necessary;
- (b) incidentally result in a saving of Rs. 54 lakhs by utilising some of the machinery and buildings at Gandhi Sagar Dam, as detailed below :

(i) Using Gandhi Sagar Dam buildings for construction staff of Rana pratap Sagar Dam Rs. 32 lakhs.

Madhya Pradesh will be 16.8 crores in excess of that allotted by Planning Commission. Even for 1958-59 the provision assumed by the Team is Rs. 11.25 crores against an allotment of Rs. 5.5 crores. The accelerated programme therefore is based on incorrect assumptions regarding availability of funds.

(i) Rana Pratap Sagar Dam site is 26 miles from Gandhi Sagar Dam. The stationing of construction staff required for Rana Pratap Sagar Dam at Gandhi Sagar Dam will involve daily travelling of staff and affect the construction work adversely. The magnitude of work at Rana Pratap Sagar Dam is practically half of that at Gandhisagar Dam. The total estimated cost of buildings at Rana Pratap Sagar Dam will be only

that the Govt. of Rajasthan is anxious to take all necessary steps to expedite its construction to the maximum extent possible but hope that the Planning Commission and Chambal Control Board will also give top priority to this scheme at this end; will convey sanction at an early date, and exercise their influence with the Union Government in obtaining the necessary foreign exchange".

proposal accepted by the Control Board to achieve full irrigation development in 5 years only. It is gratifying to note that Rajasthan Govt. is keen to take up the work in view of this obvious necessity. There is a provision of Rs. 4.34 crores for Rana Pratap Sagar Dam as a separate scheme in the Second Five Year Plan against an estimated cost of Rs. 5.84 crores for civil works given in the Project Report prepared by the Chief Engineer, Rajasthan in 1956 which is before the CW & PC for their scrutiny. The Team's suggestion is that this provision should be utilised by accelerating the investigations and finalising the Project so as to dovetail this work with Gandhi Sagar Dam Project.

(i) The amount of economy namely Rs. 32 lakhs was arrived at by scrutiny of provision of Rs. 56 lakhs for buildings made in the Project Report of Rana Pratap Sagar Dam prepared by the Rajasthan Government and made available to the Team. It was not intended that construction staff should be accommodated at Gandhi Sagar Dam.

25 lakhs out of which buildings costing Rs. 6 lakhs have already been constructed. The estimated cost of buildings required for permanent electrical staff is Rs. 12 lakhs. The laboratory at Gandhi Sagar Dam has to be shifted obviously to Rana Pratap Sagar Dam after completion of works at Gandhi Sagar. As such the savings claimed are not realistic.

(ii) Establishment by accelerating the work . . . 11 lakhs.

(ii) The savings of Rs. 11 lakhs in Rana Pratap Sagar under Establishment is possible only by an accelerated programme. The project is still under investigation. Designs and estimates have yet to be prepared. The Plan provision of Rs. 0.95 crores for Irrigation and Rs. 4.65 crores for Power will not be adequate for accelerated programme even if the investigation is complete.

(iii) Utilisation of machinery at Gandhi Sagar Dam for Rana Pratap Sagar Dam.

(iii) Credit for machinery surplus at Gandhi Sagar Dam after completion of work has already been given in the estimate. The surplus machinery at Gandhi Sagar Dam will be utilised on other River Valley projects, including Rana Pratap Sagar

Madhya Pradesh: No comments. *Rajasthan:* A revised estimate for the project has been submitted to the Board and its examination by the Central Water & Power Commission and the Financial Adviser have been completed. It is expected that formal sanction of the State Government will be accorded soon. The Team has suggested an economy of only 5 lakhs rupees so far as the works excluding Rana Pratap Sagar are concerned. This is sought to be achieved by accelerating construction of canals. Every effort is already being made to push on work on the canals.

If the machinery usable at Rana Pratap Sagar is not put to use there immediately on its becoming spare at Gandhi Sagar Dam, it will either have to be kept standing idle till the work at Rana Pratap Sagar is taken up or as has been suggested in the Control Board comments it will have to be sent out to other more distant projects involving dismantlement, transport and possibly some damage and loss in transit and at the same time fresh machinery will need to be collected not long thereafter, either from abroad or from other distant River Valley Projects on work commencing at Rana Pratap Sagar Dam, a process which would not be in the interest of the Nation's overall economy. The best and most economical

as all the machinery at Gandhi Sagar is not usable at Rana Pratap Sagar.

arrangement would be to utilise the machinery and equipment available on the Chambal Project works for the Rana Pratap Sagar Dam Works.

CHAPTER V—MANAGEMENT OF IRRIGATION AND UTILISATION OF WATER.

26. Pages 23 and 24 There has been an absence of a Master Schedule including agricultural planning etc. Para 2 and 3.

Reasons for absence of Master Schedules are :

The two States lacked the necessary institutional arrangements for undertaking a job of this type.

No. comments.

To remedy the above situation, it has been suggested that :

- (a) the states should constitute some sort of Development Committees on the pattern of Bhadra Development Committee in Mysore State as described in the Lakkavalli Report and

The primary object with which the Board is set up is to ensure efficient economical and early execution of the Chambal Valley Development Scheme. On the agricultural aspect, attention of the State Government has been drawn by the Board but the execution rests with the State Governments.

- (b) the Control Board should coopt an Agricultural Member on the Board as proposed in Chapter II.

The suggestions of the Team have been agreed to by both the State Governments *vide* remarks under Serial No. 2. Further, both States have also agreed to have a Joint Committee of representatives of both the States with a representative from the Centre for implementing agricultural schemes *vide* App. XV para 19, App. XVII para 12 and App. XIX para 3.

28

Agreed to by the Control Board in principle as already referred previously under Serial No. 8.

27. Page Para 4	<p>24 <i>Curtailment of water utilisation period</i> : It may be pointed out at the outset that we do not agree with the assumption in the Project Report that it should take nearly 10 years for the benefits of irrigation to be fully realised. This leisurely pace was perhaps justified in the olden days but with the progress of agricultural science and the vast experience that this country possesses of irrigation practices, it should be possible, if proper steps are taken in time, to realise the benefits from canal irrigation in not more than 4-5 years.</p>	<p>The period of development of 10 years is taken in irrigation projects for preparing financial forecast only. It is therefore not rigid, and steps which can shorten it are to be welcomed.</p>	<p><i>Madhya Pradesh</i>—No comments, <i>Rajasthan</i> : It would be welcomed if a period of development of 10 years which is normally taken in irrigation projects for preparing financial forecast is shortened. This would certainly improve the financial picture.</p>	<p>Agreed to by both the State Governments and Chambal Control Board <i>vide</i> App. XVII, para 5 and App. XIX, para 3.</p>
28. Page 25 Para 5	<p>Anticipations in regard to increased food production may not be realised.</p> <p>Financial returns as calculated in the report may be realised only if agricultural aspects of the project is given due attention.</p>	<p>There seems to be some misunderstanding about this. The extra production is taken at one-third to one-fourth of a ton over the entire area newly brought under irrigation. As regards the bajara, jawar etc. which will be grown as Barani crops, this calculation will naturally not apply as it refers only to irrigated crops. This figure taken is an average only and includes a heavier food production in the case of crops like rice, sugarcane, potatoes etc. Here it may be men-</p>		<p>Observations of the Team are supported by State Governments <i>vide</i> App. No. XIX, sub-para 3, App. XIX-A, para 1, App. XV, para 3 & 4.</p> <p>Team regrets, it cannot share the optimism of Control Board in getting increased production of 4.8 lakh tons food-grains from 14 lakh acres to be irrigated by Chambal, firstly because according to the yard-stick laid down by the Ministry of F & A, as mentioned by Control Board itself the additional production by irrigation is .2 ton per acre which would</p>

tioned that the yardstick laid down by the Ministry of F & A for additional production by irrigation is 0.2 ton per acre.

mean 2.8 lakh tons instead of 4.8 lakh tons; secondly, all the 14 lakh acres are not to come under foodgrains as a good portion of the area would go to crops other than food; and thirdly kharif food crops now being grown will show very little increase, if any, due to abundant rainfall in Summer. Accordingly, 4.8 lakh ton increased food production is definitely an over estimate.

As regards financial returns, the Team adheres to its previous views which are also supported by the State Governments that they will be realised *only if* agricultural aspect of the Project is given due attention (which has not been the case so far).

Observations and suggestions agreed to by the State Governments, and necessary schemes with financial implications have been prepared.

29

Page 26
Para 7

At present the condition of agriculturists in the region is very poor, methods of farming primitive resulting in sub-normal yield, the fields are infested with ber bushes. The pattern of agriculture would undergo revolutionary change and agricultural research would be necessary to determine the suitable varieties etc. and proper crop rotations under altered conditions will have to be experimented upon.

No comments.

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1	2	3	4	5	6
30	Pages 27 to 29 Para 8	The water allowance should be re-examined on account of:	(a) The rainfall in the commanded area in Rajasthan is generally below 30 inches. It should however be borne in mind that the winter rain is very poor.	<p><i>Madhya Pradesh:</i> No comments.</p> <p><i>Rajasthan:</i> The water allowance at outlet head on the Chambal Project has been taken to be 4 cusecs per thousand acres of culturable command against 2.56 on the Bikaner Canal and 2.4 on the Bhakra. It may be mentioned that the intensity of Rabi irrigation proposed on the Bhakra and Ganga Canal is 36% while the figure on Chambal is 55. The water allowance of 4 cusecs is therefore provisionally correct. It may be pointed out that the quantity of water supply to any area depends both on the water allowance and on capacity factor i.e. the proportion which the number of running days bears to the total number of days in the period. In the case of Chambal the capacity factor will be much lower than that of the other two systems mentioned because the canal will practically be closed from July to October in a normal year and there may be closures in the cold weather also. It is therefore not correct to say that we have been unduly liberal in fixing the water allowance. It has to be borne in mind that the area traversed by the Chambal is of such</p>	<p>Against the figure of 30" rainfall now given by the Control Board, a figure of 35 inches had been given by the State Agriculture Department, while a figure of 34" is stated on page 31 of "Chambal Valley Development Project Report of 1954, Volume 1". This is more than double of that in most areas coming under Bhakra Project.</p>
		(b) There being a lot of area with sub-soil water table too high, thus posing the danger of water-logging on irrigation.	(b) The sub-soil water level rises high in wells which are close to depressions and drainages. This can naturally be expected after the monsoon. The estimate includes provision for constructing drains in isolated pockets where canal irrigation may cause excessive rise of the water table. As the country has good slopes and numerous natural drainage lines extensive water logging is not likely.		<p>Secondly, the statement that sub-soil water level rises high in wells which are close to depressions and drainages not supported by the data available. Results of soil survey carried out by the Agricultural Chemist of Rajasthan attached herewith gives a list of 170 wells scattered all over the area, where ground water level rises upto dangerous level and most of these wells are far away from depressions or running streams of water. The conditions are particularly bad in Digod Tehsil of Rajasthan and Gohad & Mehgaon Tehsils in Madhya Pradesh.</p>
		(c) Existence of uneven ground in several places which cannot be amenable to irrigation without heavy expenditure on levelling of land.	(c) As mentioned at (a) above the water allowance is uniform per thousand acres and is based on the conditions likely to be experienced.		<p>Thirdly, in certain areas like Borod & Etawa, 2/3rd of the area is uneven and unfit for irrigation unless proper levelling</p>
		The resulting surplus water, if any, may be utilised to benefit new areas or re-allocated for intensive irrigation of sugarcane crop in specified areas and this may necessitate designing of the minors and distributaries therein,	Adequate provision will be made for sugar-cane belts when these are finally selected.		

a feature that even sowing of Rabi is not possible if the monsoon fails in September. In such cases it will be necessary to run the canal to cover the entire area to enable sowing to be done and a high water allowance is essential in the circumstances. The slope of the country in Rajasthan varies from 5 to 10 ft. per mile and there are a large number of well defined and deep drainage lines. There is thus very little danger of water logging. A lump sum provision for drains has, however, been made in the Project estimate to deal with any passage where the local water-logging may be likely.

is done, although this area is included in the C.C.A.

In spite of all this, all that the Team had suggested, and it still adheres to it, that the matter deserved to be considered so that surplus water, if any from certain localities, could be diverted to other localities where it could be more profitably utilised.

When channels are designed, complete Sajara sheets of the area are prepared and the culturable commanded area is the actual figure which is considered suitable for irrigation. The water allowance and the capacity factor is determined accordingly. The ravine areas and lands unfit for irrigation are excluded.

31 Page 29
Para 9

Salt contents of water & water tables in the percolation wells, and danger of water logging in some areas.

Wherever such conditions exist, steps will be taken on the lines suggested by the Team.

Madhya Pradesh : No comments.

Rajasthan : The waterlevel in Rajasthan is generally fairly deep. It is high only in the area near streams and in the vicinity of tanks. As most of the lands are situated in such a locality, the spring level in them do not give correct picture.

While the Team is glad to note that the Control Board agrees to take steps on the lines suggested by the Team in places where danger of salinity and water-logging exists, and *Madhya Pradesh* Government also agree with the observations of the Team *vide* Appendix No. XVII & XVIII and

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as suggested by the Team the State Government has also made necessary provision for this purpose, the Team is unable to subscribe to the views of Rajasthan Government. The conclusions drawn by Rajasthan Government in regard to the sub-soil water level, salt contents of well water and danger of water-logging find little support from the data presented by the State Agricultural Chemist, who had carried out an extensive soil survey of the area in Rajasthan coming under Chambal Project. His analysis of 185 open wells had shown that in 45 wells, conditions both in regard to the water level and salt contents were such as to cause serious apprehension *vide* pages 29 to 32 of the Report of the Team. Accordingly, at the recommendations of the Team *vide* proceedings of the meeting held on September 1957-Appendix XX-A, the Agricultural Chemist was asked to carry out analysis of some more wells. Further work has only confirmed the previous apprehension.

Statement attached gives a list of 170 open wells where in Monsoon water level comes within 10' of the surface; in 61 wells at 3' and less and in 28

wells it touches the ground level and majority of these wells are not at all near the streams or water tanks as contended by Rajasthan, ~~and~~ ~~the~~ ~~State~~. In view of the havoc and devastation caused by water-logging all over India (in Punjab alone over 3 million acres have been ruined in the last 10 years), it is wise to take timely precautions before the mischief is done and it is better to err on the side of caution.

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|-------------------------------------|---|---|---|---|
| 32 <i>Page 31</i>
<i>Para 10</i> | Steps to prevent water logging, salinity, bad drainage etc. | Wherever such conditions exist, steps will be taken on the lines suggested by the Team. | <i>Madhya Pradesh</i> : No comments.
<i>Rajasthan</i> : In view of the circumstances existing in Rajasthan there seems to be very little risk either of water-logging or of extension of salts. It is, therefore, unnecessary to think of lining of canals and distributories. As such lining of irrigation channels cannot have effect on waterlogging. Provision for drainage has already been made in the Project. The strata in the locality, it is understood not suitable for tubewells. | Agreed to by State Govts. and necessary Financial provision of Rs. 50 lakh for Rajasthan and Rs 34.50 lakh for Madhya Pradesh is being asked for <i>vide</i> App. XVI, App XVII para V, App. XX-B and the letter No. F 23 (193) Agr/57/II dated 26-2-58 from Secy. Rajasthan Govt. Deptt. of Agriculture. |
| 33 <i>Page 33</i>
<i>Para 11</i> | Irrigation and Land Development requirements. | Board agrees with the recommendations but states that funds will have to be found from some other source. | <i>Madhya Pradesh</i> : No comments.
<i>Rajasthan</i> : No comments. | |

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					Chambal Control Board agrees with the suggestions but states that the additional funds will have to be found from some other source.
34	Page 34 Para 12	Steps to be taken for eradication of wild Ber Bushes.	Board agrees with the recommendations but states that funds will have to be found from some other source.	Madhya Pradesh: No comments. Rajasthan: No comments.	Agreed to by both the State Govts. vide App. XV(14), App. XVII(4) and App. XX-A(5).
35	Page 35 and 36 Para 13 and 14	Dealing with the problems of kankar layers and hard pans.	Do	Do	Agreed to by both the State Govts. vide App. XX-A(3) and App. XVII (iii b).
36	Page 36 to 38 Para 15 and 16	Important problems like determination of C.C.A., determination of varieties of crops best suited under irrigated conditions, cultural practices under irrigation time of sowing, seed-rate etc. manurial requirements under irrigated conditions, intensity of irrigation or water requirements of crops and the manner of irrigation with a view to secure maximum advantage from canal irrigation need attention.	The State Governments are requested to take necessary action.	Do	Agreed to by both the State Govts. vide App. XV(6), App. XVII(12), App. XX-B and App. XVII(IV).
37	Page 38 Para 17	Special scope for horticultural industry.	This falls within the purview of State Departments of Agriculture. There is ample water available for fruit gardens and no modification in designs of channels should be necessary for this purpose.	Madhya Pradesh: No comments. Rajasthan: The development of horticulture in the Chambal area should be welcomed as it would considerably add to the cash earnings of the cultivators and would encourage food growing in the State. This soil is very suitable for Mango.	Agreed to by both the State Govts. and necessary financial provision worked out vide App. XV para 13, App. XVII para VI App. XX-A para 7 and App. XX para 2.

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Citrus, Fruits, Papaya Guavas etc. There is ample water available for fruit gardens and no modification in designs of channels should be necessary for this purpose.

38 Page 39 Special scope for sugar industry
Para 18 and need for creating sugarcane belts.

Do

Madhya Pradesh : No comments.
Rajasthan : The Chambal Channels in Rajasthan are designed to irrigate 55% of the commanded area in Rabi and the capacity to suffice for 25% in Kharif. The intensity of 25% for sugarcane is very high and no modification of channels should therefore be necessary on this account. If, however, it is expected that in any locality the Sugarcane percentage will go appreciably above 25, it would be quite easy to increase the channel capacity as and when required. Allowance for this can be made in the beginning if such localities are intimated now,

Recommendations of the Team about special scope for development of sugar industry and for creating "Sugarcane Belts" have been accepted by both the State Governments *vide* Appendix No. XV(12) XVII(7), 20(3) and 20A(7). The contention of the Rajasthan Government that this will not require modification of the channels, is not accepted by the Team. The Project Report 1954 provides for only 5% intensity for sugarcane and garden combined or roughly about 2.5% only for sugarcane. Sugarcane requires many times more water than ordinary crops do. It is obvious that if intensity of cropping (*i.e.* cropped area) is to be maintained at 70% as contemplated in the Project, and area of sugarcane cultivation is to be increased from 2.5% to 25% or even more in any given locality as envisaged in "Sugarcane Belts" much greater discharge of water would be needed and channel capacity must necessarily be revised in "Sugarcane Belts".

39 Page 40 Necessity of conserving farm The State Govts. are requested
Para 19 yard manure, composting and to take necessary action.
green manuring.

Agreed to by both the State Govts. *vide* App. No. XV(15) XVII(8) and XX-A(8).

1	2	3	4	5	6
40	Page 40 Para 20	Expeditious consolidation of Land Holdings.	The State Govts. are requested to take necessary action.		Agreed to by Madhya Pradesh Govt. vide App. No. XVII (3).
41	Page 41 Para 21	Village tanks and their future use.	Do.		Agreed to by the State Govts.
42	Page 41 Paras 22 and 24	Necessity for planning of new villages, towns and pucca roads.	Do.		Agreed to vide App. XVII (9).
43	Page 41 Para 25	Introduction of warabandi system, a necessity.	Do.	Madhya Pradesh: No comments. Rajasthan: The distribution of water issuing from an outlet is normally done by the cultivators themselves. But in case of dispute a programme of distribution is drawn up by the Irrigation Department in accordance with the Rules in the Canal Act. As Panchayats exist in most of the villages it should be possible to entrust distribution to them and wholesale warabandi should not be required.	Agreed to by Madhya Pradesh Govt. vide App. XVII (11). The Team reiterates that warabandi is indispensable if the evils of irregular irrigation are to be avoided.
44	Page 42 Para 26	Construction of Main Field Channels.	Do.	Madhya Pradesh: No comments. Rajasthan: No comments.	No comments.
45	Page 42 Para 28	Introduction of cooperative garden colonies.	Do.	Do.	Agreed to in principle by Madhya Pradesh Government.
46	Page 43 Para 30 and 31	Prevention of soil erosion and financial provision for the same.	Do.	Madhya Pradesh :—The Cham- bai Project does not include anything for levelling of lands,	Agreed to by both the State Governments,

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- 47 Page 44 For proper and quick Irrigation and Development of waste lands, ceiling on ownership of land and tenancy laws may not be applied for 25/7 years or so. Do,] *Madhya Pradesh* : This was suggested by the *Madhya Pradesh Government vide App. XV (9)*. The Team supports suggestion in the interests of diverting private capital towards the development of waste-land.
- 48 Page 45 *Betterment Levy*: Certain principles have to be laid down in this respect and one of them would be that the rate of levy should be half the estimated increase in the value of the land as a result of the benefits of irrigation of the area, per acre. The question of charging betterment levy in Chambal areas is still under consideration of the State Government. However, it may be mentioned that the Act relating to betterment levy in Rajasthan lays down that the extent of betterment levy charged can be up to 50%. In view of that what extent of the levy will actually be imposed, will have to be decided by keeping in view the various factors. It is hoped that the work of collecting the fee will start at an early date. *Madhya Pradesh* : *Betterment Levy*: The question of charging betterment levy in Chambal areas is still under the consideration of the State Government. However, it may be mentioned that the Act relating to betterment levy in Rajasthan lays down that the extent of betterment levy charged can be up to 50%. In view of that what extent of the levy will actually be imposed, will have to be decided by keeping in view the various factors. It is hoped that the work of collecting the fee will start at an early date. *Rajasthan* : No comments.
- Rajasthan* : No Comments.
- Rajasthan* : No comments.

VI. POWER GENERATION

- 49 Page 72 Owing to the present financial difficulties in the country, the load growth in the Chambal will not be as rapid (increasing five-fold in five years) as it was forecast earlier. Hence it is suggested that foreign exchange expenditure on The load forecast upto 1960-61 is quite realistic since it has been based on actual commitments made for industries being established. 1965-66 loads have also been estimated on similar considerations except that in res-
- In the case of the Chambal region which is at present undeveloped, the Team have taken into account all the large and heavy industries that are definitely planned in the region and assumed that the other types of loads

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Ranapratap Sagar Power plant may be postponed but the civil works should be started in the Second Plan Period. The works could be accelerated if any unforeseen development of new loads does come about earlier than now considered probable.

pect of general demands trends of development have been taken into account by C.W. & P.C.'s load survey party. During initial stages, high rates of doubling of demands in 5 years or even earlier should be expected in under-developed regions. To be able to meet the estimated demand, expeditious construction of Ranapratap Sagar power project is called for. This would be in the interest of maximum economy since Ranapratap Sagar Schemes is primarily a power project and to build the dam without the power plant would be incongruous. Even according to Committee on Plan Project's load estimates Ranapratap Sagar Station would be required by 1963. This would call for start of construction of both the dam and power plant straightway, since it takes about 5 years to complete such works.

will double in five years. This is a liberal assessment. Depending on the rate of load growth that would be indicated by the time the Gandhisagar Station commences operation, a schedule may be drawn up for placing orders, erection etc. for the Ranapratap Sagar power plant. *There is no incongruity in starting the construction of the Dam without the power plant as this would definitely save the inevitable time-lag between the completion of civil engineering works and the erection of the power plant.*

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50 Page 72
Para 6.2

The proposed transmission system layout may be modified slightly so as to interconnect with the Chambal grid the recently installed thermal power plants and those under erection presently, contributing an effective capacity of 34,000 KW.

Rajasthan Electricity Department has pointed out that only about 5000 to 6000 KW is actually available against the 16,500 KW assumed by Committee on Plan Projects from Rajasthan (out of the total of 34,000 KW). The transmission system as sanc-

The team believes that the firm capacity figure of 5000 to 6000 KW quoted by Rajasthan is low and too conservative. The additional investment on the transmission system is justified as it will expedite the utilisation of the available power resources fully.

tioned already inter-connects with thermal stations at Jaipur, Kotah, Indore, Gwalior and Bhopal. Inter-connections with thermal station under erection at Bhilwara, Alwar and Bharatpur have not been provided for in the first stage because of their limited capacities, and inordinately long transmission distances, requiring disproportionately high additional capital outlays.

51 Page 72
para 6.3

At the Gandhi Sagar Power Station, the 5th generating unit for which the penstock pipe has already been provided in the Dam, may be installed. With this installation and in conjunction with the thermal plants, it is possible to meet a system demand upto 1,20,000 KW. The addition of 5th unit not only serves to meet the load demand in the interim period till additional hydro capacity is commissioned in the region, but also provides spare generating capacity for all the 3 hydro-stations, namely, Gandhi Sagar, Ranapratap Sagar and Kotah in the ultimate stage.

Addition of the fifth generating unit at Gandhisagar, without corresponding water potential, and with no utility in the foreseeable future, constitutes an avoidable foreign exchange involvement. In fact, it would be far better to divert the foreign exchange funds required for the fifth unit at Gandhisagar, for installing the first unit at Ranapratap Sagar station, where it would enable additional energy generation.

The main objective of the integrated operation of Gandhi Sagar with the thermal stations is to utilise fully the available power resources in the region before investing money on additional power generating capacity. A sum of over Rupees 2 crores has been invested on the recently commissioned thermal power plants and on the new thermal power stations under construction and these have to be utilised and not kept merely as stand by.

The addition of the fifth generating unit gives a net increase of 17,000 KW which is nearly 75 % of the rated capacity of the unit and is about the maximum output that could be obtained from each unit under minimum reservoir levels. The foreign exchange involved is a fraction of what it would be if the power plant for Ranapratap Sagar is ordered now. It is easier and quicker to install the 5th unit at Gandhisagar rather than the 1st unit at Ranapratapsagar. The 5th unit is of real value in meeting the load demand in the interim period and in enabling the generation of maximum hydro-energy in good years. The firm generating capacity in the inter-connected system is also increased by 17/23 MW and will result in corresponding increase of load carrying capacity in the system.

52 Page 73
para 6.4

By the integrated operation of the Gandhi Sagar Station with the new thermal plants, more thermal generation than now may be necessary but it is possible to minimise it. To begin with, irrigation would not have fully developed.

Initial plant capacity of 4 units of 23,000 KW at Gandhisagar station was decided on the basis of using *all the available waters in the interest of power production*. There can, therefore, be no additional potential (over and above what has already been assessed, during the period of irrigation development) which would be available for reducing thermal generation. For the COPP's proposed scheme of integrated operation with a number of small thermal stations, the fuel costs alone would be of the order of Rs. 1.3 crores *every year*. Besides procurement and transport of the required quantity of 300,000 tons of good quality coal bristles with practical difficulties. Both on grounds of practical feasibility and in the interests of economy, Ranapratap Sagar power scheme should be expedited and not delayed.

The Team's estimate of hydro-energy generation at Gandhisagar prior to full irrigation development is based on the working of the reservoir for the 8-year period from October, 1947 to September, 1955 starting with reservoir full on 1st October, 1947. It is reiterated that the consumption of coal need not be of the order of 300,000 tons *every year*. Supplemental thermal generation would be necessary only in an average or a lean year, depending on the load demand and the load factor. During load-building stage, thermal generation would obviously be not necessary. During the interim period till additional hydro-capacity, is commissioned in the region, the average coal consumption may be only slightly more than what it is at present and the existing transport facilities should be adequate.

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53 73

Also, in the early stages of load development, the system load factor will be lower than 60% and it may be possible to meet the entire load demand by operating 5 units at Gandhisagar power station only. As the system load grows and load factor improves, thermal

No convincing reasons have been given for adopting a lower load factor. This cannot be accepted as a basis for planning particularly in the face of expanding industrial activity. Gandhisagar reservoir has an effective capacity of

If the present restrictions and staggering of loads on the thermal stations of the region are lifted with the advent of hydro power, the load factor will certainly be below 60 per cent and will take some time to improve. With regard to the reservoir operation the basis

support could be brought in gradually. Prior to full irrigation development, keeping the reservoir full (R.L. 1312) at the end of the Monsoon on 1st October and by drawing down the reservoir to as low a level as possible by the end of June and building it up during the Monsoon, it is possible to generate maximum hydro energy. In a good year, there will be no need for thermal generation at all except for about an hour or so per day to meet the peak demand. In years of average or low rainfall it would be necessary to supplement the hydro energy by thermal generation. It is expected that the average coal consumption per annum may not exceed what it would be, say in 1958.

54 Page 73
para 6.5

Another advantage of the integrated operation would be the improvement in the performance of the unusually extensive (about 1,000 miles) transmission network associated with this Project which has an ultimate hydro potential of about 2,00,000 KW in the 3 hydro stations. Normally in a well-developed region this quantum of power would be absorbed in a distance of about 200 miles. It is suggested that the performance of the proposed transmission system may be studied on the Network Anal-

6.17 maft. whereas the average annual inflow during the 7 year period of planning from July, 1947 to June, 1954, is only 3.74 maft. This large storage of 6.17 maft. was provided specifically to enable a method of reservoir operation by which surplus waters available in good years could be stored and carried over for increasing power generation in dry years, thus ensuring constancy of power generation at the maximum level of firm output feasible. No avoidable spills or use of water for irrigation has been assumed, in the pre Rana Pratap Sagar stage. It would therefore be seen that maximum conservation of water has already been planned for.

Network Analyser Studies at Bangalore of the Chambal Transmission system has already been recommended by the Central Water and Power Commission to the State Authorities.

for our recommendation has already been indicated in item No. 54 above.

The design and lay-out of the transmission system should be finalised only after making the Network Analyser Study.

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ysers at the Indian Institute of Science, Bangalore. Based on the results of this study, the design and the lay-out of the transmission system may be suitably modified.

55 Page 73
para 6.6

With a view to economise in the use of steel, the possibility of utilising wood-poles or concrete poles for transmission lines of 66 KV and below may be examined.

Designs of 11 and 33 KV transmission lines with wood poles have already been adopted. The adoption of R.C.C. and wood poles for 66 KV lines would depend mainly on the availability and cost considerations prevailing at the time they are taken up during the second stage.

56 Page 73
para 6.7

The major handicap for the speedy execution of the electrical works appears to be the shortage of technical personnel. It is suggested that the C.W.&P.C. may consider sparing for this Project some officers who, being familiar with the Designs, could be of help to accelerate executions in the field.

No comments

Madhya Pradesh:

It may be mentioned in this connection that the Technical Man-Power Committee of the State has taken action in connection with the shortage of technical personnel on the electrical side not only in the Chambal Organisation but in other organisations of the State dealing with electrical projects. To meet this shortage the immediate action that the Government has taken is to sanction opening of more Polytechnic Institutes in the State which will impart training in Electrical Engineering. In addition to this, the Government have

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57 Page 73
para 6-8

For deriving early and maximum benefits from the sale of power that will be developed by the Chambal Project in successive stages of its construction, it is essential that the State Electricity Boards of Madhya Pradesh and Rajasthan should co-operate very closely and plan on the full utilisation of the hydro power as it becomes available, based on short-term power sales understandings between the two Electricity Boards. Power should be utilised fully by whichever administration is ready to do so and the programme should not be impeded by a literal inter-

It is expected that the transmission lines in Rajasthan are also likely to be ready in time. The Control Board in any case should be able to take care of the contingency anticipated by C.O.P.P.

also agreed to increase the number of candidates to be admitted into the existing institutions imparting Civil and Electrical Engineers training. This will, however, improve the position in years to come. For the present, however, the gap between the personnel required and the existing strength has been filled up through the selections by the Public Service Commission. The response to the advertisement made by the Public Service Commission was quite encouraging. This shows that while it is difficult to find experienced technical personnel, the junior staff can be obtained without much difficulty.

Rajasthan: No comments

Madhya Pradesh: Sharing of Power. The apprehension of the Team in regard to the difficulty likely to arise in utilising the power in two States has been already answered by the Chambal Control Board, who expect that the transmission lines in both the States would be ready in time.

As regards utilization of power within the State it may be mentioned that the State Government had appointed a Committee to examine and recommend a plan. The Committee's report is since available and is under further examination by a Committee

pretation of the Agreement that the power available should be shared equally between Madhya Pradesh and Rajasthan. Power may be made available for all consumers who can make effective use of it irrespective of where they are whether in Madhya Pradesh or in Rajasthan. Such a load-building programme will keep the total power generating facilities fully loaded all the time and will facilitate early and profitable construction of the Ranapratap Sagar power Stations and other power stations down below.

of technical officers of all the concerning Departments including the Electricity Board,
Rajasthan: No Comments.

VII—WORKS NEEDING URGENT ATTENTION

58 Page 74
 Para 7.1

Transmission Lines.—Transmission lines both in Madhya Pradesh and in Rajasthan need immediate attention regarding procurement of materials and erection of sub-stations so as to obtain the benefits of power soon after the plant is ready for operation. **No comments**

Accepted.

59 Page 74
 Para 7.2

Earthen Section of Kotah Barrage
 The Kotah Barrage including erection of gates has to be completed by 1959. Uptill now progress on earthen dam portions of the barrage is practically nil. In order to complete the same by June 1959, very special efforts **No comments**

Madhya Pradesh: No Comments.
Rajasthan
Earthen section of Kotah Barrage
 The final designs have been settled and action has been taken to plan construction accordingly. The extra staff required has already been sanctioned by the Board.

Do.

and care are necessary in providing the filters, clay grouting of foundation, and placing bleeder wells. A very careful schedule is considered imperative in view of the necessity to complete all the foundation works before the commencement of coming monsoon and the entire earth work, during the next working season before the Monsoon of 1959.

60 Page 74 *Radial Gates:*
Para 7.3 Control Board should arrange No comments
for the necessary agency to watch the progress of fabrication of these gates at various stages to see that every item in the schedule is adhered to and the target achieved and also, in case of short fall, if any, to get the schedule revised in time so that the work may not be extended beyond March, 1959.

Madhya Pradesh : No comments.
Rajasthan
Erection of gates on Kotak Barrage Do.
The Board has sanctioned extra staff to act as liaison between the Project Authority and the Tungabhadra workshops but the officers have not yet joined as the terms of their deputation are still under correspondence with the Central Government.

61 Page 74 *Field Channels:*
Para 7.3 Finalising at an early date the No comments
policy in regard to the excavation of field channels already stated is urgently needed.

Do.

KOTAH-BUNDI (RAJASTHAN)

Showing location of wells and water tables

Sl. No.	No. as shown in map	Name of the well	Village	Tehsil	Summer water table ft.	Monsoon water table ft.	Fluctuation of water table ft.
1	2	3	4	5	6	7	8
	16		Mandania	Ladpura	30	G.L. (General level)	30
2	27	Raj ka kuwa	Dhakarheri	do.	20	C.L.	20
3	33	Jagannath ka Kuwa	Bari Polai	Digod	36	7	29
4	35	Nawal ka kuwa	Char	do.	35	6	29
5	37	Bhanwarlal ka kuwa	Degaria	do.	35	8	27
6	40	Khar ka kuwa	Sholi	do.	12	..	5
7	48	Keopura ka kuwa	Deopura	do.	20	8	12
8	49	Khara kuwa.	Chhoti polai	do.	45	8	37
9	54	..	Bhonra	do.	12	8	4
10	56	Devilal ka kuwa	Kalyanpura	do.	24	6	18
11	57	Kalyan ka kuwa	Ukalda	do.	16	8	8
12	58	Mali ke kuwa	Parasalia	do.	5	2	3
13	59	Baba ka kuwa	Khacholia	do.	10	3	7
14	60	Baria kuwa	Bhagtari	do.	..	3	7
15	64	Bhowaral ka kuwa	Toran	do.	11.5	5	6.5
16	65	Chanwari ka kuwa	Chanwari	do.	30	10	20
17	66	Gaon ka kuwa	Darbiji	do.	25	10	14
18	67	..	do.	do.	25	10	15
19	70	..	Jhopri	do.	33	9	24
20	72	Kiwri ke kuwa	Sarola	do.	19	4.5	14.5
21	73	Kherli ka kuwa	Kherli	do.	16	4	12
22	74	Mali ka kuwa	Amapura	do.	6.5	4.5	2
23	75	Motilal ka kuwa	Napahera	do.	6	G.L.	6
24	76	Ramilal ka kuwa	do.	do.	7	4	3
25	77	Motilal ka kuwa	do.	Barod	25	G.L.	25
26	82	Mathura ka kuwa	Kinshanganj	do.	21	4	17
27	86	Narain ka kuwa	Dugari	Antah	..	24	..
28	88	Manu ka kuwa	Gopalpura	do.	20	4	16
29	105	Shivlal ka kuwa	Mundla	Mangrol	24	8	16
30	106	Gaon ka kuwa	Mundli	Etawa	22	9	13
31	112	Dhulilal ka kuwa	Parlia	Mangrol	13	9	4
32	115	..	Batwara	do.	13	8	5
33	121	Amarlal ka kuwa	Borda	do.	34	3	31
34	123	Manna ka kuwa	..	do.	20	9	11

1	2	3	4	5	6	7	8
35	124	Gordhan ka kuwa . . .	Moa	Mangral	27	8	19
36	125	Moa	do.	27	10	17
37	127	Khara kuwa . . .	Gorigaon	Antali	47	G.L.	47
38	128	Mura ka kuwa . . .	Baragaon	do.	12	1	11
39	133	Bhoja ka kuwa . . .	Pakalkhera	do.	19	4	15
40	145	Raj ka kuwa . . .	Kumari	Etawa	18	8	10
41	146	Darilal ka kuwa . . .	do.	do.	32	6	26
42	148	Raj ka kuwa . . .	Ganeshpura	do.	30	10	20
43	151	do. . .	Shrinal	Mingrol	45	9	36
44	162	do. . .	Dhaneri	Etawa	21	4	17
45	163	do.. . .	Kherli deo	do.	21	7	14
46	165	do. . .	Lunwara	do.	21	7	14
47	167	do. . .	Ganeshpura	do.	20	10	10
48	172	Govt. ka kuwa . . .	Kishanpura	do.	14	4	10
49	178	Raj ka kuwa . . .	Sobhagpura	do.	18	2	16
50	179	Laxminarain ka kuwa . . .	Rajopa	do.	..	8	..
						(diggies)	
51	184	Panchayat ka kuwa . . .	Sanmanpura	do.	..	8	..
						(diggies)	
52	185	Leshav ka kuwa . . .	Ganeshkheri	do.	..	7	..
						(diggies)	
53	186	Dhalilal ka kuwa . . .	do.	do.	24	10	14
54	188	..	Hatoli	do.	30	9	21
55	189	Chitar ka kuwa . . .	Ardana	Patan	21	4	17
56	191	Seth ka kuwa . . .	Deopura	Bundi	30	2	28
57	192	Bala ka kuwa . . .	Manturda	do.	18	G. L.	18
58	194	Harikishan ka kuwa . . .	Hingonia	Patan	10	1	9
59	195	Ghansi ka kuwa . . .	Chadgaon	Patan	14	G.L.	14
60	207	Bhinji ka kuwa . . .	Bhairupura	Bundi	14	7	7
61	208	Sitaram ka kuwa . . .	do.	do.	15	8	7
62	209	Phundalal ka kuwa . . .	Jaripura	do.	15	2	13
63	211	Dhulai ka kuwa . . .	Samarlia	do.	14	2	12
64	212	..	Rampura	do.	17	5	12
65	213	Bad ka kuwa. . .	Rampura	do.	16	G.L.	16
66	219	Bumaji ka kuwa . . .	Ladpura	Talora	9.5	5	4.5
67	220	..	Sanwasa	do.	8.5	6.5	5.5
68	221	..	do.	do.	10.5	5.5	5
69	223	Patwari ka kuwa . . .	Lesarda	Talora	10.5	3	7.5
70	224	Dhali ka kuwa . . .	Bundi Rd.	Patan	15	7.7	8
71	225	Ganesh ka kuwa . . .	do.	do.	12	4	8
72	226	Panchayat ka kuwa . . .	do.	do.	13.5	3.5	10
73	228	Dhanna ka kuwa . . .	Hatnapura	do.	18	G. L.	18
74	229	Bardha ka kuwa . . .	Bindia	do.	13.5	5	8.5
75	230	Bara ji ka kuwa . . .	Jaloda	do.	12	9	3
76	231	Sukha ka kuwa . . .	Arnetha	do.	12.5	G.L.	12.5
77	232	Kalu ka kuwa . . .	do.	do.	12	4	8
78	233	Kalyan ka kuwa . . .	do.	do.	15	4	11
79	235	Phundilal ka kuwa . . .	Chhaparda	Bundi	27	10	17
80	244	Gopilal ka kuwa . . .	Haripura	do.	12	6	6

1	2	3	4	5	6	7	8
81	245	Kapurchand ka kuwa	Nayagaon	Bundi	12	6	6
82	246	Teja ka kuwa	do.	do.	13	5	8
83	247	Jogannath ka kuwa	do.	do.	15.5	6	9.5
84	248	Kesar Singh ka kuwa	Kagren	Patan	12	4	8
85	249	Haldia ka kuwa	Kapran	do.	9	6	3
86	250	Motilal ka kuwa	Chadgaon	do.	20	5.5	14.5
87	253	Panchayat ka kuwa	Darawan	do.	22.5	7	15.5
88	269	Am ka kuwa	Hatoli	Etawa	15	7	8
89	270	Samil ka kuwa	Sammanpura	do.	10	4.5	5.5
90	271	Dhakar ka kuwa	Barda	do.	26	G.L.	26
91	275	Kakankar ka kuwa	Sumerpur	Pipalda	40	10	30
92	281	Mali ka kuwa	Kajalia	do.	24	5	19
93	282	do.	Laxmipura	do.	22	5	17
94	283	Gaon ka kuwa	Mundli	Etawa	22	8.5	13.5
95	287	Amli ka kuwa	Raithal	Mangrol	29	9	20
96	288	Chamar ka kuwa	Pakal	do.	15	G.L.	15
97	290	Raj ka kuwa	Raingarh	do.	18	9	9
98	292	Khatai ka kuwa	Siswali	do.	12	5	7
99	293	Boraji ka kuwa	Sorkhand	Anta	26	6	20
100	294	Ugnia ka kuwa	Simli	do.	20	G.L.	20
101	296	Naya kuwa	Chainpura	do.	13	8	5
102	297	Onkar ka kuwa	Gopalpura	do.	20	4	16
103	298	Pilya kuwa	Molki	do.	26	7	19
104	299	..	Between Batwara & Chainpura	do.	20	G.L.	20
105	300	Ravanji ka kuwa	Anta	do.	25	3	22
106	301	Ramji ka kuwa	Palkasa	do.	35	5	30
107	302	Jankilal ka kuwa	Daori	do.	25	8	17
108	303	Ugania ka kuwa	Bamulia	do.	13	3	10
109	305	Kharia ka kuwa	Gorigaon	do.	47	G.L.	47
110	306	Amli ka kuwa	Bhoran	Digod	20	4	16
111	307	Dhakar ka kuwa	Kherli	do.	12	2	10
112	308	Amba ka kuwa	Dabar	Barid	30	8.5	21.5
113	309	Ramnarain ka kuwa	Atton	do.	20	9	11
114	310	Dhakar ka kuwa	Kishorpurā	do.	20	5	15
115	311	Ramkumar ka kuwa	Champakhera	do.	15	3	12
116	312	Virdha ka kuwa	Morapa	do.	18	3	15
117	313	Dhakar ka kuwa	Borkhera	do.	20	3	17
118	314	Balaji ka kuwa	Dhanwa	do.	16	10	6
119	315	Boraji ka kuwa	Kanwarpurā	Digod	35	8.5	26.5
120	316	Bajrang ka kuwa	Mandi	do.	9	2	7
121	317	Mukshiji ka kuwa	Pempura	do.	16	5	11
122	318	Kalyansingh ka kuwa	Surala	do.	15	3	12
123	319	Pirji ka kuwa	Notara	Barod	18	4.5	13.5
124	321	Panchayat ka kuwa	Bantja	do.	15	4	11
125	322	Chhatariwala ka kuwa	Kishanganj	do.	30	1	29
126	324	Badrilal ka kuwa	Budadit	do.	15	4	11
127	328	Kiwari ka kuwa	Haripura	Digod	25	7	18
128	329	Baman ka kuwa	Kherli	do.	22	2	20

D26-271RC, 14077
57259 JB-1

1	2	3	4	5	6	7	8
129	330	Jagnnath ka kuwa	Morapa	Digod	22	6.5	15.5
130	331	Pannalal ka kuwa	Ukalda	do.	15	1	14
131	332	Radha Kishan ka kuwa	Kherli	do.	13	7	6
132	333	Dhakar ka kuwa	Daba	do.	30	5	25
133	334	Mera ka kuwa	Rel.	do.	20	5.5	14.5
134	335	Raghumali ka kuwa	Simali	do.	15	3	12
135	336	Purilal ka kuwa	Nayagaon	do.	15	G.L.	15
136	337	Kalu wali ka kuwa	do.	do.	18	G.L.	18
137	339	Jyotishiji ka kuwa	Dungarja	do.	40	10	30
138	340	Sark ka kuwa	Raipur	Ladpura	7	3	4
139	341	Gela ka kuwa	Nethun	do.	28	2	26
140	345	Arania Patel ka kuwa	Arnia	do.	27	10	17
141	348	Chargela ka kuwa	Padla	do.	13	3	10
142	353	Mali ka kuwa	Bhojpura	do.	24	10	14
143	354	Dholaram ka kuwa	Mohra	do.	17	G.L.	17
144	355	Farm ka kuwa	Borkhera	do.	22	3	19
145	356	Ganeshpura Mana ka kuwa	Ganeshpura	Bundi	29	5.5	23.5
146	357	Mali ka kuwa	Onkarpura	do.	34	G.L.	34
147	358	Pipalia ka kuwa	do.	do.	30	G.L.	30
148	359	Kalyan ka kuwa	Bherupura	do.	25	7	18
149	361	Babaji ka kuwa	Hirapura	Patan	27	10	17
150	371	Kan Singh ka kuwa	Adila	Barana	15	G.L.	15
151	372	Gopal ka kuwa	Borda	Patan	30	G.L.	30
152	373	Harkishan ka kuwa	Hingonia	do.	9	1	8
153	374	Radha kishan ka kuwa	do.	do.	10	1	9
154	375	Ghasi ka kuwa	Chadgaon	do.	14	G.L.	14
155	376	Kalal ka kuwa	Gurjani	do.	8	G.L.	8
156	377	Ramkishan ka kuwa	do.	do.	20	5	15
157	378	Gujaraon ka kuwa	Arnia	do.	19	2	17
158	379	Ganeshilal ka kuwa	Chardana	do.	24	4.5	19.5
159	380	Chitra ka kuwa	Ardana	do.	21	4	17
160	384	Shiv Singh ka kuwa	Kodika	do.	18	G.L.	18
161	385	Lata ka kuwa	Ordi	do.	15	4	11
162	387	Sitwala ka kuwa	Deopura	Bundi	30	2	28
163	388	Bola ka kuwa	Matunda	do.	18	G.L.	18
164	389	Brahman ka kuwa	Jawti Choti	do.	28	4.5	23.5
165	390	Khati ka kuwa	Kunwanti	do.	40	1	39
166	393	Bhagwan ka kuwa	Govindpura	Ladpura	30	9	21
167	394	Mina ka kuwa	Balop	Talera	15	4.5	10.5
168	397	Naya kuwa	Gumanpura	do.	30	G.L.	30
169	398	Joshi ka kuwa	Chhatrapura	Bundi	30	2	28
170	401	Gomat sa kuwa	Sidari	Patan	15	G.L.	15
171	402	Mali ka kuwa	Chatawa	do.	15	8	7

These samples have been collected from the whole of the commanded area and most of the wells as not located near the standing water or running streams.

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⁵⁻⁴⁻⁵⁸
Agricultural Chemist, Rajasthan.

NOTE.—61 wells with water level at 3' or less, 28 wells with water level at ground level.

GMGIPND—L—14 PC—10-5-58—2,000.