Indus Basin Dispute — Historical background information

(3)

210-08

GOVERNMENT OF INDIA

MINISTRY OF HOME AFFAIRS

DESCRIPTIVE MEMOIR

OF

PLANNING COMMISSION

June, 1951

PRINTED IN INDIA BY THE MANAGER GOVERNMENT OF INDIA PRESS SIMLA, 1951.

DESCRIPTIVE MEMOIR

OF THE

PLANNING COMMISSION

(As on 30th June, 1951)

The Planning Commission was established by a Resolution of the Government of India dated March 15, 1950. It commenced work on March 28, 1950.

I.—Functions

The terms of reference of the Commission are :—

(1) to make an assessment of the material, capital and human resources of the country, including technical personnel, and investigate the possibilities of augmenting such of these resources as are found to be deficient in relation to the nation's requirements ;

(2) to formulate a Plan for the most effective and balanced utilisation of the country's resources ;

(3) on a determination of priorities, define the stages in which the Plan should be carried out and propose the allocation of resources for the due completion of each stage ;

(4) to indicate the factors which are tending to retard economic development, and determine the conditions which, in view of the current social and political situation, should be established for the successful execution of the Plan ;

(5) to determine the nature of the machinery which will be necessary for securing the successful implementation of each stage of the plan in all its aspects ;

(6) to appraise from time to time the progress achieved in the execution of each stage of the Plan and recommend the adjustments of policy and measures that such appraisal may show to be necessary ; and

(7) to make such interim or ancillary recommendations as appear to it to be appropriate either for facilitating the discharge of the duties assigned to it ; or on a consideration of the prevailing economic conditions, current policies, measures and development programmes ; or on an examination of such specific problems as may be referred to it for advice by Central or State Governments.

II.—Services actually rendered by the Commission

The Commission has been assisting the Central Government, and, where necessary, individual Ministries and States Governments with advice on matters of general policy. Its main task, however, has been to undertake studies on the line indicated to its terms of reference with a view to the formulation of a national plan. The Commission has presented the First Five Year Plan in draft outline. The Plan covers the period 1951-52 to 1955-56.

III.—General Description of the Commission

The Commission is an Advisory body. It makes recommendations to the Cabinet. It works in close understanding and consultation with the Ministries of the Central Government and the Governments of the States. The responsibility for taking decisions and their implementation rests with the Central and the States Governments.

The composition of the Commission is as follows :—

CHAIRMAN	..	**Shri Jawaharlal Nehru.**
DEPUTY CHAIRMAN	..	**Shri Gulzarilal Nanda.**
MEMBERS	..	**Shri V. T. Krishnamachari.**
		Shri G. L. Mehta.
		Shri C. D. Deshmukh.
		Shri R. K. Patil.
SECRETARY	..	**Shri N. R. Pillai.**
DEPUTY SECRETARY	..	**Shri Tarlok Singh.**

M431MofHA

IV.—Description of the Secretariat Organisation

The Commission is organised into two Secretariat Branches for Administration and Co-ordination and Six Divisions. The Divisions are as follows :—

1. Resources and Economic Survey ;
2. Finance ;
3. Industry, Trade and Communication ;
4. Food and Agriculture ;
5. Development of Natural Resources ; and
6. Employment & Social Services.

There is also a Section dealing with Development Plans.

The Members of the Commission work as a body, but for convenience each Member has charge of a Division and directs the study of problems dealt within the Division. The Economic and Finance Divisions are under one Chief and the Employment and Social Services have two Assistant Chiefs but no Chief of Division. The other Divisions have a Chief and an Assistant Chief each. Assistant Chiefs attached to the Industries and Natural Resources Divisions have since been transferred and the Divisions are now controlled by the Chiefs direct. The Chief and the Assistant Chief of a Division are assisted as a rule by staff comprising four Research Officers and four junior Investigators. Details of the staff are shown in Appendix 'I'.

The strength of the Senior and Junior Administrative Officers, the Ministerial Staff and other categories of posts as on 30th June, 1951 is given below :—

(*All the posts are temporary*)

Senior Administrative Officers	
Secretary	1
Deputy Secretary	1
Junior Administrative Officers	
Under Secretaries	2
Ministerial Establishment	
Superintendents	2
Assistants-in-Charge	2
Assistants	12
Clerks	29
Stenographers (including Personal Assistants)	26
Other Categories of Staff	
Chief of Division	4
Assistant Chief of Division	4
Officer on Special Duty	1
Research Officer	19
Economic Investigator (Gr. I)	2
Economic Investigator (Gr. II)	20
Private Secretary to Deputy Chairman & Members	5
Librarian	1
Senior Artist (Draftsman)	1

An Administrative Chart showing the organisation and functions of the various branches and divisions is attached as Appendix 'I'.

V & VI.—Description of attached and Subordinate Offices

There are no attached or subordinate offices under the Commission.

VII.—Arrangement for Co-ordination

The Planning Commission is in close contact with the Ministries of the Government of India concerned with development subjects. It has established a procedure for consultation and for co-ordination of its work with the various Ministries of the Government of India. In the States, at the suggestion of the Planning Commission, suitable machinery at Secretariat level for Planning has been set up. As a rule, this consists of an inter-departmental committee of Secretaries. One of the Secretaries has been appoined as Secretary for Planning and acts as Chairman. In most States, the Committee works under the direction of the Chief Minister.

VIII.—External Relations

There is a Planning Commission Advisory Board, consisting, for the greater part, of persons nominated by associations connected with Commerce, Industry and Labour, and other associations in the technological and socio-economic field. The list of the Members of the Advisory Board is given in Appendix 'II'.

With a view to securing the association of officials and non-officials who have special knowledge and experience in their respective fields in the work of the Planning Commission and with the object of obtaining their constant help and advice, the Planning Commission has also constituted a number of Panels on different subjects. A List of the Panels to be set up is given in Appendix 'III'. Those already set up are shown with an asterisk. For planning in the field of industry consultations are arranged from time to time with representatives of different industries.

IX. Abstract of Establishment

Senior Administrative Officers	2
Junior Administrative Officers	2
Ministerial Establishment	71
Other categories of staff	57

X.—Financial

The total expenditure incurred by the Planning Commission during the year 1950-51 was Rs. 8,40,281 distributed as follows :—

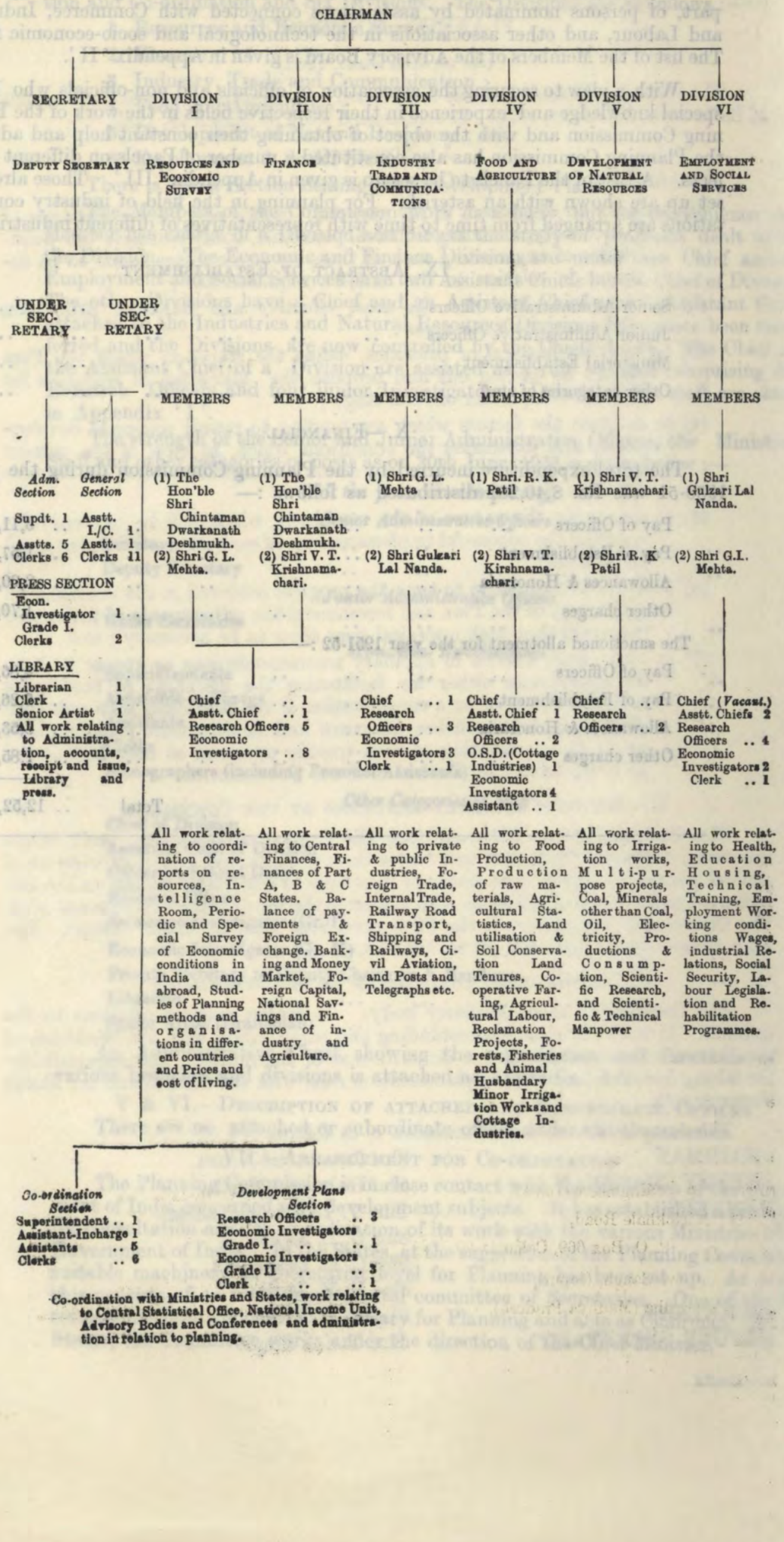
Pay of Officers	3,11,719
Pay of Establishment	1,57,682
Allowances & Honoraria	2,00,529
Other charges	1,70,351

The sanctioned allotment for the year 1951-52 :—

Pay of Officers	4,86,100
Pay of Establishment	2,26,900
Allowances & Honoraria	3,53,900
Other charges	1,85,200
Total	12,52,100

APPENDIX I.

Administrative Chart showing the set up of the Planning Commission as on 30th June, 1951



APPENDIX II

List of Members of the Planning Commission Advisory Board

1. Prof. D . R. Gadgil,
   Director, Gokhale School of Economics,
   Poona-4.
2. Shri Manu Subedar,
   Kodak House, Hornby Road, Bombay.
3. Dr. J. C. Ghosh,
   Director, Indian Institute of High Technology,
   6, Esplanade East, Calcutta.
4. Shri Shri Ram,
   Chairman, Industrial Finance Corporation of India,
   Parliament House, New Delhi.
5. Dr. Zakir Hussain,
   Vice-Chancellor, University of Aligarh, Aligarh.
6. Professor C. N. Vakil,
   School of Economics and Sociology, University of
   Bombay, Bombay.
7. Dr. C. G. Pandit,
   Secretary, Indian Council of Medical Research,
   New Delhi.
8. Dr. V. K. R. V. Rao,
   Director, Delhi School of Economics,
   University of Delhi, Delhi.
9. Associated Chamber of Commerce of India,
   Royal Exchange Place,
   Calcutta. — Mr. W. H. J. Christie.
10. Hind Mazdoor Sabha,
    Mumbai Marathi Grantha Sangrahalaya,
    Bombay-2. — Shri Asoka Mehta,
    General Secretary.
11. Indian National Trade Union Congress,
    17, Queensway, New Delhi. — 1. Shri Khandubhai K. Desai.
    2. Shri Suresh Chandra Banerjee.
12. All-India Manufacturers' Association,
    Industrial Assurance Building,
    Church Gate, Fort, Bombay. — Shri Hans Raj Gupta.
13. Federation of Indian Chambers of Commerce
    & Industry, 28, Ferozeshah Road,
    New Delhi. — 1. Shri B. M. Birla.
    2. Shri Dharmsey Khatau, &
    3. Shri Tulsidas Kali Chand.
14. Indian Society of Agricultural Economics,
    46/48, Esplanade Mansion,
    Mahatma Gandhi Road,
    Bombay. — Shri Manilal Nanavati,
    President.
15. Institute of Engineers (India),
    8, Gokhale Road,
    P. O. Box 669, Calcutta-20. — Shri N. V. Modak.
16. Serva Sewa Sangh, Gopuri,
    Wardha (Madhya Pradesh). — Shri J. C. Kumarappa.
    Shri Anna Sahib Sahasrabuddhe.

APPENDIX 'III'

PROPOSED LIST OF PANELS OF THE PLANNING COMMISSION ADVISORY BOARD

Industry, Trade and Communications

1. Industry.*
2. Transport.*
3. Commerce.*
4. Technical consultants.*

Food and Agriculture

5. Agriculture.*
6. Cottage Industries.*

Development of Natural Resources

7. Irrigation and Power.
8. Coal and Minerals.*
9. Scientific & Technical Manpower.

Employment and Social Services.

10. Labour and Employment.
11. Health Programmes.*
12. Education Programmes.
13. Housing.*
14. Social Welfare.*

*These have already been set up

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REPORT

OF A COMMITTEE OF THE CENTRAL BOARD OF IRRIGATION ON

DISTRIBUTION OF THE WATERS

OF THE

INDUS AND ITS TRIBUTARIES

1st to 8th March 1935
17th to 20th June 1935

VOLUME I

Final Report

(For official use only)

Lahore
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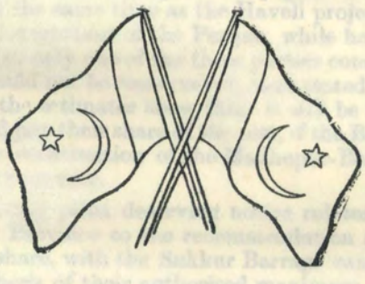

Lahore
PRINTED BY THE SUPERINTENDENT, GOVERNMENT PRINTING, PUNJAB
1950

No. I.R.-18

GOVERNMENT OF INDIA

DEPARTMENT OF INDDUSTRIES AND LABOUR

PUBLIC WORKS BRANCH

Dated New Delhi, the 30th March 1937.

From

S. N. ROY, Esq., C.I.E., I.C.S.,

Joint Secretary to the Government of India.

To

THE SECRETARY TO THE GOVERNMENT OF THE PUNJAB, PUBLIC WORKS DEPARTMENT, IRRIGATION BRANCH.

Subject :—Distribution of the waters of the Indus and its tributaries

SIR,

I AM directed to refer to the correspondence ending with your No. 12/Con., dated the 4th January 1937, and to communicate the orders and observations of the Government of India on the recommendations of the Committee on the distribution of the waters of the Indus and its tributaries.

2. The Government of India have given careful consideration to the report of the Committee and to the views expressed thereon by all the parties concerned, and they are now in a position to issue the orders which are embodied in a statement appended to this letter and which cover the various recommendations of the Committee. The orders generally confirm the recommendations of the Committee and I am to express the satisfaction of the Government of India that it has been found possible to secure agreement on all the major issues covered by the Committee's report and thereby to render possible an allocation of the waters of the Indus and its tributaries which should prove beneficial to all the parties interested in the maintenance and development of irrigation in the Indus valley. I am at the same time to refer to a few points affecting some of the recommendations of the Committee in regard to which questions of an important nature have been raised by some of the parties concerned.

3. Firstly, the recommendations of the Committee regarding the method of allocation of supplies between the Haveli and Panjnad Canals, from the Chenab river, gave rise to a considerable amount of controversy between the Governments of the Punjab and Bahawalpur. A satisfactory agreement has now been reached between them and the terms of the settlement have been incorporated under item 7 in the statement of orders appended to this letter. In view of this mutual agreement, the recommendation recorded in item 8 ceases to have any force.

4. Secondly, certain suggestions were made by the Governments of the Punjab and Bahawalpur for the utilization of extra water in the Chenab and the main Indus at times when there was a surplus at Sukher, but in certain contingencies not covered by the Committee's recommendations. A mutual settlement has been arrived at between the parties concerned the terms of which have been embodied under item 9 in the statement of orders.

5. Thirdly, the Bahawalpur Government stipulated as an essential condition of their assent to the Committee's recommendations that a link from the Ravi to the Beas known as the Madhopur-Beas link and referred to in paragraph 53 on page 25 of Volume I of the Committee's report, should be constructed about the same time as the Haveli project, if it were found to be remunerative to Bahawalpur. The Government of the Punjab, while holding that it would be unreasonable to insist on remunerativeness to only one of the three parties concerned as the sole factor for deciding whether the link should or should not be constructed, have stated definitely that they are prepared to proceed with the scheme, as the estimates show that it will be remunerative as a whole, and that they will construct the link and pay their share of the cost, if the Bahawalpur and Bikaner Durbars also consent The question of the construction of the Madhopur-Beas link has, and therefore, been settled in an eminently satisfactory manner.

6. The remaining point deserving notice relates to an objection of the Government of the North-West Frontier Province to the recommendation of the Committee that the Paharpur and the Thal system should share, with the Sukkur Barrage canals, the supplies available during any period of shortage, on the basis of their authorised maximum withdrawals. This recommendation of the Committee has been accepted by the parties, except the North-West Frontier Province Government who state that the Paharpur Canal, sanctioned in 1905, was allotted a supply of 604 cusecs and that, as this canal is on a par with the older canals of the Punjab, the supply of 604 cusecs allotted to it should not be interfered with. In this connection I am to point out that the Committee have recommended, and all parties have accepted, that the Paharpur canal should have an authorized maximum discharge of 875 cusecs in *Kharif* and 700 cusecs in *Rabi* with mean discharge of 500+360 cusecs respectively. It appears from item 3 of the Summary of Findings and Recommendations in Volume I of the Commiittee's report that these are the supplies asked for by the North-West Frontier Province Government and it will also be observed from paragraph 20 of the Committee's report that only in exceptional years would be total requirements of the Paharpur, the Thal and the Sukkur Barrage Canals exceed the supplies available and that any deficiency of supply even then would ordinarily be so small as to create no difficulty.

In these circumstances, the Government of India do not see any reason to depart from the recommendations made by the Committee for the allocation of supplies for the Paharpur Canal, and they have, therefore, confirmed the findings of the Committee in this respect.

7. These orders considerably modify the terms of the Tripartite agreement of 1920 between the Punjab, Bahawalpur and Bikaner Governments and it will be necessary to draw up revised formal

agreements. I am accordingly to ask the Government of the Punjab to take early steps for the framing of agreements, in consultation with the Governments of Bahawalpur and Bikaner, to whom a copy of this letter is being forwarded through the usual official channel. I am to add that in submitting their comments on the recommendations of the Committee, the Bahawalpur Government proposed that the Sutlej Valley Agreement of 1920 should on revision be replaced by two agreements between the partners in the Sutlej Valley Project, covering the Sutelj and Panjnad river system, respectively. The Government of India have given careful consideration to this proposal and to the views of the other parties concerned, and they are pleased to approve in principle the proposal for preparing separate agreements to cover the Sutlej and the Chenab rivers and would leave the details for the mutual consideration of the parties while drafting the Agreements.

8. Similarly, the relations between the Government of Sind and the Khairpur State will be regulated by a formal agreement, but this will be preceded by arbitration proceedings to determine the conditions on which the Khairpur State participates in the Sukkur Barrage Project and a separate communication on this subject will be made to the parties concerned in due course.

9. Finally, I am to observe that it is possible, and even probable, that while drafting the agreements made necessary by these orders, or in giving effect to them, various minor points will arise which are not specifically covered by these orders or by the recommendations of the Indus Committee. The Government of India, however, trust that the parties concerned will approach problems of this nature in the spirit of mutual accommodations which have enabled agreement to be reached on the recommendations of the Indus Committee, and that they will settle them in consonance with the main frame work of its recommendations and with due regard to the requirements of the parties intere sted in the distribution of the waters of the Indus and its tributaries.

I have the honour to be,

Sir,

Your most obedient servant,

S. N. ROY

Joint Secretary to the Government of India

Orders of the Government of India on the recommendations of the Committee on the distribution of the waters of the Indus and its tributaries. The recommendations are numbered according to the summary of Findings and Recommendations on pages 29—31 of Volume I of the Report of the Committee.

Serial No. of findings or recommendations.	Substance	Orders and remarks where necessary
1	Khairpur State—Introduction of perennial irrigation and settlement of mean withdrawals.	The Government of India confirm the recommendation of the Committee. This will be followed by (a) arbitration to determine the conditions on which the Khairpur State participates in the Lloyd (Sukkur) Barrage Project, and (b) the execution of a formal agreement between Government and the Khairpur State specifying the rights and liabilities of the parties.
2	British Sind Canals—Revision of authorised withdrawals.	The Government of India confirm the recommendation of the Committee.
3	Paharpur Canal—Allotment of discharges.	Ditto.
4	Thal Canal—Settlement of mean and maximum withdrawals.	Ditto.
5	Shares of Thal and Paharpur systems in relation to Sukkur Barrage during times of shortage.	The Government of India confirm the recommendation of the Committee.
6	Panjnad Canal—The Panjnad Canal should be allowed to draw off any water arriving at Panjnad Weir up to the withdrawals specified.	The Government of India confirm the recommendation of the Committee. This order and those on items 7—11 below will be followed by modification of the Tripartite Agreement of 1920.
7	Haveli Canal—(*a*) Rights of Haveli and Panjnad Canals in the event of shortage in the Indus proper. (*b*) Rights of Haveli Canal to water above Trimmu.	The Government of India confirm recommendation (*a*) of the Committee and recommendation (*b*) subject to the following provision which have been agreed upon between the Governments of the Punjab and Bahawalpur:— (*i*) If there is not sufficient water to give the Haveli and Panjnad Canals the full authorized discharges specified by the Committee, *in any month* excepting November the water should as far as is physically possible, be shared between them in proportion to their authorised discharges at the time. (*ii*) During any period of short supplies, after the Haveli Canal has been constructed, the pond level above the Trimmu weir shall not be raised above its existing level at the time if thereby the supply of the Panjnad Canal should be reduced below its authorised discharge. (*iii*) All closures of the Panjnad canal shall be fixed in consultation with the Chief Engineer, Bahawalpur, as also a programme for sharing water during periods of shortage.
8	Arbitration on method of allocating supplies for Haveli and Panjnad Canals.	A mutual agreement having been reached by the Punjab and Bahawalpur Governments, in regard to sharing supplies in periods of shortage as indicated in item 7, this recommendation lapses.

Serial No. of findings or recommendations.	Substance	Orders and remarks where necessary
9	Distribution of excess supplies between Thal, Haveli and Panjnad systems, when there is surplus water at Sukkur	The Government of India confirm the recommendation of the Committee with the following further provisions which have been agreed upon between the Governments of the Punjab and Bahawalpur and which apply only when there is surplus water at Sukkur. (*i*) If there is no surplus water in the Chenab and Panjnad rivers, the Thal Canal should not be deprived of additional withdrawals because water is not available in the Chenab or Panjnad river to give similar additional supplies to the Haveli and Panjnad Canals. Similarly the Haveli and Panjnad Canlas may share surplus water in the Chenab even if there is no surplus water in the Indus to give similar additional supplies to the Thal canal. (*ii*) Until the Thal canal is constructed the Panjnad and Haveli canals may share any surplus water in the Chenab in accordance with their authorized discharges for the periods concerned. Until the Haveli canal is built such surplus water may be utilized by the Panjnad canal, on the clear and definite understanding that this arrangement is purely temporary and will confer no prescriptive rights.
10	Gharra reach of the Sutlej river-redistribution of supplies.	The Government of India confirm these recommendations of the Committee, subject to the following further provisions which have been agreed upon between the Governments of the Punjab, the Bahawalpur and Bikaner:–
11	Limits of Kharif *period* ..	The Government of India confirm the recommendation of the Committee.
12	Priority of claims– (Every agreement should contain a clause in accordance with which it can be reviewed when circumstances prove that the agreement is no longer equitable).	This recommendation has aroused the apprehensions of the three parties to the Sutlej Valley Project and the Government of India consider that no review clause need be insisted upon in irrigation agreements.
13	Basis of allocation of irrigation waters	The Government of India confirm these recommendations of the Committee.
14	Water table survey ..	
15	Discretion to apply water at will ..	
16	Storage– There is no objection to the construction of small storage works on the affluents of the main rivers for storing water during the flood season in July and August.	The Government of India confirm the recommendation of the Committee.

Serial No. of findings or recommendations	Substance	Orders and remarks where necessary
17	Woolar lake scheme ..	The Government of India confirm the recommendation of the Committee.
18	Provision for the future—There should be a central co-ordination of activities in connection with the gauging and recording of water flow in rivers affecting several units.	The Government of India do not propose to deal with this recommendation at this stage, which applies generally and not only to the Indus Valley, and would leave it for later consideration as a separate issue. The parties affected on the Indus have accepted this recommendation, subject in the case of Sind to consideration of the costs and details on a later reference.
19	Permission to the Punjab to be allowed to utilize the water set free in the Ravi by the construction of the Haveli Project as and when they desire.	(*i*) In the event of the Punjab Government deciding to build a link of 700 cusecs capacity from Balloki to the Pakpattan canal they will surrender 1 per cent of the river from their allotted share during *Kharif*. (*ii*) The Bahawalpur Government will give back this 1 per cent *when the Madhopur—Beas link*, which is also referred to in para. 5 of the covering letter to these orders, *is constructed*.
20	Transfer of water from Chenab to Sutlej—The Sutlej Valley Project requires additional supplies at the beginning of *Kharif* and there would be no objection to transferring water from the Chenab to the Sutlej, provided that such action would not affect the Sind Inundation canals.	The Government of India confirm the recommendation of the Committee, subject to the remark that only the excess supply needed over and above the requirements of Sind, the existing Punjab and Bahawalpur canals and the supplies proposed for Haveli and Panjnad should be considered as available for transfer and that the proviso is strictly observed.
21	Discharge records ..	These items do not require any immediate action on the part of the Government of India and they do not propose to pass any orders on them at this stage.
22	Inundation Canals ..	
23	Sind and Waterlogging ..	
24	Supplies allotted to Sind ..	The Government of India confirm the recommendations of the Independent Members.
25	Adjustment of cost of Sutlej Valley Headworks.	
26	Agreements—Modifications of agreements.	The Government of India agree with the Independent Members that the Sutlej Valley Project 1920 Agreement will require modification, but as explained under item 12, they do not consider that a review clause should be insisted upon in irrigation agreements.
27	Future controversies—An Irrigation Adviser with the Government of India is required.	The Government of India do not at present propose to appoint an Irrigation Adviser.

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VOLUME II

VOLUME III (CONFIDENTIAL)

LINE DIAGRAM
of
THE INDUS BASIN
SHOWING
PROVINCES, STATES, RIVERS, HEADWORKS & GAUGING STATIONS.

Scale 1" = 32 miles.

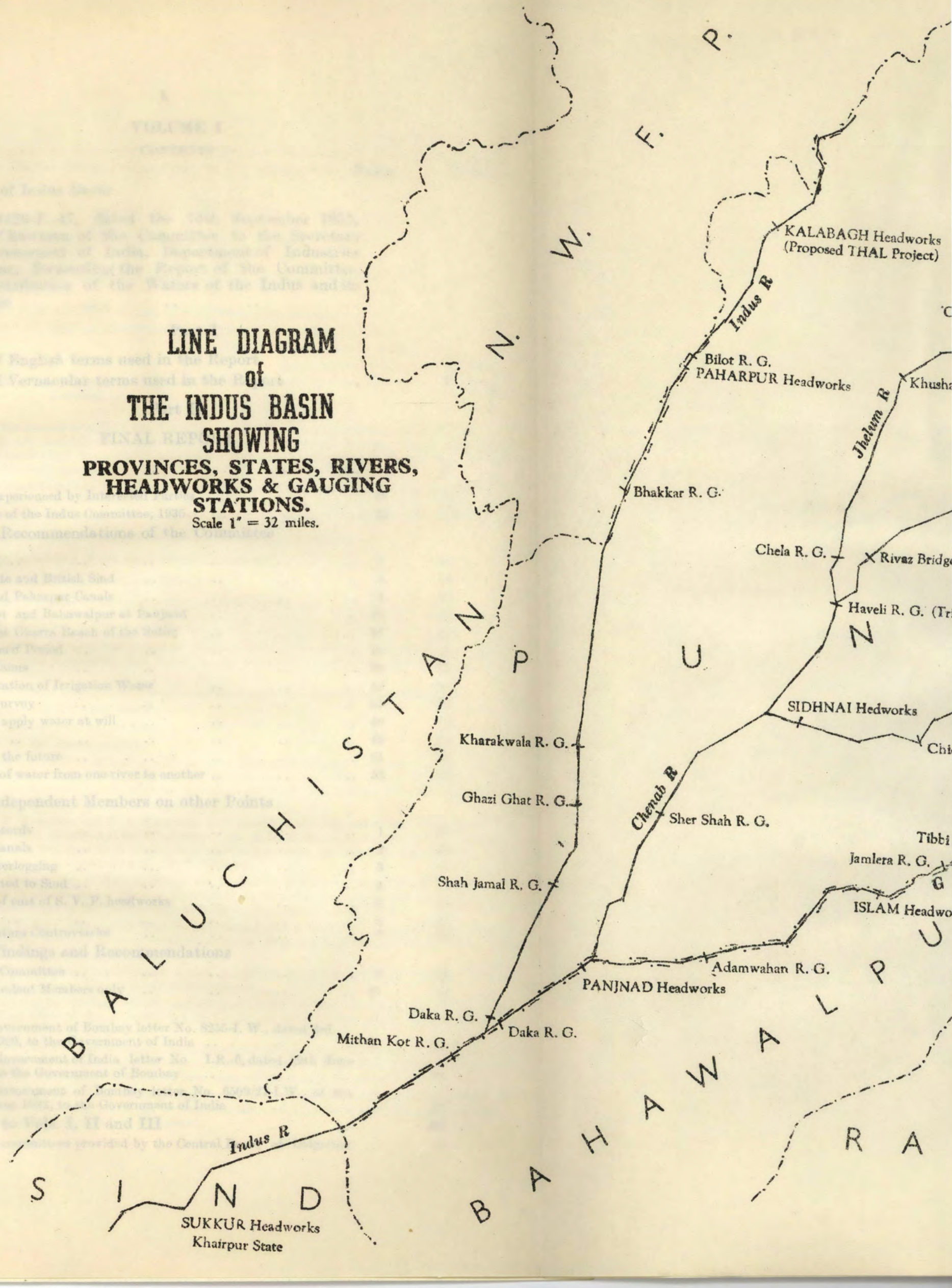

PLATE I

P.

T.

KALABAGH Headworks
(Proposed THAL Project)

Indus R

MANGLA Headworks

Jatli R. G.

Riasi R. G.

RASUL Headworks

Chak Nizam R. G.

Akhnur R. G.

Shampur R. G.

MARALA Headworks

Bilot R. G.

PAHARPUR Headworks

Jhelum R

Khushab R. G.

Garhi Gola R. G.

Alexandra Bridge R. G.

KHANKI Headworks

B

MADHOPUR Headworks

Mukesar R. G.

akkar R. G.

Chenab R

Chinot R. G.

A

Naushahra R. G.

Pang R. G.

Ravi R

Chela R. G.

Rivaz Bridge R. G.

Shahdara R. G.

Beas R

River Gaunge No. 13

Mandi R. G.

Haveli R. G. (Trimmu)

J

BALLOKI Headworks

U

N

Haraki R.G.

Bhakhra R. G.

Chak Lachman R. G.

Yusufpur R. G.

Bilaspur R. G.

FEROZEPORE Headworks

SIDHNAI Hedworks

Sutlej R

Betu R. G.

Chichawatni R. G.

Phillaur R. G.

RUPAR Headworks

ab R

Sutlej B

a c h

G

SULAIMANKI Headworks

Ladhuka R. G.

Sher Shah R. G.

Tibbi R. G.

Jamlera R. G.

Ghaggar R

P U N J A B

ISLAM Headworks

S T A T S

Adamwahan R. G.

Headworks

W A L P U R

B I K A N E R

R A J P U T A N A

VOLUME I

CONTENTS

Letter forwarding the Report of the Committee on "Distribution of the Waters of the Indus and its Tributaries" to the Government of India.

No. 4420-F -47

FROM

F. ANDERSON, ESQUIRE, C.I.E., I.S.E.,
Chairman,
Committee on "Distribution of the Waters of the Indus and its Tributaries".

To

THE SECRETARY TO THE GOVERNMENT OF INDIA,
DEPARTMENT OF INDUSTRIES AND LABOUR,
PUBLIC WORKS BRANCH, SIMLA.

Dated Simla, 16th September 1935

SUBJECT:—*Apportionment of the waters of the Indus and its tributaries between the parties interested.*

SIR,

I HAVE the honour to submit the final report of the Committee convened under Mr. Jenkins' letter No. I. R.-18, dated January 30, 1935, to the Government of Bombay, Punjab and others concerned, to examine and report on the apportionment of the waters of the Indus and its tributaries between the interested parties.

2. The matters at issue, the procedure proposed and the reasons for convening the Committee were discussed in considerable detail in Mr. Jenkins' letter No. I. R.-18, dated November 8, 1934, to the Governments and Darbars concerned and their views were invited on the following points :—

(*a*) the necessity for the appointment of an expert committee,

(*b*) the suitability of the draft terms of reference,

(*c*) the composition of the committee,

(*d*) the suitability of the proceedure proposed, and

(*e*) the allocation of the expenditure.

3 The interested parties accepted the proposals of the Government of India, and the Committee was convened to examine, and report to the Government of India upon, the following matters—

I. The extent to which additional supplies of water are actually required for :—

(*a*) the Khairpur State ;

(*b*) the Bahawalpur State ;

(*c*) the Haveli project

II. The possibility of finding such supplies without detriment to the parties interested in the waters of the Indus and its tributaries, and the effect upon the existing or prospective rights of those parties of any fresh withdrawals the authorization of which the Committee recommend.

Messrs. F Anderson and F. A. Betterton were placed at the disposal of the Government of India as Independent Members of the Committee. Mr. A. M. R. Montagu, Secretary of the Central Board of Irrigation, was appointed as Secretary to the Committee, and when he proceeded on leave on May 1, 1935, he was succeeded by Mr. M. T. Gibling.

4. The first meeting of the Committee was held at Delhi from 1st to 8th March and an agreement arrived at on all the major issues. Thereafter an Interim Report was approved by all the members and submitted to the Government of India on the 20th of April, 1935.

5. After further information had been collected and a draft of the final recommendations had been circulated, a second meeting was held at Simla from the 17th to the 20th of June, 1935, to settle some further points in dispute.

6. As a result of these meetings it is now possible to submit a unanimous report. This is divided into three volumes for the sake of convenience.

Volume I contains the final report, consisting of a brief history, the findings of the Committee and the opinions of the Independent Members on some further points, together with a summary.

VolumeII deals with the history in more detail and also contains the Briefs of the interested parties, the Interim Report and appendices. The Committee wish to keep the proceedings of the meetings confidential and they are therefore separately bound in Volume III.

The Committee trust that the final report now submitted will enable the Government of India to arrive at conclusions which can be implemented with advantage to all the parties interested in the waters of the Indus and its tributaries.

PART I

GLOSSARIES

GLOSSARY.

A.—English terms.

In the REPORT and proceedings, the following expressions have the meaning assigned—

BRIEFS	The statements of claims made by the INTERESTED PARTIES together with the arguments in support thereof.
COMMITTEE	A committee of Members of the Central Board of Irrigation together with the representatives of INTERESTED PARTIES convened under the aegis of the Central Board of Irrigation to consider the question of the distribution of the waters of the Indus and its tributaries.
INDEPENDENT MEMBERS	The two nominees of the Government of India from Provincial Governments not concerned with the dispute.
INTERESTED PARTIES	The three Provinces and three States concerned in the dispute, *viz.*, Bombay (Sind), Punjab, North-West Frontier Province, Bahawalpur, Bikaner, and Khairpur.
INTERIM REPORT	A report submitted to the Government of India by the Committee as a whole, indicating, the extent to which agreement has been reached, to permit of early orders being passed in respect of urgent matters affecting the INTERESTED PARTIES.
ISSUES	The summary prepared by the INDEPENDENT MEMBERS of those points, upon which they proposed to take evidence during the meetings of the Committee, with a view to answering the terms of reference.
POINTS FOR DISCUSSION	The particular points arising out of the proceedings of the Committee, upon which the INDEPENDENT MEMBERS desired that the INTERESTED PARTIES should consult in formally.
REPORT	The entire report in three volumes, recording the whole history of the Committee, its proceedings and conclusions.

The following technical terms used in this REPORT have the meaning assigned to them:—

Annual Intensity	The term applied to the percentage of the culturable irrigable area irrigated during a year. The project intensity is the annual intensity aimed at in the project.
Authorized (or Designed) Full Supply Discharge.	The maximum discharge for which a channel is designed. In irrigation practice the authorized full supply discharge should never be exceeded
Available Supply	In the river.—The discharge passing at the moment. At the head of a canal.—The authorized share of the river discharge pertaining to a canal.
Average Supply	The average supply in a channel is the sum of the daily discharge at the head of the channel divided by the number of days when the channel is in flow.
Base, Base Days or Base Period ..	The number of days in a crop. For example, in Northern India it is 183 for kharif and 182 for rabi.
Capacity	When applied to a channel, the authorized full supply discharge.
Capacity Factor	The ratio of the mean supply to the authorized full supply or capacity

Crop Ratio	The crop Ratio or kharif to rabi ratio is defined as the ratio between the anticipated areas to be irrigated in these two crops.
Culturable Commanded Area	That portion of the culturable irrigable area which is commanded by flow irrigation.
Culturable Irrigable Area	The gross irrigable area less the area not available for cultivation, *e.g.*, village area, roads and unculturable lands.
Culturable Lift Area	That portion of the culturable irrigable area which can be irrigated by lift.
Cusee	The unit of discharge used in irrigation practice and means a rate of flow of one cubic foot per second.
Cusec Day	A unit of volume of water used in irrigation practice and means the volume of water resulting from a discharge of one cusec for one day (24 hours). It amounts to 6,400 cubic feet of water.
Delta	An expression used in irrigation practice to mean the depth of water that would result over a given area from a given discharge for a certain length of time. Alternatively, the Delta may be defined as the total volume of water delivered, divided by the area over which it has been spread.
Designed (or Authorized) Full Supply Discharge	The maximum discharge for which a channel is designed. In irrigation practice the authorized full supply discharge should never be exceeded. In some Provinces this is referred to as Capacity.
Duty	When applied to a channel, the area irrigated during a base period divided by the mean supply utilized in cusecs.
Full Supply Factor	The area irrigated during the base period divided by the authorized full supply discharge of the channel at head.
Gross Area	The total area within the extreme limits set for irrigation by a project, system or channel.
Gross Commanded Area	That portion of the gross irrigable area which is commanded by flow irrigation.
Gross Irrigable Area	The gross area less such areas within irrigation limits, as may be excluded for any reason, from irrigation by the project, system or channel.
Gross Lift Area	That portion of the gross irrigable area which can be irrigated by "lift".
Inundation Canal	This term is ordinarily applied to a canal with or without some form of head regulator, and dependent upon the surface level of the water in the river for its supplies. It follows that Inundation Canals will only run when the supply in the river rises to a level which permits of feeding the canals.
Mean Supply	The sum of the daily disscharges at the canal head divided by the number of days in the base period.
Non-Perennial Area	The area served by a non-perennial channel.
Non-Perennial Channel	A channel which is designed to irrigate during only a part of the year, usually the kharif or summer season.
Perennial Area	The area served by a perennial channel.
Perennial Channel	A channel which is designed to irrigate all the year round.

Rotational Working	When demand exceeds the available supply, recourse is had to the system known as Rotational Working. In sound irrigation practice, every endeavour is made to run the distributary channels at the authorized. full supply discharge or to close them entirely. This is possible in the case of some branches and most distributaries. .. Each channel takes a turn of full supply for a certain number of days, other channels being closed to admit of this. The unit period for which the channels run or are closed is known as a Rotational Turn.
Time Factor	The ratio of the number of days the channel is in flow to the base days.
Water Allowance	The outcome of all considerations of the duty of water intensity, proposed crop ratio, water available, etc., is the fixing of the Water Allowance. Water Allowance may be defined as the number of cusecs of outlet capacity authroized per 1,000 acres of culturable irrigable area. The Water Allowance, therefore, not only defines the size of outlet for each outlet area but also forms the basis for the design of the distributing channels in successive stages.

B.—VERNACULAR

VERNACULAR EXPRESSION	ENGLISH EQUIVALENT	PROVINCE
Abkalani	Inundation season..	Sind.
Bosi	Crop sown with the aid of canal waters, but receives no further watering after sowing.	Sind.
Chahi	Irrigated by wells	Punjab and United Provinces.
Chak	Area served from one outlet	Northern India.
Desi	Of the country	India.
Dubari	Second crop grown on the irrigated land of the first without further watering.	Sind.
Fasal	Crop	Northern India.
Hissa	One tenth of one foot	Northern India.
Kallar	Impregnated with salts	Punjab and Sind.
Khadir	River valley: low alluvial lands ..	Punjab and United Provinces.
Kharif	Summer crop	India.
Kor	First watering after crop is sown ..	Northern India.
Nahri	Canal irrigated	Northern India.
Rabi	Winter crop	India.
Sailaba	Flood irrigation	Northern India.
Selab	An inundation flooding, Natural overflow of water from floods.	Sind.
Sem (Sindhi, Sim)	Seepage	Punjab.
Shikargah	Hunting grounds	Sind.
Tahsil	Sub-division of a civil district.. ..	India.
Tor	Flow	Punjab and United Provinces.
Zaid-kharif	Late summer crop..	Punjab.
Zaid-rabi	Late winter crop	Punjab.
Zamindar	Land owner	India.

PART II

FINAL REPORT

BRIEF HISTORY, FINDINGS AND SUMMARY

HISTORY

The controversy over the distribution of the waters of the Indus and its tributaries is one of long standing, and may be said to date back to the year 1919 in which year the Report of the Indian Cotton Committee was published. That Committee was particularly interested in the Sukkur Barrage Project then under preparation. The Government of Bombay were not unnatuarlly apprehensive as to the amount of water there would be available, and drew attention to certain projects which were under contemplation in the Punjab.

2. Despatch No. 3.-Public Works, from the Government of India, dated 2nd June, 1927, to the Secretary of State, (1) deals very fully with the history of this involved dispute in its earlier stages, and it is proposed to give only a precis of the relevant portions of that Despatch and the subsequent history which led to the appointment of this Committee.

3. It is now clear that lack of data relating to the available supplies of the Indus and its tributaries was the root cause of the uncertainty that prevailed. It is due to Sir Thomas Ward, then Inspector-General of Irrigation, that a system of discharge observation stations both on the Indus itself and on its tributaries was introduced in the year 1920, and it may be noted here that but for the results obtained from this system the present Committee would not have been able to arrive at the conclusions contained in this Report.

4. The apprehension on the part of the Punjab and Bombay Governments is clearly apparent from the fact that, before even the Sutlej Valley and Sukkur projects were sanctioned, there was considerable doubt regarding the sufficiency of water for both those projects. In order to endeavour to establish prior claims to whatever water was considered available, the Government of the Punjab submitted the Thal Scheme in September 1919 to the Government of India, in the hope that it would receive preference over the Sukkur Barrage Project. The Government of the Punjab were also prompted to press for sanction of this scheme by the fact that the Sind Sagar Doab Colonization Act, passed by the Punjab Legislative Council in 1902, would place them in possession of a very large area, 1,710,000 acres, of proprietory waste land with effect from the commencement of the work. The Government of India did not sanction this scheme firstly because of the number of difficulties anticipated in its operation, as pointed out by the Government of the Punjab when forwarding the scheme, and secondly because the Government of India were expecting the submission of the Sutlej Valley and Sukkur Barrage Projects, which they considered should be given priority. On receipt of the Government of India's refusal in April 1920 to sanction the Thal Scheme, the Government of the Punjab submitted certain statements in July 1920 showing the supplies required by the major irrigation scheme contemplated in the near future, *i.e.*, the Thal, Haveli and Sutlej Valley Projects, with the object of establishing prior claims to whatever water might be available.

5. About the same time, the Sutlj Valley and Sukkur projects were received and submitted to the Secretary of State, who sanctioned them in December 1921 and April 1923, respectively. Although the data available at that time were not sufficient to show the effect on the discharge of the Indus at Sukkur of the Sutlej Valley Project withdrawals, no insurmountable difficulty was anticipated, and the Government of India were of the opinion that both schemes could be undertaken at the same time.

6. The system of gauging recommended in December 1920 by Sir Thomas Ward was introduced in the autumn of 1921 for the main purpose of studying the effect on the Indus at Sukkur of the withdrawals in the Punjab. In accepting the proposals of the Government of India, for this new gauging, the Government of the Punjab questioned the propriety of the assignment to Bombay of any right to the water allotted to the Sukkur project, and reserved the right to question those rights when the cases of the Bhakra Dam, Thal and Haveli Projects were dealt with.

7. A few months later the Government of the Punjab resubmitted the Thal Project, but in a considerably altered form. They proposed to commence the Thal and Haveli Projects in the fourth and sixth years respectively, after work

on the Sutlej Valley Project had been begun. The Government of India, however, informed the Punjab Government in December 1921 that they could only agree that a strong case had been made out for continuing and completing the surveys and investigation necessary for the preparation of a detailed Thal Canal Project adding that in any such project particular attention should be given to the question of the necessary supplies for the Sukkur Barrage Project.

8. On receipt of the Secreatry of State's sanction to the Sukkur Barrage Project, the Government of the Punjab protested in April 1923 against what they regarded as a perference to Sind, and for the first time questioned the duties adopted for the Sukkur project, contending that higher duties, comparable with those ruling in the Punjab should be applied for calculating the Sukkur water requirements.

9. The Government of Bombay strongly objected to this attitude on the part of the Punjab Government, and alleged that the Punjab had had more than their share of the waters of the Indus and its tributaries for its vast schemes of perennial irrigation, while Sind had not commenced a single one. They laid stress upon the statement of Sir Thomas Ward that all future Punjab scheme would have to be examined carefully in relation to possible effects at Sukkur. They also complained that when the Sutlej Valley Project was under consideration, they had not been consulted regarding its effects on Sind, and they were faced with the situation that on the completion of that scheme the supplies available at Sukkur would be considerably less than those on which the Sukkur project had been framed. The Bombay Government had been advised that the Thal project was nothing more than "a financial speculation for the exploitation of a wilderness", and considered it to be of the greatest danger to Sind. They protested against "the sacrifice of the welfare of a populous Province in order to exploit a desert for the benefit of the speculator".

10. The Government of India informed the Punjab Government in August 1923 that the Sukkur project had been sanctioned for the benefit of the country that was fully entitled to the water proposed to be allotted to it, and that its supplies must be assured. They were satisfied that there was sufficient water for the Sukkur and Sutlej Valley projects recently sanctioned, and further believed that the gaugings in progress would show that there was sufficient water for the ultimate requirements of both provinces and deprecated the prior raising by the Punjab of the question of respective rights of the two Local Governments. The Government of India had accepted the duties proposed for the Sukkur project and were not prepared to reopen the question. The Government of India assured both Governments that no new major project in either province would be sanctioned which was likely to affect either the Punjab or Sind without the other party having been given timely notice and full information.

11. In November 1924, the Government of the Punjab again reopened the question of the Thal Project, with a proposal to construct a small experimental canal, which, they opined, would yield the information necessary for working out the details of the larger scheme. The Government of Bombay to whom the matter was referred, strongly objected to this proposal and again expressed the earnest hope, that no proposals whatever for further withdrawals from the Indus and its tributaries would be entertained by the Government of India until the Sukkur scheme had worked sufficiently long to enable proof to be obtained that surplus water was actually available, after meeting the requirements both of that scheme and of lower Sind.

12. The Government of India, however, found it difficult to justify an objection to the Thal Experimental Canal, and contended that the withdrawals of 750 cusecs only could not materially affect the supplies available at Sukkur. While negotiating with Bombay in an endeavour to persuade them to resile from the attitude which they had adopted, the Government of India were surprised to receive in September, 1925, a communication from the Punjab Government. stating that they had decided to drop altogether the proposal for the experimental canal finally and to proceed with the preparation of a much larger Thal scheme.

13. The Government of India received the Thal Canal Lesser Project from the Punjab in the following month. It was not stated how the Punjab had solved the difficulties for which the experimental canal had been proposed, but the report merely said that further investigations had shown that it would not be a productive

work, and that they had decided to embark upon this new project. It was accompanied by a technical note elaborating the theory that withdrawals made in that Province were compensated for by seepage back into the river lower down, and repeating the contention that an excessive amount of water had been allotted to the Sukkur project.

14. The project was referred to the Government of Bombay, who replied that though they might have been prepared to reconsider their decision, regarding the experimental canal, they emphatically refused to agree to the Thal Canal Lesser Project until the Sutlej Valley Project was actually working and its effect on the supplies at Sukkur was known.

15. In February 1926 the Government of India found themselves forced, in equity, to support the attitude adopted by the Bombay Government, and promulgated their final conclusions as follows:—

"(*a*) that, until such time as the Sukkur Barrage Scheme comes into operation, and further experience of perennial irrigation in Sind is available, the question of the volume of water required for that scheme cannot be re-opened.

(*b*) that, faced as they are with the unknown effect of the withdrawals which will be necessary for the supply of the Sutlej Valley Canals in the Punjab, the Government of Bombay have the right to object to further withdrawals from the Indus or its tributaries unless and until definite proof can be given that the supplies necessary for the Sukkur Barrage Project will not be endangered thereby.

(*c*) that such proof must be based upon the results of the more accurate gaugings of the supplies in the river and its tributaries which were instituted as a result of Sir Thomas Ward's note of the 10th December 1920.

They added that should the Punjab desire to proceed with the small experimental canal, with which they were in agreement, the Government of India would do their best to obtain the consent of the Bombay Government.

16. These rulings resulted in an immediate and lengthy protest from the Government of the Punjab, and in conclusion they asked that the whole matter might be referred to the Secretary of State and that he should be requested to convene an impartial committee of experts to decide whether the experience gained of the Indus discharges, together with such information as had been collected by the Punjab, were not sufficient to show that the Thal Canal Lesser Project could be executed without detriment to the Sukkur scheme. They also suggested that the committee should decide whether, if this did not prove to be the case, the proper and most effective use of the Indus waters would not justify some reduction of the irrigation proposed under the Sukkur scheme.

17. The Government of India, in view of the Punjab Government's statement that they had evidence to show that the Thal scheme would not endanger the schemes already sanctioned, were prepared to refer the matter to an impartial committee if the Punjab and Bombay Governments agreed. The Government of the Punjab accepted the proposal but refused to agree that the volume of water allotted to Sind was not open to any readjustment. The Government of Bombay, while reluctantly accepting the proposal, pointed out that the gauging operations had been in operation for less than five years, the observations of two of which were defective, and as any conclusion of the committee could only be based on inference, they reserved the right to appeal against any findings of the committee.

18. When the Government of India decided in 1926 to convene the proposed committee, the Government of the Punjab protested against the terms of reference and asked that they should be referred to the Secretary of State if the Government of India would not include the important question of the Sukkur Project duties in the terms of reference.

The Government of India then referred the matter to the Secretary of State, gave a complete history of the case from the year 1919 and asked for his instructions.

19. The Secretary of State replied that as regards the question of the Sukkur Project duties, on which point only his orders were required, he agreed with the conclusion of the Government of India that nothing but experience could show exactly what value should be taken for those duties, and having regard to the fact that the Sukkur canals had not even begun to irrigate, no reason had been shown for a reconsideration of the duties, and it would be unreasonable to reopen the question at that time.

20. The Indus Discharge Committee which was established in September 1921, to co-ordinate and scrutinize the results obtained from the new system of gauging instituted by the Punjab and Bombay Governments, found at their first meeting in June 1928, that a matter of great importance was the amount of water lost and gained between the various discharge sites, *i.e.*, the quantity absorbed or regenerated in the river beds between the points of observation.

21. At their next meeting in March 1929, they found that it would be unjustifiable to withdraw the perennial supplies required for the Thal Canal Lesser Project, as the data available did not show that it was possible to do so without materially affecting the supplies allotted to the Sukkur Project, but they agreed that a rabi supply limited to 1,250 cusecs could be made available for utilization in the Punjab from the Indus tributaries. The Government of Bombay had already consented to 500 cusecs being utilized by the Punjab for the Jalalpur pumping scheme and the Committee considered that that discharge might be increased to 1,250 cusecs, as the difference of 750 cusecs was well within the margin of error in discharge observations at Sukkur. The Committee also suggested that if the Government of the Punjab preferred to undertake the Haveli Scheme in preference to the Jalalpur scheme, the 1,250 cusecs allotted in rabi to the latter would enable them to do so as there appeared no difficulty in finding the 7,500 cusecs from the 20th of April required for kharif. At the same time they advised that no further withdrawals should be permitted for a period of ten years, by which time the results of the observations at the various discharge stations would be better known and adequate discharge data would have become available.

22. At that time the effect of a proposed storage dam at Bhakra on the Sutlej was under consideration by the Punjab and Bombay Governments, and the Committee agreed that the solution of the problem of further extension of irrigation in the Punjab lay primarily in the conservation of the kharif supplies which were running waste to the sea. The water was available, but it was a question of the effect upon the inundation canals in Sind between Mithankot and Sukkur by the possible lowering of water levels in the river, and they recommended that each local Government concerned should place an officer on special duty to investigate the case.

23. On this recommendation two officers were deputed for the purpose, and in their report submitted at the end of 1930, they recorded their opinion that the inundation canals in the Mithankot-Sukur reach would not suffer any material reduction of supply when the Bhakra Dam came into effect; the Bombay officer stated, and the Punjab representative agreed, that conditions in the inundation canals below Sukkur also would not be worse owing to regime rises, and might even be better by the time the Bhakra Dam project was constructed, even allowing for the adverse effects of the Bhakra withdrawals. In March 1934, the Government of Bombay informed the Punjab Government that they would offer no opposition to the construction of the Bhakra Dam.

Difficulties experienced by the Interested Parties

24. The Sutlej Valley Project provided for four weirs on the Sutlej at Ferozepur, Suleimanke, Islam and Panjnad, canals were constructed for supplying water, both perennial and non-perennial, to tracts in the Punjab Province, and in Bikaner and Bahawalpur States, under a tripartite agreement by which the water available at those weirs was to be distributed to the various canals. The Panjnad weir, which was constructed below the confluence of the Sutlej and the Chenab, allowed the Bahawalpur State to participate in supplies in the Chenab, as well as in the surplus waters of the Sutlej, for their canals taking off at the Panjnad weir

but their withdrawals from the Chenab were restricted by Clause 4. D. 2 of the 1920 Tripartite Agreement.

> "For the perennial and non-perennial canals for Bahawalpur from the Panjnad the mean draw off in each crop shall be maintained at the same fraction of their authorized maximum capacity in cusecs as that of the British canals from the Gharra".

25. The Sukkur Barrage Project was completed in 1932, and various discharges were allotted to the canals in accordance with figures contained in the Project, *vide* page 7, Vol. V of the 1919-20 Project. Although those figures were evidently intended to be the authorized maximum withdrawals, which could be utilized at any time in the month concerned, the Sind authorities did not consider them as maxima and on occasions exceeded those figures. Moreover, the Government of India, in their letter No. I.R.6, dated June 29th, 1929([2]) accorded sanction to withdrawals in excess of the maxima laid down on the understanding that no "prescriptive rights" to such excesses were claimed at a later date.

26. Khairpur State, through which territory one of the main canals (the Lohri) of the Sukkur Scheme has been constructed, had, prior to the construction of the Barrage, enjoyed an adequate inundation supply from its own canals, and when the Sukkur Scheme was constructed, two Feeders were provided above the Barrage in order to feed the existing canals in the State. Those Feeders run one on each side of the Lohri canal. In the original project, perennial supplies were provided for the the Feeders, but in the final Project, which was sanctioned, only kharif and early rabi supplies (up to end of December) were allowed. The State authorities, however, protested against the non-provision of a perennial supply to their canals, and as water was available, the Bombay Government permitted Khairpur to withdraw certain rabi supplies throughout the full season, as a temporary measure, until the question of a perennial supply was decided.

27. Meanwhile certain difficulties had arisen in Bahawalpur State and a Committee was convened in 1932 to investigate amongst other things the quality of the land to be irrigated and the sufficiency of the supplies available. They recommended that large areas proposed for irrigation should be abandoned, because the soil was such that it could not economically be brought under cultivation. This necessitated some internal adjustments to enable the supplies available to be used to the best advantage. The Committee also found that the supplies available at certain periods of the year were far short of requirements for the canals taking off the Sutlej. On the other hand there appeared to be ample water at Panjnad and therefore they recommended the deletion of clause 4. D. 2 of the Agreement quoted above.

The internal adjustments to the Bahawalpur State, systems were carried out in accordance with those recommendations, and as an act of grace the Punjab removed the restrictions on the withdrawals at Panjnad, since there was water available by reason of the Haveli Project not being undertaken. This concession, however, was only to remain in force up to the 1st April 1935, after which date the Agreement was to be strictly enforced.

28. The insufficiency of water in the Sutlej at certain seasons of the year more particularly during early kharif, created serious difficulties in Bikaner State, so much so that it was necessary at times for the other partners of the 1920 Agreement to give up a share of their water from their non-prennial canals to avoid serious consequences in that State. Bikaner therefore claimed that the Agreement should be revised and, since it had been found that Bahawalpur had less area fit for cultivation than that on which their Agreement share of the water had been based, a redistribution should be made.

29. The position in the Punjab regarding the Thal Canal Lesser Project remained unchanged, since it had been decided that the question of allotting additional supplies from the Indus should not be re-opened until 1939, by which time it was anticipated that sufficient reliable data regarding the water supplies would be available.

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(2) Appendix B.—The Bombay Government letter to whieh this is a reply is printed as Appendix A.

In regard to the Haveli Project, the Government of Bombay had agreed to the allocation of 1,250 cusecs in rabi and 7,500 (approximately) cusecs in kharif from the Chenab, but construction of that Project had remained in abeyance because the Punjab contended that the rabi supply was insufficient to make the scheme productive.

30. The North-West Frontier Province had also approached the Punjab and Bombay Governments regarding certain small additional withdrawals from the Indus required for the Paharpur canal. No objections were raised to this demand.

Appointment of the Indus Committee, 1935

31. These matters came to a head in 1934, and as at least two of the matters under dispute called for immediate settlement, the Government of India convened the Committee now submitting this report, with the following terms of reference :—

"The extent to which additional supplies of water are actually required for :—

(*a*) the Khairpur State,

(*b*) the Bahawalpur State,

(*c*) the Haveli Project.

The possibility of finding such supplies without detriment to the parties interested in the waters of the Indus and its tributaries, and the effect upon the existing or prospective rights of those parties of any fresh withdrawals, the authorization of which the Committee may recommend".

32. Each of the Interested Parties was invited to nominate one member who might bring with him such advisers as he deemed necessary, but such advisers would not be me mbers ot the Committee.

The final composition of the Committee was :—

Central Board of irrigation.

Independent Members nominated by the Government of India—

F. Anderson, Esq., C.I.E., I.S.E. (Unitd Provinces)	Chairman.
F. A. Betterton, Esq., I.S.E. (Bihar and Orissa) ..	Vice-Chairman.

Bombay (Sind)—

W. L. C. Trench, Esq., I.S.E.	Member.
Mr. Gurmukhsingh J. Butani, B.S.E.	In attendance.

Punjab—

H. W. Nicholson, Esq., C.I.E., I.S.E.	Member.
J. P. Gunn, Esq., I.S.E.	In attendance.

North-West Frontier Province—

A. Oram, Esq., I.S.E.	Member.

Bahawalpur State—

Sir Bernard Darley, Kt., C.I.E.	Member.
C. A. H. Townsend, Esq., C.I.E.	In attendance.

Bikaner State—

T. A. W. Foy, Esq., I.S.E.	Member.
Rai Bahadur Jai Gopal	In attendance.

Khairpur State—

J. M. Sladen, Esq., I.C.S.	Member.
Khan Bahadur J. R. Colabawala	In attendance.
J. Wright, Esq.	

Secretary, Central Board of Irrigation—

A. M. R. Montagu, Esq., I.S.E.	Until April 30, 1935.
M. T. Gibling, Esq., I.S.E.	From May 1, 1935.

33. The proceedings of the first meeting of the Committee were opened formally by the Hon'ble Sir Frank Noyce, Member for the Department of Industries and Labour, on the 1st of March, 1935, in the Cecil Hotel, Delhi. The Committee met daily until the 8th of March and an Interim Report was submitted to the Government of India in April, in order that immediate steps might be taken to implement certain recommendations which were of importance to some of the Interested Parties. Certain other proposals were also framed for inclusion in the final Report, but when they were considered in more detail, it was found that they required further discussion before definite conclusions could be reached.

34. A second meeting of the full Committee was therefore held in Simla between the 17th and the 20th of June 1935.

The unanimous findings of the Members of the Committee are now presented below for the information of the Government of India, in supersession of the Interim Report.

The Independent Members have also recorded their opinion on a few points which arose out of the discussions but on which unanimous findings of all the Members of the Committee were not possible.

FINDINGS AND RECOMMENDATIONS OF THE COMMITTEE

Introduction

1. The Committee, when it met at Delhi, at first attempted to find a common basis for the distribution of supplies, but so many varying factors entered into the question that it was impossible to find a formula applicable to all. It was necessary therefore to take each project separately and arrive at a compromise agreeable to all the parties concerned.

An abstract of the Briefs prepared by each party before the Committee met is given later. These Briefs were considered in detail and the demands of each party modified by mutual agreement until a fair compromise was arrived at, which appeared to meet the needs of each individual case.

After a complete, survey of the modified requirements had been made, the Committee examined in detail the supplies available, based on a very complete set of hydrographs which were put up by the Punjab and Sind representatives.

2. When it came to the question of giving additional supplies to the Panjnad canal, the Bikaner representative claimed that this could not be done unless other clauses of the Agreement, which he considered operated unfairly against Bikaner State, were also modified. It was decided therefore to consider the distribution of water between the partners of the Agreement whose canals took off the Gharra reach of the Sutlej.

In addition to the extra supplies required for the Haveli canal, the Punjab Government also asked for supplies for the modified Thal Canal Project. The Government of the N.-W. F. Province were also allowed to send a representative to urge the claims for certain small supplies required to make the Paharpur canal a success.

In the case of the Gharra reach of the Sutlej it was only necessary to arrive at a fair re-distribution of the supplies available. For the canals to take off the Indus, and the Haveli and Panjnad canals it was necessary to see if the extra supplies required would be available.

3. A careful study of the hydrographs showed that there would be sufficient water in all but a few periods in exceptional years to meet the needs of all canals proposed. It was thus possible to frame recommendations not only concerning those issues which were referred to the Committee, but also concerning the supplementary issues raised in the Briefs of the Interested Parties.

I.—Khairpur State and British Sind.

4. Precis of the Briefs.—The substance of the Khairpur State case as represented in their Brief is that the irrigation of the State should be perennial on the same basis as that in British Sind. Their contention is that perennial irrigation was one of the inducements to them participate in the Sukkur Barrage Scheme, for which they gave permission to construct the Rohri canal through the middle of State territory.

5. In the 1910 Sukkur Barrage Project a rabi supply of 1,675 cusecs was provided for the State area, but in the 1919 Project, which was sanctioned, a kharif supply plus a rabi supply for October, November and December only, was provided. This provision was in their opinion sufficient only for an annual intensity of about 60 per cent whereas in British Sind, kharif and rabi intensities of 27 per cent and 54 per cent respectively were adopted, making a total intensity of 81 per cent. The State consider that in view of the fact that they enjoyed an adequate inundation supply through their own canals prior to the construction of the Sukkur Barrage, the provision now made for their irrigation is very little better than that which existed before the scheme was introduced. They are of the opinion that they are entitled to enjoy the benefits from the Sukkur Barrage on an equal footing with British Sind, and particularly ask for a perennial supply, even if it means reducing the rabi area in British Sind. Actually, they have been allowed to withdraw water for their Feeders throughout the whole of the rabi season as a temporary measure by the Bombay Government, who acted on the permission from the Government of India to withdraw any water at Sukkur which would otherwise run to waste.

6. The Khairpur State now require this temporary arrangement of giving them a perennial supply to be made on a permanent basis. They state that the culturable commanded area within the State is 600,000 acres *plus* another 40,000 acres, at present classed as "Shikargah". While the State desire their irrigation to be placed on an equal footing with that in British Sind, they prefer an annual intensity of 80 per cent with a rabi to kharif ratio of 1·25 to 1·0, but contend that the Full Supply Factors adopted for Sind are too high for their canals.

A kharif discharge of 400 cusecs was allowed for certain State lands irrigated from the Eastern Nara Canal, and if the State irrigation is to be perennial then it is claimed that this land also should receive a perennial supply.

7. The Bombay Government in their Brief state the terms on which an extra rabi discharge may be given to the Khairpur State, namely :—

(1) that the minima discharges of the Indus at Sukkur to which Sind shall have a prescriptive right shall be those mentioned in Government of Bombay letter No. 6590/27-I. W. of 26th June 1933 (3).

(2) that the Khairpur State shall also agree to pay an increased share of the cost of the Lloyd Barrage according to the formula already accepted by the Government of India in paragraph 7 of their Despatch No. 23-W. P., dated the 16th December, 1920, to the Secretary of State, i. e., that the cost of the barrage proper shall be shared between the Khairpur Darbar and the Bombay Government, in the ratio of the ultimate anticipated area of kharif *plus* rabi cultivation in the State to the ultimate area of kharif *plus* rabi cultivation in the whole barrage area.

8. The Bombay Government have asked for certain modifications in the figures of discharges authorized to be withdrawn for the Brtitish Sind canals at Sukkur. The most important demand, is for an increase of 6,500 cusecs in the month of October, which was omitted from the calculations when the demands were first made.

9. Recommendations of the Committee.—The Committe are of opinion that the irrigation of Khairpur State should be brought on to a perennial basis as in British Sind.

They accept the figure of 640,000 acres as the culturable irrigable area of the State on the East and West Feeders; this includes 40,000 acres of Shikargah which the Committee are prepared to include in the area for which perennial water should be supplied.

The capacity per thousand acres culturable perennial area on the British canals taking off from Sukkur is 4·2 csecs.

This is arrived at as follows :—

Culturable perennial area	549,700 acrers.
Discharge—less non-perennial supplies for rice	22,900 cusecs.
Discharge per thousand acres	4·2 cusecs.

With the same discharge per thousand acres the perennial capacity of the Khairpur State East and West Feeders would be 2,688 cusecs.

10. In British Sind, however, the crop ratio aimed at on perennial canals is 2 rabi to 1 kharif and the intensity is 81 per cent while in Khairpur State an intensity of 80 per cent is proposed, with a crop ratio of 1·25 rabi to 1 kharif. The Committee agree that a greater capacity in the State canals will be necessary to take the larger supplies required for kharif. In rabi, the capacity factor of the canals should be proportionately decreased, but in view of the special circumstances in Khairpur State, including the fact that two parallel canals have to be run, one on each side of the Rohri canal, leading to a diminution of efficiency, the Committee agree to accept a rabi duty of 122 at canal head proposed for the State. They therefore recommend that the mean monthly withdrawals should be as shown in Table I.

(3) Appendix C

TABLE I

Present authorised withdrawals, and those recommended to be authorised for Sind and Khairpur State (cusecs)

Month	Present authorized withdrawals				Withdrawals recommended to be authorized			
	British Canals	Nara, for Khairpur lands	Khairpur East and West Feeders	Total	British Canals	Nara, for Khairpur lands	Khairpur East and West Feeders (Mean discharges)	Total
1	2	3	4	5	6	7	8	9
January ..	22,656	..	..	22,656	22,656	267	2,000	24,923
February ..	22,656	..	..	22,656	22,656	267	2,000	24,923
March ..	23,454	..	..	23,454	23,454	267	2, 60	25,721
April ..	26,629	400	2,000	29,029	26,629	267	1,000	27,896
May ..	36,143	400	3,000	39,543	36,143	267	2,250	38,660
June ..	41,496	400	4,030	45,926	41,496	267	3,000	44,763
July ..	41,496	400	4,030	45,926	41,496	267	4,000	45,763
August ..	41,496	400	4,030	45,926	41,496	267	4,000	45,763
September ..	41,496	400	4,030	45,926	41,496	267	4,000	45,763
October ..	22,897	..	3,000	23.897	29,397	267	2,675	32,339
November ..	20,540	..	3,000	23,540	20,540	267	2,675	23,482
December ..	22,656	..	3,000	25,656	22,656	267	2,625	25,548

11. In the case of the State area to be irrigated from the Eastern Nara Canal for which a non-perennial capacity of 400 cusecs was previously allotted, the Committee recommend the allotment for the future of a perennial capacity of 267 cusecs. The authorized withdrawals of the Sukkur Barrage canals including Khairpur State canals will now be as shown in Table I, column 9.

12. No claim to any discharge in excess of the figures in column 9 of Table I can be made. Since, however, the authorized Khairpur withdrawals are mean monthly withdrawals, the condition under which extra water may be withdrawn, as enunciated in Government of India letter No. I. R.-6 of 29th June 1929, is re-affirmed (4). That is to say, if the Khairpur canals require a greater supply for part of the month, they may be permitted to draw accordingly, provided the water is available at Sukkur and the monthly mean is not exceeded.

13. The Committee recommend an increase of 6,500 cusecs maximum withdrawal for British Sind canals in the month of October to meet the deficit caused by failure to include in the sanctioned Project the requirements for kharif crops in that month of the Eastern Nara, North Western and Dadu canals. This additional discharge of 6,500 cusecs is included in the figures in Table I.

II.—SIND, THAL AND PAHARPUR CANALS

14. PRECIS OF THE BRIEFS.—Several different schemes have been put forward at various times for irrigating the Sind Sagar Doab, or Thal as it is called, the first of which was prepared in 1871, but none of them has been sanctioned, owing to the fact that some of the areas were considered to be unsuitable for inclusion in the

(4) The relevant sentence is as follows:—

"I am directed to say that the Government of India have no objection to certain of the canals in the Sukkur Barrage Project being designed to draw off a larger volume of water than that allotted to them in the Project estimate on the conditions proposed by the Government of Bombay, *viz.* that no prescriptive right to the additional quantity of water is claimed by the local Government and that the additional water will be utilized only when available, instead of letting it run waste".

Project, or later, due to the desire of the Government of India to approve of the Sutlej Valley and Sukkur Barrage Projects first before dealing with any other Punjab schemes.

15. The Punjab Government have now put forward in their Brief a claim for water for the Patti Project to irrigate the Thal tract, which entails a canal with a capacity of 6,000 cusecs and rabi capacity factor of 0·6, the actual monthly capacity factor to vary in the same way as the capacity factor on other perennial canals in the province.

16. The North-West Frontier Province did not submit any Brief, but their representative stated the requirements of the new Paharpur canal which provides for irrigating a portion of Punjab territory in addition to the North-West Frontier Province territory commanded.

17. RECOMMENDATIONS OF THE COMMITTEE—The Committee consider that generally speaking, except where specifically stated hereinafter, the requirements of the Sind, Thal and Paharpur systems should be met from such supplies as are available in the Indus proper, and they have endeavoured to apply this method of allocating supplies in dealing with the other systems under consideration.

18. They recommend that supplies be allotted for the Thal Project canals up to a maximum capacity of 6,000 cusecs with mean supply as shown in Table II (*vide* also paragraph 30).

19. The newly proposed Paharpur canal requires for the irrigation of the North-West Frontier and the Punjab tracts concerned, a maximum supply in kharif of 875 cusecs with a mean discharge of 500 cusecs, and a maximum rabi supply of 700 cusecs with a mean of 360 cusecs, to which the Committee agree.

20. In the event of the supply in the Indus proper being insufficient, the Thal, Paharpur and Sukkur Barrage canals should share supplies available on the basis of their authorized monthly maximum withdrawals for the period concerned.

It is found, however, from records placed at the disposal of the Committee that it would be in exceptional years only that the total requirements of those systems would exceed the supplies available, and any deficiency of supply would ordinarily be so small that it would create no difficulty.

21. The Committee consider that the Haveli and Panjnad systems should have a prior claim on the waters of the Chenab up to their authorized withdrawals, and in the event of any shortage at Sukkur the Haveli and Panjnad canals should not be called upon to forego any part of their withdrawals up to the authorized figures.

III—HAVELI PROJECT AND BAHAWALPUR AT PANJNAD

22. PRECIS OF THE BRIEFS—The construction of Panjnad weir below the confluence of the Sutlej and Chenab rivers enabled water from the Chenab to be utilized in Bahawalpur State territory through the Panjnad canals, but in order to reserve the right of some of the Chenab water for the proposed Haveli Project, the authorized withdrawal of the Panjnad canals, was limited under Clause 4 D. 2 of the Sutlej Valley Project Agreement to the same fraction of their authorized maximum capacities as the British canals higher up the Sutlej. A special Committee, convened to investigate difficulties that had arisen in connection with the working of the Sutlej Valley Project in the Bahawalpur State, recommended that the restriction of Clause 4 D. 2 should be removed, as the supplies permissible under that clause were insufficient for the Panjnad canals, while ample water was available. The Punjab and Bombay Governments agreed to allow supplies to be withdrawn in excess of those permissible under the Agreement, but this was merely a temporary arrangement, and the Punjab intimated that they were not prepared to give unrestricted supplies after 31st March 1935 lest Bahawalpur should acquire a prescriptive right to water which might be required for the Haveli Project.

In their Brief submitted to this Committee, the Punjab Government hold that the construction of the Panjnad headworks ensured that the Bahawalpur inundation canals would not be adversely affected by the construction of the Haveli Project.

23. Although the Indus Discharge Committee found it possible to allot a rabi discharge of 1,250 cusecs to the Haveli Project, the Punjab considered it

insufficient to make the project productive since greater supplies were necessary in October, November and March. The 1932 Project provides canals with a capacity of 2,750 cusecs perennial and an additional 5,000 cusecs non-perennial. If supplies are available, the perennial canal should run full supply up to 30th November and from 1st March to 1st April, and with a capacity factor of 0·3 for the remaining rabi months, *i. e.*, mean discharge of 825 cusecs.

24. In stating their requirements at Panjnad, the Bahawalapur State consider that their canals should receive the same volume of water per unit of area as that given to the Sukkur Barrage canals, and point out that the extra supplies required would have no appreciable effect on the Sukkur canals during either kharif or rabi. There would probably be some effect on the Sind inundation canals, but the question arises as to how far it is justifiable to deprive a large area upstream, where the supply is controlled, for the sake of inundation canals lower down, which can only draw off a fraction of this supply, the major portion inevitably running waste to the sea. It appears necessary, however, in the interests of the Haveli Project to restrict the withdrawals at Panjnad, and that arrangement would probably be acceptable to Sind. From records of discharges available at Trimmu (Haveli) and Panjnad, it seems that there would be ample water from regeneration to meet the needs of the Panjnad perennial canal during rabi. The State therefore propose that during kharif 49% of the discharge above Panjnad should be drawn off subject to a combined maximum discharge of 9,750 cusecs, and in rabi either 38% of the discharge available or the difference between the discharges in the river at Trimmu and Panjnad, whichever was greater, subject to a maximum of 1,032 cusecs. Any additional water not required at Sukkur would be shared equally with the Haveli system.

25. Recommendations of the Committee—The Committee consider that when the Haveli Project is constructed the supplies of the Chenab at Trimmu and Panjnad should be shared between the Haveli and Panjnad systems, and the latter should have no claim whatsoever on Sutlej waters, except for regeneration and surplus water below Islam weir, which should be included in the available supplies at Panjnad.

26. For the period 16th to 31st October, after the demands of the perennial canals have been met, the non-perennial canals should share the balance of water available according to the full capacities of those canals. For the first fortnight in April the non-perennial canals may open if and when there are surplus suppliles at Sukkur.

The full capacities agreed to are :—

——	Perennial (Cusecs)	Per cent	Non-perrennial (Cusecs)	Per cent	Total (Cusecs)	Per cent
Haveli	2,750	65	5,000	44	7,750	48
Panjnad	1,500	35	6,500	56	8,000	52

27. While agreeing to the principle of the Chenab supplies being confind to the Haveli Project and the Bahawalpur canals at Panjnad, up to their authorized withdrawals, the Committee realize that the problem is more complicated than that of the Indus, by reason of the fact that during the major portion of the rabi season the Khanki, Rasul, and Islam weirs are closed, and it is clear, therefore, that during the major portion of that season the Haveli and Panjnad systems must be dependent on infiltration or regeneration below those weirs. The Committee agree that if it is physically possible the water available in a river should be shared between the canals taking off on the basis of their authorized withdrawals. But from the records of discharges, it is seen in this case, that it may not be possible at times to divide water strictly in proportion to the authorized withdrawals of the canals, because the regeneration between Trimmu (Haveli Project) and Panjnad, may be more than the Panjnad canal's share. Again,

there is no certainty as to what effect the closing of the inundation canals between Trimmu and Panjnad, and the substitution of weir controlled canals, will have on the regeneration between these points.

28. In view of the physical difficulties anticipated, the Committee consider that the Haveli canals should be allowed to draw off any water above Trimmu, up to their authorized withdrawals, and the Panjnad canal should draw off any water arriving at Panjnad weir, also up to its authorised withdrawals. If, however, it became apparent that this method of distribution was unsatisfactory and no mutual agreement could be reached, on the request of either party, the matter should be referred to arbitration; the method of arbitration should be specified in the agreement, but under the present administrative conditions should be by means of a Committee of the Central Board of Irrigation.

29. Until such time as the Haveli Project is constructed, the Panjnad canal should be allowed to withdraw its full requirements up to the specified monthly discharges (Table III columns 6 and 7), on the understanding that it is purely a temporary arrangement which must not give rise to the acquisition of rights in those waters.

30. The mean and maximum monthly discharges given in Tables II and III for the Thal, Haveli and Panjnad canals were accepted by the Committee as the basis of allocation of water to those systems, but in the event of supplies at Sukkur being in excess of the authorized withdrawals (5) the Thal system should be allowed to claim additional withdrawals up to the Panjnad capacity factors in Table IV, Column 6. Thereafter any spare water should be shared by the three systems in proportion to their maximum authorized discharges for the period concerned.

TABLE II

Statement showing supplies required for Punjab Projects

(Discharge in cusecs)

Month	Haveli Project					Thal Project	
	Non-perennial, mean and max.	Perennial		Total		Mean†	Max.
		Mean	Max.	Mean	Max.		
1	2	3	4	5	6	7	8
January	..	990	2,750	990	2,750	2,000	6,000
February	..	990	2,750	990	2,750	3,600	6,000
March	..	2,750	2,750	2,750	2,750	3,600	6,000
April 1st—15th ..	*5,000	2,750	2,750	*7,750	*7,750	6,000	6,000
April 16th—30th	5,000	2,750	2,750	7,750	7,750	6,000	6,000
May	5,000	2,750	2750	7,750	7,750	6,000	6,000
June	5,000	2,750	2,750	7,750	7,750	6,000	6,000
July	5,000	2,750	2,750	7,750	7,750	6,000	6,000
August	5,000	2,750	2,750	7,750	7,750	6,000	6,000
September	5,000	2, 5)	2,750	7,750	7,750	6,000	6,000
October 1st—15th ..	5,000	2,750	2,750	7,750	7,750	6,000	6,000
October 16th—31st	*5,000	2,750	2,750	*7,750	*7,750	6,000	6,000
November	..	2,475	2,750	2,475	2,750	5,600	6,000
December	..	990	2,750	9 0	2,750	2,000	6,000

*See paragraph 26. †See paragraph 30.

(5) In the case of the Khairpur Canals the term "authorized withdrawals" shall include any extra withdrawals over the figures given in Column 8 of Table II required by Khairpur, provided the monthly mean is not exceeded.

TABLE III

Statement showing supplies required for Bahawalpur State at Panjnad

(Discharge in cusecs)

Month	Capacity			Monthly mean withdrawals		Maximum authorized withdrawals
	Non-perennial	Perennial	Total	Originaly proposed	Accepted by Committee	
1	2	3	4	5	6	7
January	..	1,500	1,500	1,000	750	1,500
February	..	1,500	1,500	1—14: 1,000 15—28/29: 1,500	1,000	1,500
March	..	1,500	1,500	1,500	1,275	1,500
April 1st—15th	*6,500	1,500	*8,000	*8,000	*8,000	*8,000
April 16th—30th	6,500	1,500	8,000	8,000	8,000	8,000
May	6,500	1,500	8,000	8,000	8,000	8,000
June	6,500	1,500	8,000	8,000	8,000	8,000
July	6,500	1,500	8,000	8,000	8,000	8,000
August	6,500	1,500	8,000	8,000	8,000	8,000
September	6,500	1,500	8,000	8,000	8,000	8,000
October 1st—15th	6,500	1,500	8,000	8,000	8,000	8,000
October 16th—31st	*6,500	1,500	*8,000	*8,000	*8,000	*8,000
November	..	1,500	1,500	1,500	1,350	1,500
December	..	1,500	1,500	1,000	750	1,500

*See paragraph 26

TABLE IV

Rabi Capacity Factors

Month	Sind	Punjab, existing	Thal Project	Panjnad Canal		Haveli project
				Proposed as per Table III Column 5	Accepted as per Table III Column 6	
1	2	3	4	5	6	7
October	.90	.85	1·0	1·0	1·0	1·0
November	.81	.55	.93	1·0	.9	.9
December	.89	.4	.33	.66	.5	.36
January	.79	.4	.33	.66	.5	.36
February	.79	.5	.6	.66 / 1·0 } .83	.66	.36
March	.81	.65	.6	1·0	.85	1·0

IV—SUPPLIES IN THE GHARRA REACH OF THE SUTLEJ

31. The Committee agree that in their opinion the Panjnad canal has no claim on the Sutlej waters, except for any regeneration and surplus water below Islam weir. In view of the reduced area in the Bahawalpur State to be served by the Gharra reach, the Committee consider that a change in the distribution of water on the Gharra reach of the Sutlej is necessary, and recommend a redistribution of the supplies between the Punjab, Bahawalpur and Bikaner in accordance with Table V, which was accepted by the interested parties. The original allocation of shares in supplies available was made upon agreed figures of gross area. Culturable irrigable areas were not known, and even now the new proposals are not prepared on a common basis, and it appears impossible to make a distribution strictly on a logical basis accounting for culturable irrigable areas, full supply factors, duties and intensities, modified in turn by climatic conditions, rainfall, and considerations of water-table.

TABLE V

Gharra reach of the Sutlej

Partner	Perennial cpacity		Non-perennial share capacity		Total		Non-perennial additionl capacity	Total maximum capacity
	Cusecs	Per cent* rounded	Cusecs	Per cent* rounded	Cusecs	Per cent* rounded	Cusecs	Cusecs
I	2	3	4	5	6	7	8	9
Punjab ..	3,940	30	11,523	72	15,463	53	5,761	21,224
Bahawalpur ..	6,340	49	4,467	28	10,807	37	2,233	13,040
Bikaner ..	2,720	21	*Nil*	..	2,720	10	..	2,720
Total ..	13,000	..	15,990	..	28,990	..	7,994	36,984

*Percentage share of total supplies utilized in canals.

V.—LIMITS OF KHARIF PERIOD

32. PRECIS OF THE BRIEFS—Bahawalpur State have mentioned in their Brief that they obtained permission from the Bombay Government to keep open the Panjnad non-perennial canal until the 31st October on the understanding that it was not opened until the 15th April, as that arrangement enabled them to sow considerably greater areas of rabi crops on the non-perennial channels of the Panjnad canal. They therefore propose that in future the kharif period should be considered to extend from the 16th April to the 31st October and the rabi season from the 1st November to the 15th April.

33. Bikaner State point out in their Brief that the low supplies at Ferozepur during April and May create a very serious situation on the perennial canals which have no alternative source of supply even for drinking water. The Punjab and Bahawalpur State, who alone have non-perennial canals, have fed their perennials at the expense of their non-perennials, and have allowed the Bikaner canal an excess above its share when the river supplies were short. They desire to have some such arrangement codified, and suggest as a solution that until the river supplies available exceed 3,452 cusecs, water should not be allotted to the non-perennial canals.

34. RECOMMENDATIONS OF THE COMMITTEE—The Committee are of the opinion that a case exists for revising the official dates of the beginning and end of the kharif period for the non-perennial canals, and their proposals are as follows:—

(*a*) On the Indus below Mithankot, Sind may withdraw water as laid down in Table I.

(*b*) On the Indus above Mithankot and on the Panjnad and Haveli canals, the kharif season shall be from the 16th of April to the 15th of October, but should water be available after the demands of the perennial canals have been met, the non-perennial canals may remain open to the 31st of October. Provided that:—

(*i*) if supplies are surplus at Sukkur a non-perennial canal may open after the 1st April,

(*ii*) should supplies from the western rivers be transferred to the Sutlej at some future date, no claim on such transferred supplies shall be made on behalf of the non-perennial canals taking off as Trimmu (Haveli) and Panjnad.

(*c*) In the Ghara reach of the Sutlej. In early kharif the perennial canal of the three partners shall have preference to the extent of 26 per cent of their revised perennial capacities, *i. e.*—

	Perennial capacity. cusecs.	26% cusecs.
Punjab	3,940	1,025
Bahawalpur	6,340	1,648
Bikaner	2,720	707
Total ..	13,000	3,380

35. Until the river rises to give this discharge of 3,380 cusecs at canal heads, the rabi share percentages shall apply. When the discharge available is above this, the excess over 3,380 cusecs shall be allotted to non-perennial canals in the following proportion:—

Punjab	72 %
Bahawalpur	28 %

until the non-perennial canals draw 26 per cent of 15,990 cusecs, *i.e.*, 4,157 cusecs, whether this discharge is being utilized in the non-perennial canals or elsewhere, as provided in paragraph 46.

36. Above this combined discharge of 3,380 plus 4,157=7,537 cusecs at canal heads the partners will share as follows:—

Punjab	53 %
Bahawalpur	37 %
Bikaner	10 %

and these kharif percentages will apply, whatever the discharge, from July to 15th October.

37. Bikaner canal discharge shall be gauged immediately downstream of the unlined portion, *i.e.*, at mile 6 approximately.

VI.—PRIORITY OF CLAIMS

38. It has been found impossible to frame any rules for the allocation of water between claimants, but an endeavour has been made to act according to the general direction of the Secretary of State, namely, that in allocating water, the greatest good to the greatest number must be sought, without reference to political boundaries.

39. It is clear to the Committee, however, that the factors which decide claims to water and allocation of supplies, at a time when a project is prepared, may not necessarily be the deciding factors if the position is reviewed some years later, after the canals have been in operation for some time.

40. An *ad hoc* investigation into each case in which conditions have changed would clearly be necessary, and as the conditions under which the distribution of water was made originally, may in due course, no longer hold good, no factor should

be allowed to interfere with a redistribution which is of itself equitable, if that redistribution can be shown to be in the general interests. The economic aspect should be considered along with other aspects of the case.

41. Generally speaking, the acquiring of rights in water in perpetuity should not be allowed. While not wishing to detract from the sanctity of agreements, it is clear to the Committee that circumstances may arise justifying the reviewing of an agreement which is no longer equitable, and where on full enquiry, the interested parties being represented, this is found to be the case, the agreement should be modified to meet the altered conditions, and all agreements should contain a clause permitting this.

VII.—BASIS FOR ALLOCATION OF IRRIGATION WATER

42. The Committee consider that the fundamental basis for the distribution of water for projects prepared in the future must be the culturable irrigible area as defined in the Glossary, Part I of this Report. No project should be submitted for sanction in the future unless and until a reliable soil survey has been carried out.

VIII.—WATER TABLE SURVEY

43. The Committee have been greatly impressed by the organization which has been maintained in the Punjab for many years, and a similar organization which has recently been introduced in Sind, to watch the rise and fall of sub-soil water levels throughout those provinces. They are strongly of the opinion that in future no project should be submitted for sanction without full data relating to the prevailing sub-soil water conditions, and no claim for water, particularly for perennial irrigation, should be entertained in respect of land which is liable to be water-logged.

44. The factors affecting water-logging are several, some of which are:—

(1) prevailing depth of sub-soil water.

(2) nature of soil to be irrigated, and the sub-soil.

(3) facilities for drainage.

(4) nature of soil through which canals are excavated and whether they are to be lined.

(5) rainfall.

(6) whether wells are to be used in addition for irrigation.

It is impossible to lay down any hard and fast rules relating to those factors, and every case must be considered on its merits.

45. The consequences of water-logging, however, are likely to be so serious that in the interests of the areas concerned, demands for perennial irrigation should not be made where there is any danger of water-logging and it is essential that all authorities considering future projects should insist on a rigid investigation of the subsoil water conditions.

IX.—DISCRETION TO APPLY WATER AT WILL

46. The Committee are of the opinion that once water has been allotted to a Province or State, the distribution thereof should be left to the discretion of that authority. Each partner to an agreement should have full right to use its allotted share of the net supplies available in kharif or rabi, in its perennial or non-perennial canals. No rabi water should be allotted to any non-perennial canal or non-perennial area, but subject to this restriction, an authority may utilize the water allotted to its perennial area, in any area or through any channel, which it deems fit.

Any such transfer of water should not, however, entitle the authority concerned to make new claims for further supplies of water.

47. For the purpose of applying Article 18 of the Sutlej Valley Project Agreement of 1920, the water distribution account for each crop season is divided into three sub-periods which are taken as units of time for the distribution of water. This practice of dividing the crop season into sub-periods is considered desirable and should not be changed.

X.—STORAGE

48. In addition to the Bhakra Dam Storage Scheme, to which no objection has been raised by any interested party, the Punjab Government have put forward in their Brief the Woolar Lake Scheme which comprises a storage work on the Jhelum river to store 334,000 foot acres of water in August and September.

Observations are also being made in connection with several small storage works on the affluents of the main rivers, but there are no definite proposals in hand at the moment.

49. Storage works are an expensive expedient, and small storages have not, as a rule, proved to be remunerative, but the Committee consider storage schemes to be of great value in regulating the flow of rivers, in reducing peak floods, and economising water, and are therefore of opinion, that small storage schemes of a capacity not exceeding half a million foot acres on the affluents of the Indus, Jhelum, Chenab, Ravi, Beas and Sutlej rivers, for the storage of water during the months of July and August, may be undertaken by any Provincial or State Government entitled to do so, without the formal sanction of any other authority. But all other interested parties should be informed of the main details of the scheme prior to its being undertaken. Any scheme with a proposed storage capacity of more than the above figure must have the prior approval of all interested parties.

50. The Committee recommend that the proposed Woolar Lake Scheme on the Jhelum, although on a main river, is of such a small capacity that it may be undertaken without the sanction of any other interested party represented on this Committee.

XI.—PROVISION FOR THE FUTURE

51. It appears clear to the Committee that the Indus basin is not the only case in which difficulties are likely to arise, in connection with the distribution of water and they are of the opinion that it is highly desirable that there should be some central co-ordination of both provincial and Indian State activities in connection with the gauging and recording of water flow in rivers affecting several units.

52. The compilation and study of the voluminous records involved should generally be the duty of a special officer and staff in each province concerned, and all the work should be supervised and controlled by some central authority.

XII.—TRANSFERENCE OF WATER FROM ONE RIVER TO ANOTHER

53. The Punjab Government point out in their Brief the possibility of constructing feeder canals to pass water from one river to another. For instance, the water which now passes Madhopur on the Ravi in early kharif must at present be allowed to find its way 435 miles to the Sidhnai, and most of it is wasted on the way. On the construction of the Haveli Project it would be possible to divert this water *via* the Upper Bari Doab canal to the Beas river for use in the Gharra reach of the Sutlej. This is purely a question of transferring water which at present never passes out of the Punjab.

54. On the other hand there are possibilities of constructing a feeder canal from the Chenab to transfer to the Beas early kharif water which at present passes Panjnad. The existence of such a feeder would, in addition to increasing supplies for the Sutlej Valley Project, also enable a canal to be constructed to irrigate the Jullundur doab where the water table has been falling for many years. Such a feeder from the Chenab to the Beas would enable water to be supplied in the months of April, May and June to any extent that experience may prove it is possible to withdraw water from the Chenab during these months.

55. The Committee recommend that the Punjab be allowed to utilize water which will be set free in the Ravi by the construction of the Haveli Project, as and where they desire.

56. The Committee are impressed by the insufficiency of the supplies available for the Sutlej Valley Project canals at the beginning of the kharif season when it is particularly required for sowing higher valued crops, and are of opinion that there would be no objection to the transference of supplies from the Chenab to the Sutlej, if it were not evident that such action would in all probability affect the inundation canals in Sind to the extent of delaying their opening by about a week.

Although the proposal would be of distinct advantage to the Sutlej Valley Project canals, the matter needs careful investigation in regard to the probable effect on the Sind inundation canals.

F. Anderson	Chairman.
F. A. Betterton	Vice-Chairman.
F. J. Waller	Punjab Representative.
W. L. C. Trench	Bombay (Sind) Representative.
A. Oram	N.-W. F. Province Representative.
B. Darley	Bahawalpur State Representative.
Jai Gopal	Bikaner State Representative.
J. Booth	Khairpur State Representative.

OPINIONS OF THE INDEPENDENT MEMBERS OF THE COMMITTEE ON POINTS ARISING OUT OF THE MEETINGS UPON WHICH THE COMMITTEE AS A WHOLE WERE UNABLE TO PASS UNANIMOUS RESOLUTIONS.

1. Discharge Records.

The Independent Members would like to place on record their appreciation of the records placed at the disposal of the Committee by the Punjab and Sind representatives. It is hardly possible to over-estimate the value of these records and it is not too much to say, that in their absence, an agreed conclusion would have been quite impossible.

It was a matter of great satisfaction to them to find that these records were accepted by every member of the Committee without hesitation. In this respect the Independent Members would like to quote the following resolution of the Committee:—

> "One of the outstanding features of our proceedings has been the acceptance by every representative of the records of river discharges placed at our disposal by Mr. Gunn (Executive Engineer, Discharge Division) who accompanied Mr. Nicholson. We are confident that, but for the information so obtained, it would have been impossible for this Committee to reach any conclusion as to the adequacy of the water supply at the key points on the Indus and its tributaries. We record our opinion that the work of the Discharge Division has been of the utmost value and importance.
>
> We record our concurrence with the views of Sir Thomas Ward expressed in 1921, that each province interested in water supplies should maintain some organization continuously, to keep records of this nature. As questions of water supplies become of greater importance with India's development, authentic records of this nature become more and more essential to the solution of these problems. We congratulate the Punjab Government on their enterprise in this respect and trust that the organization now in being will continue this most valuable—indeed we may say essential—work".

Similar records of discharges have been maintained in Sind since 1901.

2. Inundation Canals.

The Independent Members are of the opinion that where the functioning of inundation canals prevents the utilization of an appreciable volume of water for irrigation by allowing it to run to waste, in order to attain the level at which these canals operate, their continued existence as inundation canals and claims for consideration in the allocation of water must be considered in relation to the economic and practical problem of converting them into weir controlled canals. Either those inundation canals must be attached to a weir controlled system and the necessary remodelling carried out, or separate weirs must be built, if the situation cannot be dealt with by providing new heads upstream and regrading.

3. Sind and Waterlogging.

The Independent Members feel obliged to record their opinion that the authorized withdrawals for the Sukkur Barrage canals are high, and they consider that the careful investigations into the possibilities of waterlogging now being carried out should be continued. From the experience of other provinces the Independent Members believe that as time goes on the Sind engineers will find it advisable to restrict the supplies and thereby lessen their requirements at Sukkur.

4. Supplies allotted to Sind.

The Independent Members are of the opinion that the discharges tabulated in columns 2 and 6 of Table I (page 17) must be treated as *maximum* authorized monthly discharges.

5. ADJUSTMENT OF COST OF SUTLEJ VALLEY PROJECT HEADWORKS.

The Independent Members feel that the adjustment of supplies of water now proposed in the Gharra reach of the Sutlej river is for mutual advantage, and the measure of such adjustment in monetary terms in respect to original costs of the Sutlej Valley Project headworks, is in their opinion, quite impossible.

6. AGREEMENTS.

While they do not feel that they are called upon to touch on the subject of agreements, the Independent Members would point out that the Sutlej Valley Project 1920 Agreement will require modification in the event of the proposals contained in this Report being accepted.

They further recommend that all agreements should provide a clause for revision when occasion necessitates such action, as indicated in paragraph 41 of the Findings of the Committee.

7. DISPOSAL OF FUTURE CONTROVERSIES.

In addition to the Findings of the Committee as a whole, recorded in paragraphs 51 and 52, the Independent Members feel obliged to state that in their opinion the presence of an Irrigation Adviser with the Government of India would have greatly expedited the disposal of this case, and consider that the creation of such a post would facilitate early settlement of similar controversies which must undoubtedly arise in the future.

F. ANDERSON
F. A. BETTERTON } *Independent Members.*

SUMMARY OF FINDINGS AND RECOMMENDATIONS

A summary of the Findings and Recommendations is tabulated below for facility of reference.

1. KHAIRPUR STATE

Irrigation of Khairpur State should be on a perennial basis. (Paragraph 9, page 16).

The mean withdrawals given in columns 7 and 8 of Table I may be approved. (Paragraphs 10—12, pages 16 and 17).

2. BRITISH SIND CANALS.

The authorized withdrawals for the British Sind Canals in October may be increased by 6,500 cusecs. (Paragraph 13, page 17).

The authorized withdrawals should be in accordance with column 6 of Table I. (Paragraphs 11 and 13, page 17.)

3. PAHARPUR CANAL.

The Paharpur Canal should be allotted the dischages asked for by the North-West Frontier Province. (Paragraph 19, page 18).

4. THAL CANAL.

The mean and maximum withdrawals for the proposed Thal Canal given in columns 7 and 8 of Table II may be approved. (Paragraphs 18 and 30, pages 18 and 20).

5. The Thal and Paharpur systems should share with the Sukkur Barrage Canals the supplies available during any period of shortage on the basis of their authorized maximum withdrawals. (Paragraph 20, page 18).

6. PANJNAD CANAL.

The Panjand Canal should be allowed to draw off any water arriving at Panjnad Weir up to the withdrawals specified in columns 6 and 7 of Table III. (Paragraph 28, page 20).

Until the Haveli Project is constructed, the Panjnad Canal should be allowed, as a temporary measure, to withdraw the full requirements subject to the mean and maximum authorized withdrawals given in columns 6 and 7 of Table III. (Paragraph 29, page 20).

7. HAVELI CANAL.

The Haveli and Panjnad canals should not be called upon to forego any part of their authorized withdrawals during any period of shortage of supplies in the Indus proper. (Paragraph 21, page 18).

When the Haveli Project is constructed, the canal should be allowed to draw off any water above Trimmu subject to the authorized withdrawals specified in columns 5 and 6 of Table II. (Paragraph 28, page 20).

8. Should this method of allocating supplies between the Haveli and Panjnad canals prove unsatisfactory, the matter should be referred to arbitration if no mutual agreement can be reached. (Paragraph 28, page 20).

9. When supplies at Sukkur are in excess of the authorized withdrawals, the Thal system may claim additional withdrawals up to the Panjnad capacity factors given in column 6 of Table IV. Thereafter any spare water should be shared by the three schemes according to their maximum authorized discharges for the period concerned. (Paragraph 30, page 20).

10. GHARRA REACH.

The supplies in the Gharra reach of the Sutlej river should be redistributed between the Punjab, Bahawalpur and Bikaner in accordance with Table V. (Paragraph 31, page 22).

11. Limits of Kharif period.

Certain modifications are proposed in the official dates of the beginning and end of the kharif period for the non-perennial canals, namely:—

(*a*) On the Indus below Mithankot, Sind may withdraw water as laid down in Table I. (Paragraph 34 (*a*), page 22.)

(*b*) Above Mithankot and on the Panjnad and Haveli canals, the kharif season should be from the 16th of April to the 15th of October but should water be available after the demand of perennial canals has been met, the non-perennial canals may open on the 1st of April and remain open until the 31st of October under the conditions specified in paragraph 34 (*b*), page 23.

(*c*) In the Gharra reach of the Sutlej special arrangements are proposed,—*vide* paragraphs 34 (*c*), 35 and 36, page 23.

12. Priority of Claims.

Every arrangement should contain a clause in accordance with which it can be reviewed when circumstances prove that the agreement is no longer equitable. (Paragraph 41, page 24).

13. Basis for allocation of Irrigation Waters.

The fundamental basis for the distribution of water should be the culturable irrigable area. No irrigation project should be submitted for sanction in future without a reliable soil survey. (Paragraph 42, page 24.)

14. Water Table Survey.

No irrigation project should be submitted for sanction in future without full data relating to sub-soil water conditions. (Paragraphs 43—45, page 24).

15. Discretion to apply water at will.

The distribution of water allotted to a Province or State should be left to that authority subject to the restriction that rabi water shall not be allotted to any non-perennial canal or non-perennial area. (Paragraph 46, page 24.)

16. Storage.

There is no objection to the construction of small storage works on the affluents of the main Punjab rivers for storing water during the flood season in July and August. (Paragraph 49, page 25).

17. The construction of the proposed Woolar Lake Scheme on the Jhelum may be permitted as a special case. (Paragraph 50, page 25).

18. Provision for the future.

There should be a central co-ordination of activities in connection with the gauging and recording of water flow in rivers affecting several units. (Paragraphs 51 and 52, page 25).

19. Transferring water from one river to another.

The Punjab Government may be allowed to utilize the water set free in the Ravi by the construction of the Haveli Project. (Paragraph 55, page 25).

20. The Sutlej Valley Project requires additional supplies at the beginning of kharif and there would be no objection to transferring water from the Chenab to the Sutlej provided that such action would not affect the Sind inundation canals. (Paragraph 56, page 25).

Opinions of the Independent Members on other points

21. Discharge Records.

The records of river gauging placed at the disposal of the Committee by the Punjab and Sind representatives were greatly appreciated, and without them it

would have been impossible to frame the recommendations now submi tted (Paragraph 1, page 27).

22. Inundation Canals.

Continued existence as such of inundation canals which necessitate waste of water to allow of their functioning must be considered in relation to the economic and practical problem of converting them into weir controlled canals. (Paragraph 2, page 27).

23. Sind and Waterlogging.

The waterlogging investigations now in hand in Sind should be continued. The Sind engineers may find it advisable to restrict the supplies allotted to their canals as the authorized withdrawals are high. (Paragraph 3, page 27).

24. Supplies allotted to Sind.

The discharges tabulated in columns 2 and 6 of Table I must be treated as *maxima*. (Paragraph 4, page 27).

25. Adjustment of cost of S. V. P. headworks.

Adjustment of original costs of S. V. P. headworks on the basis of re-distribution of water now proposed, is quite impossible. (Paragraph 5, page 28).

26. Agreements.

The Sutlej Valley Project 1920 Agreement will require modification in several respects if the recommendations made in this report are accepted. (Paragraph 6, page 28).

27. Future controversies.

An Irrigation Adviser with the Government of India is required. (Paragraph 7, page 28).

APPENDIX A.

Copy of letter No. 8255-I.-W., dated 3rd June 1929, from Government of Bombay to Government of India.

No. 8255-I.W.

PUBLIC WORKS DEPARTMENT

Bombay Castle, 3rd June 1929.

FROM

C. M. LANE, ESQUIRE,

Joint Secretary to the Government of Bombay,
Public Works Department

To

THE CONSULTING ENGINEER TO THE GOVERNMENT OF INDIA,

Department of Industries and Labour,
Public Works Branch.

SUBJECT:—*Alterations in the alignment of the Lloyd Barrage Canals.*

SIR,

I am directed by the Governor in Council to refer to paragraph 2 of your letter No. I-6/109, dated 5th November 1927, and to enclose wherewith a statement showing, month by month, the discharges allotted to each of the Lloyd Barrage Canals as per actual detailed designs, the total of such discharges being compared with the volume shown in paragraph 15 of the Government of India Despatch No. 23-P.W., dated 16th December 1920.

2. The Government of India will observe that the demands, month by month, exceed the project figures to the extent shown below (*vide* column 10 of the statement):—

——	Project	As per actual detailed designs	Difference	Percentage
	Cusecs	Cusecs	Cusecs	
January	22,756	23,802	1,046	4·6%
February	22,756	23,802	1,046	4·6%
March	23,454	25,339	1,885	8·0%
April	29,029	30,871	1,842	6·3%
May	39,543	40,041	498	1·3%
October	25,897	27,121	1,224	4·7%
November	23,540	24,604	1,064	4·5%
December	25,756	26,714	958	3·7%

3. I am now to make the following observations in regard to these excesses:—

(*i*) The figures of discharges given in paragraph 15 of the Government of India Despatch No. 23-P.W., dated 16th December 1920, are a copy of those given in the last column of statement No. 1 following paragraph 24 of Volume V of the Sukkur Barrage Canals Project (1919-20). From an examination of that statement it has been found that there is an arithmetical error in totalling up the discharges for the months of January, February and December. The totals should have been 22,756, 22,756 and 25,756 cusecs, instead of 22,656, 22,656 and 25,656 cusecs, respectively. The figures in the statement accompanying this letter have now been compared with the project figures thus corrected.

(*ii*) In my predecessor's letter No. 8255-I. W., dated 12th September 1927, it has already been brought to the notice of the Government of India that the excesses shown in paragraph 2 *supra* are largely due to the lack of exact data in consequence of which the transit losses in the Eastern Nara were originally under-estimated. The project allowed for a uniform transit loss of 832 cusecs (about 8/3 cusecs per million s. fts of wetted surface) in every month of the year; but when preparing working designs

the whole question of transit losses in this channel was exhaustively reviewed and it was decided to adopt for purposes of transit losses 8 cusecs per million s. ft. of wetted perimeter. Had it not been for this factor of increased transit loss, the difference between the project and the revised discharges would have been insignificant,—*vide* columns 10 and 13 of the appended statement.

4. In paragraph 2 of their letter under reply, the Government of India say that they are not in a position to agree to the allotment to the Lloyd Barrage and Canals Project of any supplies in excess of those mentioned in paragraph 15 of their Despatch No. 23-P. W., dated 16th December 1920; and that if any modifications of the project necessitate an increase of supply to certain of the canals, the additional voume must be met in full by the omission of, or the reduction of the supply to, other portions of the system.

I am to say that the Government of Bambay do not wish to reduce in any way the area to be commanded as now worked out in detail for each channel, nor to tamper with the duties allowed for in the porject. It would be inadvisable to curtail any area, for any such reduction would have to be carried out empirically, and in the end the auction sales of Government lands might be adversely affected. The Government of Bombay consider it equally inadvisable to increase the duties, which have been arrived at after very careful investigation not only by officers on special duty but also by conferences representing the Irrigation, Revenue and Agricultural Departments. The question then arises whether the procedure of designing the Eastern Nara to draw-off a larger volume of water than the volume allotted to it in the project estimate can be admitted. The Governor in Council understands* that there will be no objection to this provided that no prescriptive right to the additional quantity of water shown in column 10 of the appended statement is claimed by the Government of Bombay and that this additional water will be utilised only when available, instead of letting it run waste to the sea, and this is what is intended. The Government of India will, it is presumed, agree to the small corrections mentioned in paragraph 3(*i*) above.

**Vide* paragraph 18 of the Report of the Indus Distharge Committee, 1929.

I have the honour to be,

SIR,

Your most obdient servant

(Sd.) C.M. LANE,

Joint Secretary to the Government of Bombay,
Public Works Department

Accompaniment:—

The statement referred to. (*See next page*).

APPENDIX A—*contd.*

(Accompaniment to Letter No. 82855-I., W., dated 3rd June 1929, from the Government of Bombay to the Government of India)

Statement showing month by month the discharge to each Canal in the Lloyd Barrage and Canals Construction Scheme under the revised proposals as compared with those shown in paragraph 15 of the Government of India Despatch No 23 P. W. of 16th December 1920.

Month	Revised discharges						Total	Total discharge originally communicated to the Government of India,—*vide* Statement I following paragraph 24 of Volume V of the Sukkur Barrage Canals Project, and paragraph 15 of the Government of India Despatch No. 23-P. W., dated 16th December 1920.	Difference between columns 8 and 9.	Losses in Eastern Nara.		
	North-Western Perennial Canal	Central Rice Canal	South Eastern Perennial (now Dadu) Canal	Rohri Canal	Khairpur Feeders	Eastern Nara				As in project	As now calculated.	Difference between columns 11 and 12
1	2	3	4	5	6	7	8	9	10	11	12	13
January ..	3,211	..	2,337	10,090	..	8,164	23,802	22,756	1,046	832	2,003	1,171
February ..	3,211	..	2,337	10,090	..	8,164	23,802	22,756	1,046	832	2,003	1,171
March ..	3,023	..	2,059	10,883	..	9,374	25,339	23,454	1,885	832	2,147	1,315
April ..	3,167	3,136	1,873	10,084	2,000	10,611	30,871	29,029	1,842	832	2,290	1,458
May ..	4,373	7,714	2,456	10,149	3,000	12,349	40,041	39,543	498	832	2,576	1,744
June ..	5,099	10,215	2,837	10,191	4,030	13,389	45,761	45,926	—165	832	2,862	2,030
July ..	5,099	10,215	2,837	10,191	4,030	13,389	45,761	45,926	—165	832	2,862	2,030
August ..	5,099	10,215	2,837	10,191	4,030	13,389	45,761	45,926	—165	832	2,862	2,030
September ..	5,099	10,215	2,837	10,191	4,030	13,389	45,761	45,926	—165	832	2,862	2,030
October ..	1,927	..	2,020	10,664	3,000	9,510	27,121	25,897	1,224	832	2,290	1,458
November ..	2,890	..	2,103	9,260	3,000	7,351	24,604	23,540	1,064	832	1,860	1,028
December ..	3,211	..	2,337	10,090	3,000	8,076	26,714	25,756	958	832	2,003	1,171

APPENDIX B.

Copy of letter No. I. R. 6, dated 29th June 1929, from the Government of India to Government of Bombay.

GOVERNMENT OF INDIA.

DEPARTMENT OF INDUSTRIES AND LABOUR.

PUBLIC WORKS BRANCH.

No. I.R.6.

Simla, the 29th June 1929

FROM

A. BREBNER, ESQUIRE, C.I.E.,

Offg. Consulting Engineer to the Government of India.

TO

THE SECRETARY TO THE GOVERNMENT OF BOMBAY,

Public Works Department

SUBJECT:—*Alterations in the alignment of the Lloyd Barrage Canals.*

SIR,

With reference to the correspondence resting with your letter, No. 8255-I.W., dated the 3rd June 1929, I am directed to say that the Government of India have no objection to certain of the canals in the Sukkur Barrage Project being designed to draw off a larger volume or water than that allotted to them in the project estimate, on the conditions proposed by the Government of Bombay, *viz.*, that no prescriptive right to the additional quantity of water is claimed by the local Government and that the additional water will be utilized only when available, instead of letting it run waste.

2. As regards the arithmetical error of 100 cusecs in totalling up the discharges for the months of January, February and December, referred to in your letter, I am to say that the Government of India are not in a position to agree to the allotment to the Lloyd Barrage and Canals Project of any supplies in excess of those mentioned in paragraph 15 of their despatch No. 23-P. W., dated 16th December 1920, with which the project was submitted to the Secretary of State for sanction. As the difference is small, indeed so small as to be almost insusceptible of measurement, the Government of India trust that the Government of Bombay will not press the matter.

I have the honour to be,

SIR,

Your most obedient servant

(Sd.) A. BREBNER,

Offg. Consulting Engineer to the Government of India

APPENDIX C.

Copy of Bombay Government letter No. 6590/27-I. W., of the 26th June 1933, to the Foreign and Political Department, Government of India.

No. 6590/27-I.W.

PUBLIC WORKS DEPARTMENT.

Bombay, Castle, 26th June 1933.

FROM

C. M. LANE, ESQ., I.S.E.,
SECRETARY TO THE GOVERNMENT OF BOMBAY,
PUBLIC WORKS DEPARTMENT.

To

THE DEPUTY SECRETARY TO THE GOVERNMENT OF INDIA,
IN THE FOREIGN AND POLITICAL DEPARTMENT.

SUBJECT:—*Extra supply for the Abbasia Canal in the Bahawalpur State.*

SIR,

With reference to your letter No. F. 154-R./32, dated 25th February 1933, I am directed by the Governor in Council to state that the Note, forming an accompaniment to that letter, has received the most careful consideration of this Government.

2. The proposition, to which the acquiescence of this Government is asked, is that the Panjnad Canals in Bahawalpur State shall be allowed, after the needs of Sind and the Punjab have been fully met, to abstract what is required from the surplus available water which under the existing agreement is required to be passed down below Panjnad Weir. It is stated that the present arrangement is unreasonable on grounds which are detailed and in particular it is mentioned that if the Abbasia Canal were to be given more water during the earlier part of the rabi season so as to enable a larger area to be sown, it would be impossible to mature the same if supplies were correspondingly reduced in the latter part of the season.

3. In this connection I am directed to state that it apears to the Governor in Council that similar conditions may very possibly prevail under the proposed revised agreement. It seems likely that the Abbasia Canal might draw off what water it required during the early part of the rabi season, up to its authorised full discharge, because the supply at Sukkur was at that time more than sufficient to meet all demands for the Lloyd Barrage Canals so that water was passing unused to the sea. It may, however, sometimes occur that similar conditions will be absent during the second half of the rabi season with the result that the discharge of the Abbasia Canal would then be required to be limited to half the authorised full discharge. It appears to the Governor in Council most unlikely that, in such circumstances, Bahawalpur State will acquiesce without protest to the implementing of the essential conditions, underlined in paragraph 2 of this letter, which would involve sacrifice of a large part of the rabi area sown and partly matured in the State. It is obvious that in such an eventuality great pressure would be brought on the Government responsible for the administration of the Lloyd Barrage Canals and in effect the present difficulties in securing adequate supplies to the Panjnad Canals would remain unremedied. Disputes arising therefrom, which are at present Punjab-Bahawalpur problems, would merely be converted into Sind-Bahawalpur controversies.

4. As regards paragraph 16 (*e*) of the Note under consideration, I am directed to state that no provision was made in the Lloyd Barrage and Canals Construction Project for a rabi supply to the Khairpur State after the 31st December when the Canals were to be closed down until the 1st April following. The State, however, now presses for a perennial supply being allowed to it from the Lloyd Barrage. It is accordingly necessary to reserve a supply of 2,000 cusecs from January to March as a contingency against such a demand being made and conceded. This additional supply cannot possibly be met from the supplies allotted to the Lloyd Barrage Canals, and it will accordingly be necessary that the agreed minima discharges of the Indus at Sukkur to which Sind shall have a prescriptive right shall be revised as under:—

	Cusecs	
October	27,121	
November	24,604	
December	69,714	
January	25,802	Including additional 2,000 cusecs for Khairpur State.
February	25,802	
March	27,339	
April	30,871	

To this extent the allotment of supplies to the Lloyd Barrage Canals, sanctioned in Government of India letter No. I. R. 6, dated the 29th June 1929, will require to be revised for the months January, February and March. This Government will address the Government of India further in this connection if and when the necessity arises. I am, however, directed to point out that should the Khairpur State claim for 2,000 cusecs additional supply between December and April be acceded to, the difficulty mentioned in paragraph 3 of this letter will inevitably be accentuated and the position therein visualised will be rendered still less unlikely of occurrence.

5. As regards the proposition, advanced in the Note, that the Panjnad Canal shall be permitted to continue to draw water until the 31st October, instead of being closed down on the 15th October, as it is now required to be, the same objection as has been adduced with reference to the Abbasia Canal prevails in theory. But it is accepted that the possibility of Indus supplies at Sukkur being indequate at any period between 15th October and 31st October to meet the full maximum requirements of the Lloyd Barrage Canals is remote. I am accordingly directed to state that the Governor in Council will be prepared to agree to the Panjnad Canal being allowed to continue in flow until the 31st October conditionally on its being agreed by the Government of India that in the event of Sukkur supplies falling short of the allotted discharge of the Lloyd Barrage Canals at any period between the 15th October and 31st October of any year, the draw off of the Panjnad Canal shall be reduced to half authorised full discharge for so long as such deficiency continues.

I have the honour to be,
Sir,
Your most obedient servant,
(Sd.) C. M. LANE
Secretary to the Government of Bombay
Public Works Department.

SUBJECT INDEX

List of sub-Committees provided by the Central Board of Irrigation.

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1	Sub-committee convened to examine the Nyaunggyat Dam Project, Burma	12th December 1927.
2	Sub-committee convened to enquire into the causes of floods in Orissa, and possible remedies.	22nd August 1928.
3	Sub-committee convened to report on the practicability of the proposal of the Engineer-in-Chief, Cauvery Metur Project, to utilize cement concrete in place of cyclopean masonry in surki mortar in the construction of the Metur Dam	11th April 1929.
4	Sub-committee convened to examine the causes of failure of the Islam Weir, Sutlej Valley Project, on the 19th September 1929	10th December 1929.
5	Sub-committee convened to report on the organisation of the Irrigation Department, Bengal, and the practicability of separating the Department and forming a separate Board of Waterways	13th March 1930.
6	Sub-committee convened to enquire into the desirability of remodelling the headworks and canal systems of the Son Canals in Bihar and Orissa ..	16th January 1931.
7	Sub-committee convened by the Government of India to report upon the Quetta Drainage Scheme, Baluchistan	24th February 1934.
8	Sub-committee convened by the Government of India to report on the conversion of the Paharpur Canal (N.-W. F. P.) into a perennial canal ..	15th September 1934.

160 IB—100—11-8-50—SGPP Lahore.

REPORT

OF A COMMITTEE OF THE CENTRAL BOARD OF IRRIGATION ON

DISTRIBUTION OF THE WATERS

OF THE

INDUS AND ITS TRIBUTARIES

1st. to 8th. March 1935
17th. to 20th. June 1935

VOLUME II

History, Appointment of Committee,
Briefs, Interim Report, Appendices

(For official use only)

Lahore
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1950

PART III

HISTORY OF THE DISPUTE

APPOINTMENT OF THE COMMITTEE

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APPOINTMENT OF THE COMMITTEE

PREFATORY NOTE—Cross references to paragraphs in this Part III "History of the Dispute Appointment of the Committee" are made thus,—*paragraph 6.*

History of the Dispute to June 1927

The history of the dispute between the Government of Bombay, and the Government of the Punjab, in respect to the apportioning of the waters of the Indus, up to the date 2nd June 1927 is contained in Despatch No. 3-Public Works from the Government of India to Secretary of State for India, dated Simla, 2nd June 1927.

2. The following paragraphs are quoted from that Despatch.

* * * * * * * * * *

(3) The controversy between the two Governments may be said to have commenced with the publication of the Report of the Indian Cotton Committee in 1919. This Committee was particularly interested in the project for the Sukkur Barrage and Canals, then under preparation, and in a foot-note to page 27 of their Report, two of its members made a specific recommendation that no irrigation projects which would affect the Indus supply should be undertaken in the Punjab until the Sukkur Barrage and the Canlas therefrom had been carried out or, in the alternative, until the scheme had been definitely abandoned. It was, doubtless, this recommendation which led the Government of Bombay, in August 1919, to represent that certain projects, then under consideration in the Punjab, must, if constructed, necessarily affect the volume of water reaching Sukkur, and to ask that full details of these projects should be furnished to them.

(4) This request was duly forwarded by the Government of India to the Punjab Government for compliance. It elicited a request from the latter for similar information regarding projects in Bombay, which the Government of the Presidency were asked to furnish.

(5) Before the information referred to above had been received, the Government of the Punjab, in September 1919, submitted to the Government of India a comprehensive scheme for the annual irrigation, from a weir on the Indus at Kalabagh, of 1,800,000 acres in the Sind Sagar Doab, commonly known as the Thal. It is unnecessary to discuss the details of this particular proposal, which was estimated to cost Rs. 9¼ crores, as it has since been abandoned, but it is of interest to notice that the local Government, in forwarding it for examination by the technical advisers of the Government of India, laid cosiderable stress upon the difficulties which were likely to be encountered in its operation. "It should" they stated "be distinctly understood that the colonization on the canal will bear little or no resemblance to the existing Canal Colonies of the Punjab. The irrigable areas will be of very irregular shapes and much dispersed: communications will be inadequate: the soil will, much of it, be difficult of cultivation, and irrigation may for a time be subject to interruptions from the difficulties of maintaining the water-courses. The crown land will probably be found unsuitable for anything on a large scale in the shape of reward grants to soldiers, or of grants to colonists from distant areas, and it will have to be colonized on a system of its own, which will possibly include a large proportion of capitalist areas and the adoption of an inferior class of peasant colonists, recruited mainly from the Thal itself and other areas in the Western Punjab. The existence of the sand-dunes, both in proprietary and in Government lands, will be a serious obstacle, and the Lieutenant-Governor does not anticipate any very substantial disappearance of the sandy areas such as has taken place on other canals. The experience of cultivation on the Inundation Canals in the Muzaffargarh Thal gives grounds, however, for expecting that the cultivation may increase to some extent beyond the amount assumed in the project by the gradual levelling and irrigating of land now occupied by sand hills".

(6) It may, perhaps, be asked why the Government of the Punjab were desirous of proceeding with a scheme in which so many uncertain factors were involved. The answer to this question will be found in the Sind Sagar Doab Colonization Act which was passed by the Punjab Legislative Council in 1902. This Act, passed, according to its preamble "to establish the title of the Government in land to be acquired in connection with the makig of a canal in the Sind Sagar Doab" provided for the taking of agreements from persons holding proprietary rights in the lands of the doab, whereby they surrendered those rights to Government with effect from the date upon which the excavation of the canal should be begun, Government agreeing to grant in return, on the completion of the canal, similar rights in an area equal to one-fourth of that of the land surrendered. Agreements of this nature were taken in respect of 2,280,000 acres of proprietary waste. The cutting of the first sod of the canal would thus have put the local Government into possession, free of charge, of 1,710,000 acres of land capable of sale to capitalists and others.

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(7) Lord Chelmsford's Government were not however, prepared to accept the project at the juncture at which it was submitted. They were anticipating the early receipt of two further large projects drawing their supplies from the Indus and its tributaries, the Sutlej valley Project in the Punjab and the Sukkur Barrage Project in Sind, and were strongly of opinion that these two schemes should first be taken up. They deemed it most undesirable that the Thal Canal should be commenced simultaneously with the Sutlej Valley Schemes, as colonists were obviously unlikely to come forward to take up the inferior land on the former so long as good land was available for colonization on the latter. In April 1920, therefore, they returned the project to the Government of the Punjab adding that they would be prepared to examine it in detail and, if such examination proved satisfactory. to recommend it for sanction, should it be found impossible to obtain sanction to the Sutelj Valley Scheme.

(8) On the 29th, July 1920, the Punjab Government submitted certain statements showing the requirements of the major irrigation schemes "contemplated in the near future" in that province, the Thal, Haveli and Sutlej Valley Projects being included in this category. The local Government have, in the subsequent correspondence, placed considerable impotance upon the date of this letter. Copies of these statements were forwarded to the Government of Bambay in the following month.

(9) It was at about this time that the Government of India received, from the Governments of Bombay and the Punjab, respectively, the two great projects for the Sukkur Barrage and Canals and for the Sutlej Valley canals. The former was despatched to them on the 30th July 1920, the latter on the 8th September 1920. Both schemes were subjected to very careful examination by the Government of India's technic l advisers, two of the questions which received special attention being the quantity of water allotted to the areas to be irrigated and the availability of this volume at the heads of the canals. It was only after they were fully satisfied on both these points that Lord Chelmsford's Government recommended the two projects to the Secretary of State for sanction, the Sukkur Barrage Project in their despatch No. 23-Public Works dated the 16th December 1920, and the Sutlej Valley Project in their despatch No. 15-Public Works, dated the 17th March 1921. The final sanctions of the Secretary of State to the projects were received in his telegrams No. 1324, dated the 7th April 1923 and No. 6260, dated the 9th December 1921, respectively.

(10) The duties (*i. e.*, the areas of the various crops which can be irrigated by a given volume of water) adopted in the case of the Sukkur Barrage Project are based on the considerations explained in Chapter II of Messrs. Baker and Lane's report, which forms Volume XX of the project estimate. It is true that these duties are lower than those obtained in the Punjab, but they are higher than those which have previously been realised in Sind, even on canals which enjoy a perennial supply, and the differentiation is fully justified by the difference in climatic conditions. Lord Chelmsford's Government, in paragraph 13 of their despatch of the 16th December 1920, with which the project was forwarded to the Secretary of State for sanction, stated that they were satisfied that the duties adopted were such as might safely be accepted; they went further and added that they were such as would allow of a further extension of the cultivated area, if this were later found to be necessary.

(11) The question of the supplies available was discussed at considereable length in paragraph 15 of the same despatch. It was there admitted that the data available were insufficient to enable an accurate determination to be made of the effect on the discharge of the Indus at Sukkur of the withdrawals proposed for the Sutlej Valley Project in the Punjab, but it was possible to show that, even assuming the worst conditions, the shortage at Sukkur was not likely to be greater than could be surmounted by care and economy in distribution. The final conclusion arrived at is summarised in the last sub-paragraph of the paragraph referred to which runs as follows:—"We consider, therefore, that both the Sukkur and the Sutlej Valley schemes can safely be constructed at the same time, and that there will, when the Sutlej Valley scheme is in full operation. be sufficient water in the Indus at Sukkur to provide fully for the Sukkur scheme. We are instituting a comprehensive system of discharge stations, which, in due time, will admit of a more detailed study of the effect of the withdrawals in the Punjab on the Indus at Sukkur, but it will be some years before useful deductions can be drawn from the observations recorded, and we trust that you will not consider it necessary to defer the construction of this great project or of the Sutlej Valley scheme in the meantime."

(12) The institution of a comprehensive system of discharge stations was undertaken on the advice of Sir Thomas Ward, the then Inspector-General of Irrigation. In a note, dated the 10th December 1920, he urged the importance of a full investigation into the supplies of the Indus and its tributaries, and certain of the comments made by him in this note are worth quotation. "*Prima facie*," he stated, "it is logical to assume that the abstraction of water from the tributaries of the Indus must necessarily diminish the volume passing Sukkur, but it is quite possible that this diminution is to some extent compensated for by seepage back into the river, during the *rabi* season, of a portion of the enormous withdrawals made by the Punjab during the *kharif*. Unfortunately the data available are too meagre to permit of a definite conclusion being arrived at on the subject. Such records of discharges as exist have,

however, been carefully examined and analysed, and, on the information before them. the Government of India are satisfied that the Sutlej Valley Project can be put in hand without prejudicing the supplies necessary to secure the area of irrigation contemplated on the Sukkur Canals. More than this it is impossible to assert, and the question of the collection of reliable data for the disposal of the problem has become one of the first urgency. It will obviously be necessary, once construction commences on the Sukkur scheme, for any future projects put forward by the Punjab to be very carefully examined in relation to the posssible effects of further withdrawals from the tributaries of the Indus upon the rights to irrigation from the Sukkur Canals upon which the Government of Bombay are now entering. I have no hesitation in saying that the data for such an examination do not at present exist, and that, unless steps are immediately taken to collect and collate them, endless difficulty is likely to ensue. Almost all the controversies which have up to date taken place in India in respect of questions of water rights have been directly attributable to the fact that adequate figures were not forthcoming and that consequently recourse had to be had to indirect deductions and presumptions the only method of averting such controversies is to have at hand reliable information on the factors in the case."

(13) The Government of Lord Chelmsford forwarded this note to the two local Governments concerned, recommending that an experienced officer should immediately be placed on special duty by each of them to conduct the gauging operation in his own province, daily discharges being recorded at twenty-eight selected sites. The two officers should they suggested, work in close collaboration and submit joint reports at intervals on the results obtained, for examination by a Committee consisting of the Inspector-General of Irrigation, the Chief Egineer, Bombay, the Chief Engineer in Sind and two Chief Engineers from the Punjab.

(14) The proposal was accepted by both the local Governments, but the Punjab Government also questioned the propriety of the assignment to the Government of Bombay of any right to the water allotted to the Sukkur Barrage Project. "The Punjab Government", they wrote on January 25th, 1921, "observes that certain rights in the water supplies of the Indus and its tributaries have been assigned by the Government of India to Bombay, without any regard to the Statement of the Punjab future requirements and supplies available, which were communicated to you in my letter No. 0762-W. I., dated the 29th July 1920, and which was furnished long before the above rights were assigned to the Bombay Government, and would, therefore, reserve the right to question or object to these rights being so assigned when the cases of the Bhakra Dam, Thal and Haveli Projects, the supplies required for which were given therein, are being dealt with."

(15) In October 1921, the Government of Bombay forwarded to the Government of the Punjab a statement showing the requirements of Sind on the completion of the Sukkur Barrage Project; the receipt of this statement drew from the Punjab Government a further reference to the reservation mentioned in the preceding paragraph.

(16) Meanwhile, in July 1921, the Punjab Government had again advanced the Thal Canal Project, but in a cosiderably altered form. They proposed a programme of construction which contemplated the commencement of the Thal Canal in the fourth year and that of the Haveli Canal in the sixth year after work on the Sutlej Valley Project had been put in hand, and asked for the Government of India's acceptance of this arrangement. They laid particular stress upon the fact that the local Legislative Council was pressing either for the commencement of the work or for the repeal of the Sind Sagar Doab Colonization Act, and expressed the fear that, if the project were much longer deferred and the Act repealed, they would lose the enormous advantage of the reversion to them of one and three quarters millions of acres of land. Lord Reading's Government were not, however, prepared to commit themselves on the subject and, in December 1921, they informed the local Government that the most to which they could agree was that a strong *prima facie* case had been made out for continuing and completing the surveys and investigations necessary for the preparation of a detailed project estimate for the Thal Canal, adding that, in any such project, particular attention should be given to the question of the supplies necessary for the Sukkur Barrage Project in Sind.

(17) Following on this letter there came a lull of some fifteen months, until with the announcement that the Sukkur Barrage Scheme had been finally sanctioned by the Secretary of State, the controversy again broke out. In April 1923, within a month of this announcement, the Punjab Government entered a further protest against what they regarded as the preference shown to the requirements of Sind, pointing out that they had made a public announcement to the effect that they were expediting the survey work on the Thal Project with a view to having the revised project estimate ready for submission to the Government of India by October 1924 and to having work actually begun on the Thal Canal in October 1925. With this letter, they forwarded a technical note by one of their Chief Engineers in which, for the first time, the question of the duties adopted in the Sukkur Project was raised, and the argument advanced that duties comparable with those ruling in the Punjab should be applied for the purpose of calculating the supplies to which the Barrage Scheme was entitled.

(18) This letter was followed almost immediately by a strong representation from the Government of Bombay against the attitude adopted by the Government of the Punjab. They pointed out that the Punjab had had more than its share of the waters of the Indus and the five rivers and that it had carried out vast schemes of perennial irrigation while Sind had so far not commenced a single one. They laid sttress upon the statement made in Sir Thomas Ward's note that all future Punjab schemes would have to be carefully examined in relation to the possible effects of further withdrawals from the Indus and its tributaries upon the rights of the Sukkur Projects to water, and invited attention to the fact that this principle had been repudiated by the Punjab Government. They traversed the argument of the latter that the statement of their requirements overrode the needs of Sind because it was made a few months before the Inspector-General's note was written; the rights of Sind had been duly recognised and stated in that note, but they had been neither created nor assigned thereby. They complained that, when the Sutlej Valley Project was under consideration, they were not consulted as regards its effects upon Sind, and that they were consequently, faced with the situation that, on the completion of that scheme, the supplies available for the Barrage Canals would be considerably less than those on which their results had been calculated. Any further lowering of the river would, they held, have most disastrous consequences. By far the greatest danger to the welfare of Sind was the Thal Project. The withdrawals from the Indus of water sufficient for so large an area as the Sind Sagar Doab must, they averred, obviously involve the loss of an equal quantity to the Barrage Canals, which would be the ruin of the Barrage Project and of the Province which depended upon it. "This Government" they wrote "is advised that the Sind Sagar Doab is at present a sandy, desolate tract with a very meagre population; that its few inhabitants are unacquainted with canal irrigation and perfectly capable of supporting themselves without it : in fine, that the whole Thal Project is a financial speculation for the exploitation of a wilderness which will have to be colonized and developed by imported labour. If such be the case, the argument of this Government is doubly strong. They protest against the wrecking of the Barrage Project by the latter Thal Project, and against the sacrifice of the welfare of a populous Province in order to exploit a desert for the benefit of the speculator."

(19) The representations of the two Governments were very carefully considered by the Government of India. Any final settlement as regards the partition of the water was, of course, impossible; it was realised that this must inevitably wait until reliable information as to supplies based on results obtained over a series of years was available from the recently inauguarated gauging operations. But on the main points immediately at issue there was no difficulty in arriving at conclusions. It was felt to be impossible to accept the Punjab Government's argument that they had established a right to water merely because they had put forward a statement showing the supplies required for certain projects, some of which had not even been finally prepared. As regards the duties adopted in the Sukkur Barrage Scheme, the whole question was re-examined, but nothing was found to justify reconsideration of the figures adopted in the project estimate. No direct analogy is possible between the results obtained in the Punjab, where the canals are very materially helped by rainfall, and those to be expected in Sind, where the rainfall is so small that the crops must depend entirely on canal water. The areas under the Punjab canals get from three to five times more rain than the Barrage Project tract; during the *rabi* season the rainfall in the latter is negligible, and cannot be counted upon to supplement the canals even to the extent of a single watering. Due weight had not been given in the Punjab Government's arguments to the importance of rainfall and of its effect on the working of the canals. As already stated, the duties adopted in the Barrage Project are higher than any yet obtained in Sind, save in exceptional cases, and many Sind officials have expressed the opinion that they are pitched too high rather than too low. The Government of India have never shared this apprehension, but they have always realised that the project duties will not be worked up to until the canals have been in operation for some years. They were, therefore, in no way prepared to countenance an arbitrary enhancement of these duties and a conseqnuent reduction of the supplies allotted to the project.

(20) The time had clearly come for a definite statement to be made, and this was promulgated in a letter addressed by the Government of India to the Government of the Punjab on the 21st August 1923, a copy of the letter being endorsed also to the Government of Bombay. Lord Reading's Government pointed out that the Sukkur Barrage and Canals Project had been designed for the benefit of a country that was fully entitled to the water which it was proposed to allot to it, and that its supplies must obviously be assured by any project which might subsequently be put forward, whether in the Punjab or Sind, before such project was accepted. They had satisfied themselves that there was sufficient water to provide for the need of the two large projects recently sanctioned; as regards prospective projects, they believed that the result of the gaugings in progress would show that the supplies of the rivers would be sufficient for the full ultimate requirements of both provinces and deprecated the prior raising by the Government of the Punjab of the question of the respective rights of the two Governments. With reference to the particular case of the Sukkur Project, they stated that the duties adopted for the purpose of ascertaining the volume required for the canals had been accepted, after careful consideration, as reasonable in view of the peculiar conditions and scanty rainfall obtaining in Sind, and that they were not prepared to reopen the subject. They concluded by giving an

assurance to both local Governments that no new major project in either the Punjab or Sind, the construction of which might affect prospective projects in the other province, would be sanctioned until the Government of the latter had received timely notice and full information regarding it, and had been given an opportunity to represent their case should such project appear to them to be unfavourable to their interests.

(21) Nothing further was heard in the matter from either Government until, some fifteen months later, in November 1924, the Government of the Punjab again addressed the Government of India regarding the proposed Thal Canal. They stated that a revised scheme had been prepared, for the annual irrigation of 2,170,000 acres in the Thal at a cost of about Rs. 13 crores, but that it contained some uncertain factors in regard to which they desired to satisfy themselves before submitting the project for sanction. *Inler alia*, it was uncertain whether a large part of the area would produce crops without manuring and whether the Indus silt would have a fertilising value or prove deleterious, making it difficult to determine what water-rates could reasonably be demanded. They therefore proposed to construct a small experimental canal taking out of the Indus near Kalabagh, to cost about Rs. 50 lakhs and to irrigate about 130,000 acres, the operation of which would, they considered, yield the information necessary for the working out of the larger scheme. The experimental scheme was expected to prove productive in itself.

(22) In accordance with their undertaking the Government of India referred the proposal to the Government of Bombay, who objected strenuously to it, partly on the ground that it would abstract an additional 750 cubic feet of water a second from the Indus, to the detriment of the Barrage Project, and partly because it was, admittedly, only a fore-runner of a large scheme for which in the local Government's view water would never be available. They took the opportunity again to express the earnest hope that no proposals whatever for further withdrawals from the Indus or its tributaries would be entertained by the Government of India until the Sukkur scheme had worked sufficiently long to enable proof to be obtained that there was actually surplus water available after meeting the requirements both of the scheme itself and of lower Sind also.

(23) The Government of Lord Reading were, however, unwilling arbitrarily to overrule the Punjab Government in the matter. The figures submitted by the Government of Bombay in support of their contention gave, they considered, an *ultra* pessimistic view of the discharges likely to be available at Sukkur; it seemed, moreover, improbable that the abstraction of so small a volume as 750 cubic feet a second at Kalabagh could really affect materially the supplies to the Barrage Canals. Until such time as reliable information was available as a result of the gauging operations, they were not prepared to make any definite pronouncements to the effect that the Thal Canal could never be built, and, as the project could not, consequently, be finally ruled out, it seemed to them very difficult to justify an objection to the experimental canal. Provided that acceptance of the experimental canal was not held to connote acceptance of anything further, there were many points in its favour. It would give a breathing space of several years at the end of which time, if the Punjab Government still desired to proceed with the major scheme, sufficient data would be available to enable a definite quantitative determination of its effect to be arrived at, while, having regard to the view of certain experienced revenue officers who had reported on the scheme from time to time, there seemed to be at least a possibility that the experiment might show that the soil of the Thal was unsuitable for artificial irrigation, and that the main controversy might, therefore, never arise at all. In these circumstances, informal negotiations were opened with the Government of Bombay in the hope that it might be possible to persuade them to resile from the attitude which they had taken up.

(24) These negotiations were nearing completion and success appeared to be in sight when in September 1925, the Government of India were surprised to receive from the Punjab Government a communication which stated that that Government had, some months previously, decided to drop altogether the proposal for the experimental canal and to proceed with the preparation of a much larger scheme for the irrigation of the Thal. This was the first intimation received either by the Government of India or of Bombay of this change of attitude.

(25) The revised project known as the Thal Canal Lesser Project, was received from the Punjab Government in the following month. It contemplated the irrigation of 880,000 acres per annum, the expenditure of Rs. 7 crores, and the withdrawals of 3,085 cubic feet a second from the Indus during the cold weather season. But it was not explained how the local Government had solved the uncertainties, to elucidate which the expermental canal had been proposed; it was merely stated that further investigation had shown that the experimental canal would not be a productive work and that, consequently, it had been decided to embark boldy upon the lesser main project. The project was accompanied by a technical note by the Punjab Chief Engineer elaborating the theory that withdrawals made in that province are compensated for by seepage back into the river lower down, and repeating the contention that an excessive amount of water had been allotted to the Barrage Scheme in its project estimte.

(26) In accordance with the usual procedure the project, before being taken into consideration by the Government of India, was forwarded to the Bombay Government for their opinion. In reply, the local Government, while intimating that they might have been prepared to reconsider their decision regarding the small experimental canal, recorded an emphatic refusal to agree to the construction of the larger project until the Sutlej Valley Scheme was actually working and its effect upon the supplies at Sukkur was known, and until the necessary data were available for the final determination of the question of inflow into and outflow from the Indus and its tributaries.

(27) Lord Reading's Government found themselves forced, in equity, to support the attitude adopted by the Government of Bombay and, on the 18th February 1926, they promulgated their final conclusions as follows:—

(*a*) That, until such time as the Sukkur Barrage Scheme comes into operation, and further experience of perennial irrigation in Sind is available, the question of the volume of water required for that Scheme cannot be re-opened.

(*b*) That, faced as they are with the unknown effect of the withdrawals which will be necessary for the supply of the Sutlej Valley Canals in the Punjab, the Government of Bombay have the right to object to further withdrawals from the Indus or its tributaries unless and until definite proof can be given that the supplies necessary for the Sukkur Barrage Project will not be endangered thereby.

(*c*) That such proof must be based upon the results of the more accurate gaugings of the river and its tributaries which were instituted as a result of Sir Thomas Ward's note of the 10th December 1920.

They added that, should the Punjab Government desire to proceed with the small experimental canal (a course which, in view of the uncertainties already referred to, appeared to them to be highly desirable before any sum approaching Rs. 7 crores was invested in the Thal, even should the experiment not prove directly productive), they were prepared to do their best to obtain the consent of the Government of Bombay to that scheme being taken in hand.

(28) These rulings were the subject of an immediate and lengthy protest from the Government of the Punjab. They enquired, in the first place, for how long the embargo placed upon their activities was to continue, and whether it was the intention that no further development should take place in the Punjab, until both the Sutlej Valley and Sukkur Barrage Projects had been in full operation for some years. They contended that the reference to the unknown effect upon the Sukkur supplies of the Sutlej Valley withdrawals was a direct contradiction of the Government of India's previous statement that they had satisfied themselves that there was sufficient water in the Indus for both projects. They held that the Government of India, had, similarly, changed front as regards the Thal Project, quoting their letter of December 1921, in which it was agreed that a strong *prima facie* case had been made out for continuing and completing the surveys. They aserted that their requirements had been subordinated to those of Sind when the Sukkur Barrage Project was sanctioned, and that that scheme should have been postponed until the rival claims of the Bhakra Dam and Thal Projects had been considered and adjudicated upon. They advanced the argument that it was more economical to bring under irrigation areas at present lying waste than to utilise supplies for the conversion of inundation into perennial irrigation. They referred again to the possible fate of the Sind Sagar Doab Colonization Act if the commencement of the Thal Project were any longer delayed, and, in conclusion, they asked that the whole matter might be referred to the Secretary of State, and that he should be asked to convene an impartial Committee of experts to decide whether the experience gained of the Indus discharges, together with such material as had been collected by the Punjab Irrigation Department were not sufficient to show that the Lesser Thal Canal could be executed without detriment to the Sukkur Barrage Scheme. They went even further and suggested that the Committee should decide whether, even if this did not prove to be the case, the proper and most effective use of the Indus water would not justify some reduction of the irrigation proposed under the latter scheme.

(29) In reply to the specific points of substance raised in this letter, we explained that all that the rulings of Lord Readings' Government were intended to convey was, firstly that they were not prepared to reopen the question of the duties on which the discharges of the Sukkur Barrage Canals were based and, secondly, that before any further extension of irrigation could be permitted in either province, evidence, based on accurate gaugings, must be available sufficient to show beyond any reasonable doubt that the supplies necessary for scheme already sanctioned would not be endangered thereby. As, however, the Punjab Government held that they had figures to justify their contention that it was possible to withdraw from the Indus the volume required for the Thal Canal without adversely affecting the supply at Sukkur, we stated our willingess, should both local Governments agree, to refer to a Committee, consisting of Chief Engineer of other Provinces, the question of whether or not the data avaialable were sufficient to determine this issue.

(30) The Punjab Government accepted this proposal but refused to acquiesce in the position that the volume of water allotted to the Sukkur Barrage Canals had been finally and definitely fixed and was not open to any re-adjustment. The Government of Bombay also accepted, although with considerable reluctance. They pointed out that it was hardly open to argument that the data available were insufficient for a reliable conclusion to be drawn from them. Sir Thomas Ward had definitely stated, that, in December 1920, no such data existed; the gauging operations since initiated as a result of his recommendations had been in progress for less than five years, the observations of two of which were admittedly defective. They held, therefore, that if the Committee, on the data available, arrived at any conclusion it could only be a conclusion based on inference, and the success of the Sukkur Project was so vital to Sind that they were not prepared to risk it until definite proof, as distinct from inference, was available that the Thal Project would not affect its supply. Therefore, while accepting the proposal for reference of the question to a Committee, they reserved to themselves the right to appeal against any deductions and inferences the Committee might make or decision they might give.

(31) After consideration of these replies we informed both Governments, on the 15th November 1926, that we had decided to convene a Committee to determine whether, on the date available, it is possible to afford an assurance to the Government of Bombay that, even after the Sutlej Valley Canals come into full operation, there will still remain sufficient water in the Indus and its tributaries to permit of further withdrawals being made in the Punjab for the proposed Thal Canal without in any material depriving the Sukkur Barrage and Canals Project in Sind of water allotted to it in its poject estimate. We asked both local Governments to prepare statements of their cases before the 15th February 1927 and proposed that the Committee should sit in Simla early in the following April to consider the question.

(32) The Punjab Government immediately protested against the terms of reference. They quoted the despatch with which the Sukkur Project had been forwarded to the Secretary of State for sanction and in which Lord Chelmsford's Government had expressed the opinion that there was no reason why duties to those ruling in the Punjab should not eventually be obtained in Sind, and asked that the question to be placed before the Committee should be, firstly, what were the supplies required by the Sukkur Barage Scheme if similar duties to those obtained in the Punjab were taken as the basis of calculation and, secondly, whether on the basis of these duties the supplies in the Indus were sufficient to permit of further withdrawals being made in the Punjab for the proposed Thal Canal.

(33) In reply, we expressed our inability to accede to the local Government's request. It was true that Lord Chelmsford's Government, in forwarding the Sukkur Project, had expressed the view that the Punjab duties would "eventually" be obtained in Sind but it was clear from the fact that lower duties had actually been incorporated in the project that they had no anticipation that the Punjab figures would be realised in the earliest years of operation, except in years, of abnormally low supply. There was, we pointed out, a wide difference between the expression of an opinion that, in a year of scarcity, higher duties than normal would be obtained and the taking of action artificially to reduce the supply, in normal years. We saw no reason to believe that, in the earlier stages of perennial irrigation in Sind, higher duties than those assumed in the project would be realised and we were not prepared to consider an alteration of those duties, arrived at after full consideration of all the varying factors in the case, before the work was even constructed or the canals began to irrigate.

(34) The Bombay Government's statement of their case was received upon the due date but nothing further was heard from the Government of the Punjab, until in a letter dated the 25th March 1927, they preferred an appeal against our ruling. They stated that that decision if it was to hold good, would have the result of entitling the Bombay Government to the unquestioned use of a large quantity of water which, in the opinion of the Punjab Government, could be more profitably and economically utilised, and that it would stand between themselves and the Bombay Government whenever it was proposed to make any extension of irrigation in the Punjab. They, therefore, requested either that the reference to the Committee should be on the line, proposed by them, the supplies required at Sukkur being based upon the duties obtained in the Punjab, or that, if we were unable to agree, the terms of reference should be referred for the decision of your Lordship.

(35) Before discussing the issues arising out of the local Government's request, it may perhaps be convenient to mention briefly and set aside the various matters which, although germane to any decision upon the larger question, do not directly affect the point upon which an immediate ruling is required.

(36) We are not concerned at present with the merits or otherwise of the Thal Project. It is, however, certain that, even should sufficient water for it subsequently prove to be available, that scheme will have to be submitted to an exceptionally careful examination before we shall be in a position to recommend it for construction. Its history is evidently such as to emphasize the need of very careful examination; there appears

to have been a considerable difference of opinion regarding it even among the local Governments' own experts, seeing that four entirely different projects, for it, each advocating a different treatment of the area, have been put forward during the course of the last eight years. The Punjab Government have admitted that there are several uncertain factors in the scheme, two of which, the possibility of the soil proving unculturable without extensive manuring and the doubt as to the fertility or otherwise of the Indus silt, were regarded by them les than three years ago as so serious that they were unwilling to proceed with a comprehensive project until they had arrived at some definite concluson based on experiment. Other factors which will have to be considered are whether the introduction of irrigation into a country which consists of isolated patches of more or less culturable land surrounded by sand-hills will not result in the water-logging of the whole tract, whether it will ever be possible to maintain in proper order distributaries constructed through these sand-hills and, finally, whether the opening up of a new area for colonization will not retard development in the Sutlej Valley area, not only in British territory but in Bahawalpur also. In view of the great excess over the estimate of the latter project, which has resulted in the State being called upon to find several crores of rupees more than were originally anticipated and more than they originally agreed to find, both we and the Punjab Government have a peculiar responsibility for seeing that no action is taken which will tend to interfere with the success of the Bahawalpur colonization scheme. Much of the land in that State is of very poor quality and the offer of land in the Thal might well prove a counter-attraction to intending colonists.

(37) We are not at present concerned with the Punjab Government's contention that their claims have been subordinated to those of Sind, or with their argumeht that the Sukkur Barrage Project should have been postponed until the rival claims of the Thal, Bhakra Dam and Haveli Projects had been considered and adjudicated upon. The positon adopted by the local Government is, however, in our opinion hardly reasonable. Perennial canals, irrigating between 8 and 9 million acres, drawing their supplies from tributaries of the Indus, have already been constructed in the Punjab whereas, until the Sukkur Barrage Project was sanctioned, not a single such scheme existed in Sind. Moreover, acceptance of the Barrage Project was accompanied by the simultaneous acceptance of a new scheme of equal magnitude for the benefit of the Punjab and its neighbouring States. There can, therefore, be no real question of the subordination of Punjab interests. As regards the local Government's contention that the Sukkur Scheme should not have been sanctioned until all probable future projects in the Punjab had been investigated and adjudicated upon, it is clear that it would have been no more unreasonable for the Government of Bombay to urge that the Sutlej Valley Project should not have been taken in hand until the Sukkur Scheme had reached its full development and until all further possible schemes, such as that for a barrage to protect lower Sind, had been investigated and their needs secured.

(38) Nor are we immediately concerned with the difficult question of the supplies in the Indus, which will be a matter to be considered by the proposed Committee, if and when appointed. But a word as to the present position in this regard may not be out of place. Sir Thomas Ward was undoubtedly correct in saying that, in December 1920, no data were available which could possibly be regarded as of sufficient accuracy to settle a case of this magnitude; such discharges as had been recorded had been taken by rough and ready methods, often by untrained observers, and no real reliance could be placed on figures thus obtained. The systematic gaugings which he recommended were commenced in the autumn of 1921, but the results of 1921-22 and 1922-23 are defective inasmuch as the discharges in the Punjab have been calculated from surface float observations, which involve the use of a more or less arbitrary coefficient. Current meter observations were introduced in 1923-24, and it is only from that year that the records can be regarded as thoroughly reliable. There exist, therefore, accurate records for three years only, while those of a fourth are now being taken.

(39) Clearly, the gaugings have continued for far too short a period to enable final conclusions to be drawn from them; indeed, the two officers in charge of the operations, in their report on the gaugings up to 1925, the only one which has so far been published admit that the figures show certain irreconcilable discrepancies which can only be cleared up by further observations in coming years, and that deductons drawn from them can only be tentative. But it is interesting to note that, in so far as they go, they afford but little support to the theory of the regeneration of water which was dealt with in paragraph 15 of the despatch of Lord Chelmsford's Government of the 16th December 1920, with which the Sukkur Barrage Project was submitted for sanction, and which had been much quoted by the Punjab Engineers in support of their contention that it is possible to abstract water in that province without affecting the supplies at Sukkur on the ground that the water so abstracted percolates back into the river.

(40) The only point which is, at the moment, at issue is whether it is desirable to reopen the question of the volume of water allotted to the Sukkur Barrage Canals with a view to its reduction in order to make additional water avaialble for use in the Punjab. There can, we consider, hardly be two impartial opinions in this matter. The duties upon which these dischrges are based were selected, in the first instance, by a committee consisting of two expert officers, one a revenue and one an irrigation officer, both with long experience of conditions in Sind. They were accepted by the Government of India's technical advisers as reasonable only after a careful

consideration of all the circumstances of the case. As there is, at present little or no perennial irrigation in Sind, there was bound to be an element of guess-work in the choice of factors and any revision of them at present would be of exactly the same nature. Having in view the different climatic conditions in the Punjab and Sind, and more especially the almost complete absence of rain and greater sunheat in the latter, it is impossible to postualte that the results obtained in one province should also, as a matter of course, be obtained in the other. The Government of the Punjab argue that the duties adopted are too low and that the supplies allotted to the project are extravagant; some of the opponents of the project, on the other hand, have urged that the duties are too high and that the scheme is doomed to failure because it will prove impossible to irrigate the area anticipated with the water available. There has even been some slight difference of opinion on the subject among the experts of the Government of India. Sir Thomas Ward, who was advising Lord Chelmsford's Government when the project was submitted for sanction, considered that, while the duties adopted were reasonable, they would probably eventually be exceeded and permit of an extension of the irrigated area; Sir Frederick Gebbie, on the other hand, who had an unrevalled knowledge of conditions in Sind, took a less optimistic view and considered that they would not even be worked up to until after many years of operation and until the people learnt to use water much more economically than they have done in the past under the inundation system. Nothing but experience will ever show exactly what value should be taken for these duties; *prima facie* those adopted for the purpose of the project are approximately correct and certainly no ground has been shewn for a reconsideration of them before the scheme even begins to irrigate. The Punjab Government would have them examined by a committee; it would, however, be almost impossible to convene a committee whose views would carry weight against those of the several experts, revenue and irrigation, who selected and approved the figures now adopted.

(41) Even were the Sukkur Scheme still in the project stage, and the question of the duties to be adopted under consideration *ab intio*, there is no reason to suppose that duties different from those actually adopted would be recommended. But this is not the position. Work on the project is now well advanced, and the Government of Bombay have invested crores of rupees in it on the understanding that a certain volume of water, a volume accepted as reasonable both by the Secretary of State and by the Government of India, will be reserved for its use. To raise the question of an arbitary reduction of that volume, at this stage, before any test of its sufficiency or otherwise is possible, would give the local Government a most serious cause of complaint. Not only would they feel themselves threatened with action likely to lead to the failure of the scheme, but they would probably find themselves constrained to cease work altogether upon the project until a decision was arrived at. The canals now being excavated are of the dimensions necessary to deal with the allotted discharge; were this discharge reduced to about two-thirds of the project figure, as the Punjab Government suggest, the whole scheme would have to be redesigned and much, if not all, of the work so far done would require to be remodelled.

(42) There is no project in India which has been the cause of so much dissension as has the Sukkur Project. It has been violently opposed by a coterie of retired officials in England, to whose views considereable publicity has been given; it has been the subject of discussion in the House of Lords on more than one occasion; and it has, during the last few months, been attacked by a section of the Bombay Legislative Council and of the Bombay press who, solely because it was inaugurated during the Governorship of His Excellency Lord Lloyd, have attempted to couple it with the Back Bay Reclamation Scheme. It is not too much to say that the whole future prosperity of Sind is bound up with the Sukkur Barrage Project, and there is every reason to believe that it will achieve the success forecasted for it when the estimate was sanctioned. But the attacks upon it have, undoubtedly, not been without their effect and, while we do not believe that an impartial committee would come to any conclusion other than that at which our expert advisers have already arrived, we can conceive of nothing that would deal a greater blow to public confidence than a sudden announcement that a material reduction of the volume of water reserved for it was under consideration.

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3. In reply to that Despatch, the Secretary of State refused the request of the Punjab to reopen the question of supplies allotted to Sind at the Sukkur Barrage, in his Despatch Irrigation No. 2 to His Excellency the Governor-General in Council, dated London, 25th August 1927 from which the following paragraphs are quoted.

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(2) I note that Your Excellency's Government are not at present concerned with two of the three main points involved in the dispute, *viz.*, (1) contention of the Government of the Punjab that their claims have been subordinated to those of Sind, and that the Sukkur Barrage Project should have been postponed until the rival claims of the Thal, Bhakra Dam and Haveli projects had been considered and adjudicated on; and (2) the adequacy of the supply of water in the Indus for all Punjab projects without detriment to the requirements of Sind.

(3) The only point upon which my orders are required at present is the request of the Punjab Government that the question of the volume of water allotted to the Sukkur Barrage Project should be reopened with a view to its reduction, in order to make additional water available for use in the Punjab.

(4) The Punjab Government contend that the supply of water allotted to the Sukkur Barrage Project is extravagant and that the project would be adequately served were the duties prescribed for it increased to correspond with those obtained in the Punjab. In support of this contention they appear to rely mainly on the opinion expressed by Sir Thomas Ward, late Inspector-General of Irrigation in India, and accepted by Lord Chemlsfor's Government—(*vide* para. 15 of their Despatch No. 23, Public Works, dated 16th December 1920), that "there is no reason whatever why similar duties (to those in the Punjab) should not eventually be obtained in Sind."

(5) Your Excellency's Government, however, consider, and have already pointed out to the Punjab Government, that it is obvious, from the use of the word "eventually" and from the fact that lower duties were actually incorporated in the Sukkur project, that Lord Chelmsford's Government did not anticipate that the Punjab figures would be realised in the earlier years of its operation, except in years of abnormally low supply. Sir F. Gebbie, whose knowledge of conditions in Sind was unrivalled, was even less optimistic, and considered that the duties would not be worked up to until after many years of operation and until the people of Sind learned to use water much more economically than they had done in the past.

(6) I accept the conclusion of Your Excellency's Government that nothing but experience can show exactly what value should be taken for these duties and I agree that, having regard to the fact that the Sukkur canals have not yet even begun to irrigate, no reason has been shown for a reconsideration of the duties. I also attach great weight to the other arguments advanced by Your Excellency's Government in the concluding paragraphs of your Despatch, and am led to the conclusion that it would be unreasonable in itself, and unfair to the Government of Bombay, to reopen the question of the duties at the present time.

(7) The Government of the Punjab should accordingly be informed that I regret that after full consideration I am unable to accede to their request.

Indus Discharge Committee

4. Consequent upon the issue of a Note[1] by Sir Thomas Ward, Inspector General of Irrigation, dated 10th December 1920, the Governments of Bombay and the Punjab, acting on the recommendation of the Government of India instituted a comprehensive system of guage and discharge observations at all the important sites in Sind and the Punjab, on the Indus and its tributaries.

Under their letter No. 444-I., dated 7th September 1921, the Government of India established a special committee for the tabulation, co-ordination and scrutiny of the results obtained by the executive engineers appointed by the two Provincial Governments to carry out these observations.

The executive engineers met frequently to exchange notes, correlate their methods and compare their results. Consequently, when the Committee, known as the Indus Discharge Committee held its first important meeting in June 1928 at Simla with Mr. D. G. Harris, Consulting Engineer to the Government of India as Chairman, there was a considerable volume of authentic data to be examined.

5. At this first meeting of the full Committee the following were present:—

Mr. D. G. HARRIS	Consulting Engineer to Government of India.
Mr. R. T. HARRISON	Bombay.
Mr. J. B. G. SMITH	Punjab.
Mr. H. F. ASHTON	Punjab.
Mr. D. R. SATARAWALA	Bombay.
Mr. W. G. QUINTON	Joint Secretaries.
Mr. P. C. THADANI	

The term of reference laid down by the Committee for its own guidance was " to determine the history of the water of the Indus and its tributaries during its passage through the Punjab and Sind to Sukkur".

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(1) Appendix I (A) & (B) pp. 96-98.

6. The principal point which emerges from a consideration of the published proceedings is the very great importance of the amount of water lost or gained between the various discharge sites, *i.e.*, the volume absorbed or regenerated in the river beds between the points of observation.

A definite attempt was made to treat the subject mathematically—an attempt which subsequent experience has proved to have been fruitless.

Nevertheless, the proceedings of the Committee served to concentrate attention on this important matter. It is not too much to say that the results obtained from the attention subsequently devoted to this aspect of the problem, have gone far to permit of the agreed solution of the problem, reached subsequently.

7. The next meeting of the Indus Discharge Committee took place at Bombay in March 1929.

The following were present :—

Mr. D. G. HARRIS	Consulting Engineer to Government of India.
Mr. R. T. HARRISON	Bombay.
Mr. N. WHITE	Punjab.
Mr. J. B. G. SMITH	Punjab.
Mr. D. R. SATARAWALA	Bombay.
Mr. H. B. PARIKH	Joint Secretaries.
Mr. NOKCHAND	Joint Secretaries.

For purposes of this narrative the important parts of the proceedings are contained in the unanimous recommendations quoted below—

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(12) In paragraph 26 of our last Report, we expressed the hope that we might discover some means of predicting accurately the effect upon the supply at Sukkur of further withdrawals of water in the Punjab whether by projects under construction or in prospect. As we have already explained, this hope has not been realized. But, although we have to admit that the data which have so far been collected are insufficient to enable any definite quantitative determination of the effect of such withdrawals to be made, our study of the figures affords us, we consider, sufficient ground for making recommendations as to whether and if, so, what further withdrawals are justifiable.

(13) We are unanimous in agreeing that it would be unjustifiable to withdraw from the Indus at Kalabagh the perennial supply required for the Lesser Thal Project. We do not think that it is possible on the data now available to show that this supply can be taken without materially affecting the supplies allotted to the Sukkur Barrage Project in its project estimte. This conclusion should be regarded as open to reconsideration after further gaugings have been taken over a series of years; even should no prediction formula capable of physical interpretation be reached as a result of such gaugings, at least the effect of the Sutlej Valley Project upon the supplies at Sukkur and the existence or otherwise of surpluses capable of beneficial utilization will be definitely known. We consider that ten years' further gaugings will be necessary before any final conclusion can be reached in the matter and we recommend that all idea of any new canal drawing its water direct from the Indus should be held in abeyance during this period.

(14) On the other hand, we agree that a certain small perennial supply can be made available for utilization in the Punjab from the tributary components of the river. This supply should be limited to 1,250 cubic feet a second during the winter months from the 15th October to the 20th April. The Government of Bombay have already consented to the utilization by the Government of Punjab of a volume of 500 cubic feet a second for the Jalalpur pumping scheme and we consider that this volume might be increased by 750 cubic feet a second, leaving it to the discretion of the Punjab Government how and where it shall be utilized, provided always, as already stated, that it is drawn from the tributaries and not from the main river. We have no accurate means of knowing to what extent this withdrawals will affect the supplies at Sukkur, but it seems to us probable that the effect will be of the order of 750 cubic feet a second which is well within the margin of error of the measurements of the discharges at the latter place. Should the Government of the Punjab desire to proceed with the Haveli project in preference to the Jalalpur scheme, we understand that the freeing of this volume of water will enable them to do so; we see no difficulty in making available the volume of approximately 7,500 cubic feet a second required for the scheme from the 20th April onwards. It may further be remarked that, in making this recommendation, we are influenced by the fact that, in a bad year, the volume available in the

tributaries during the winter months will be considerably les than the volume which we have suggested as the maximum to be withdrawn, so that, in such a year, the effect on the discharge at Sukkur will be proportionately smaller.

(15) We now come to the proposal for a dam on the Sutlej at Bhakra which is at present under the consideration of both the Governments concerned. The original Bhakra Dam Project provided for a dam 400 feet high which would store 2½ million acre feet; the revised project now under consideration provides for a dam 500 feet high with a storage capacity of 4¾ million acre feet. We understand from our colleagues from the Punjab that the smaller project not only presents greater engineering difficulties but is likely to be financially unremunerative and, therefore, that it is not a question of a choice between the two projects but of a choice between the larger scheme and the leaving of the *kharif* supplies of the river unutilized.

(16) We would state, in the first instance, that we are unanimous in agreeing that the solution of the problem of the further extension of irrigation in the Punjab lies primarily in the conservation of the *kharif* supplies which at present run waste to the sea. The quantity of water available is sufficient for the larger scheme and the only objection which can be raised against it is its effect upon the inundation canals in Sind which have their heads between Mithankot and Sukkur. Even when the dam is in operation there will be water and to spare for these canals, but it is apprehended that the effect of the great reduction in the flood volume of the river, due to storage at Bhakra, will be to lower the levels at their heads to such an extent that both the number of days during which the fair irrigating level will be reached and the number of days during which the canals will actually flow at all will be considerably diminished. On the other hand, it has been argued, and diagrams showing conditions elsewhere have been placed, before us in support of the contention, that the effect will be less serious than might at first sight seem probable owing to the fact that, with the alteration, in the flood regime of the river, a rise in its bed and a consequent rise in the level of the water is to be anticipated.

(17) The problem is a complicated one and is one which requires considerable investigation Although we are unable, on the data available, to suggest the correct solution, we are most unwilling to believe that no such solution exists. We therefore recommend that each Government should place an officer, with the rank of Superintending Engineer, on special duty, and that these officers should be charged to make a joint investigation of the matter and submit a joint report upon it. In this report, they will discuss the probable effects of the Bhakra scheme upon the Sind inundation canals, taking into consideration the possibility of a change of regime such as already mentioned, as also the possibility of any detriment likely to accrue being counteracted by a change in the conditions of cropping. They will also consider what steps are possible to reduce any anticipated detrimental effect to a minimum, whether by restoring the levels in the Indus, by altering the positions of the heads of the canals, or by other means which may seem to them to be suitable. We have great hopes that, when this report is forthcoming, it will be possible to devise measures which will permit of the Bhakra scheme going forward.

(18) There is one other point to which we should like to refer. Owing to a miscalculation of the absorption losses, certain of the canals in the Sukkur Barrage Scheme have been designed so as to draw off a larger volume of water than that allotted to them in the project estimate and the question has arisen whether this procedure is legitimate. We can see no objection to it provided that no prescriptive right to the additional water is claimed by the Government of Bombay and that it is merely a case of their utilizing the water, when avaialble, instead of letting it run waste to the sea.

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The Government of India forwarded these recommendations, with their letter No. I. R.-61, dated 22nd March 1929, to the Governments of Bombay and the Punjab, who accepted them.

Committee on the Bhakra Dam Project.

8. Consequent upon the recommendation reproduced in paragraph 7(17) above two superintending engineers met and formed the "Committee on the probable effects of the Bhakra Dam Scheme on the inundation canals of the Indus between Mithankot and Sukkur".

The two officers were :—

Mr. H. W. NICHOLSON, C. I. E., I. S. E. .. Punjab.

and

Mr. W. L. C. TRENCH, I. S. E. .. .. Bombay.

Their report was unanimous and was addressed to Secretaries to Governments of the Punjab and Bombay. Public Works Department, Irrigation Branch, dated 15th December 1930.

9. Again, for purposes of this narrative, the important part of their conclusions is recorded under—

VIII

Recommendations.

(1) * * * * * * * * * * *

(2) We are therefore of opinion that the inundation canals in the Mithankot-Sukkur reach of the Indus, from Kashmore at the head of the Desert canal to the Begari canal, will not suffer any reduction of supply and that the canals from the Sind canal to Sukkur will obtain better supplies of water when the Bhakra Dam Project has come into effect, than they receive at the present time.

(3) * * * * * * * * * * *

10. Mr. Trench attached a note as an appendix to the report "Appendix 9—Note, dated December 15th, 1930, on the effects of the Bhakra Dam withdrawals on Canals below Sukkur". His conclusion, with which Mr. Nicholson concurred, is contained in paragraph 20 thereof.

"In these circumstances, and in view of the fact that, on the most unfavourable hypothesis the reduction of levels in the canals are small it does not appear probable that conditions 10 or 12 years hence, the earliest date on which the Bhakra withdrawals could take effect, will be any worse for the inundation canals below Sukkur than they are at the present day, and, in fact owing to regime rises, conditions may be better, even allowing for the estimated adverse effects of the Bhakra Scheme withdrawals.

11. It may be recorded here that subsequently, in their letter No. 2337/27-I., dated 27th March 1934, the Government of Bombay addressed the Government of the Punjab and intimated that they would offer no opposition to the construction of the Bhakra Dam.

Claims of Parties interested in the Waters of the Indus in 1931.

12. In 1931, the position of the various parties interested in the waters of the Indus and its tributaries may be summarized as under.

BOMBAY (SIND).—The authorized withdrawals (*vide* page 7 of Volume V of Sukkur Barrage Canal Project 1919-20) at Sukkur, for the British canals was as under—

Month.	*Discharge (cusecs).*	
January	22,656	
February	22,656	
March	23,454	
April	27,029	Including 400 cusecs for Khairpur State lands on Eastern Nara Canal.
May	36,543	
June	41,896	
July	41,896	
August	41,896	
September	41,896	
October	22,897	
November	20,540	
December	22,656	

KHAIRPUR STATE.—In addition to the withdrawals for British Sind the authorized withdrawals for the Khairpur feeders at Sukkur, were as under —

Month.	*Discharge (cusecs).*
January to March	*nil.*
April	2,000
May	3,000
June	4,030
July	4,030
August	4,030
September	4,030
October	3,000
November	3,000
December	3,000

It is not clearly laid down whether the above are maximum discharges or mean monthly withdrawals. It was the contention of Bombay that they were to be regarded as the latter. During the meetings of the Committee 1st to 8th March 1935, on the evidence before them, the INDEPENDENT MEMBERS concluded that maximum discharges were intended.

Moreover the Government of India, in their letter No. I. R. 6, dated the 29th June 1929 accorded sanction to withdrawals in excess of the maxima laid down on the distinct understanding that no "prescriptive right" to such excesses was claimed at a later date. It may be inferred therefore, that surplus water was intended to be held available for distribution elsewhere.

13. PUNJAB.

Thal Lesser Project.—It had been agreed that the question of allotting supplies from the river Indus should not be re-opened till 1939 by which time, it was anticipated that sufficient reliable data as to water available, would be to hand.

Haveli Project.—The Government of Bombay had agreed to the allocation of water from the Chenab, to the Haveli project as under—

Rabi.	*Kharif.*
1,250	7,500 (approx.)

vide paragraph 4 under Preliminary, of Report on Haveli Project, 1932, Part I *or*, (14) under paragraph 7 of this Part.

Sutlej Valley Project.—Along with the other partners in this system of canals the Punjab was bound by the Agreement "between the British Government and the Government of His Highness the Nawab of Bahawalpur and His Highness the Maharaja of Bikaner regarding the irrigation of the tracts commanded and economically irrigable from the Gharra Reach of the Sutlej River and from the Panjnad Reach of the Chenab River."

The Punjab did not advance any demand that the Agreement should be altered in any particular.

14. NORTH-WEST FRONTIER PROVINCE.—At this stage the Frontier Province had not entered the discussions, although that Government had asked the Governments of Bombay and the Punjab to agree to certain small withdrawals from the Indus for the Paharpur canal. These proposed withdrawals had not been opposed by the Bombay or the Punjab Governments.

15. BAHAWALPUR.—Bahawalpur was a partner in the Sutlej Valley Project and a signatory to the Tripartite Agreement. From the first, Bahawalpur had objected to the inclusion of Bikaner in the scheme, holding that the water supplies in the Gharra reach of the Sutlej were insufficient for the riverain partners, *viz.*, Punjab and Bahawalpur.

This "shortage" was particularly marked during early kharif.

Moreover, one headworks, the Panjnad, was actually situated on the Chenab below its confluence with the Sutlej. The supplies which Bahawalpur might extract from the Chenab at Panjnad were restricted by clause 4. D. 2 of the Tripartite Agreement.

" For the perennial and non-perennial canals for Bahawalpur from the Panjnad the me an draw-of in each crop shall be maintained at the same fraction of their authorised maximum capacity in cusecs as that of the British canals from the Gharra."

Whatever be the reason for insertion of this clause (1), the fact remains that the withdrawals authorized at Panjnad were considerably less than the water available in the river at certain critical periods.

The Bahawalpur Darbar therefore held that available supplies should be shared fairly between the Haveli and Panjnad canals, and that the withdrawals at Panjnad should not be dependent on the supplies in the Gharra reach of the Sutlej.

16. BIKANER.—Bikaner State, also a partner in the Sutlej Velley Project, had only one perennial canal taking off at Ferozepore. The opening of the non-perennial channels on 1st. April, on a low river, with the consequent change in amount of its share of the water available, often created difficulty.

Bikaner had never accepted the views put forward by Bahawalpur on the subject of riparian rights (*para.* 15). Neither did the State Authorities admit the deficiency of supplies in the Gharra reach of the Sutlej, for the irrigation of suitable perennial areas within the Sutlej Valley Project.

Finally, the culturable areas commanded by the Bikaner canal were found to be more extensive than anticipated. Consequently the State Authorities had grounds for pressing for additional supplies.

Subsequent Developments.

17. The events which ultimately led to the convening of a specially constituted Committee under the ægis of the Central Board of Irrigation to re-examine the problem, sprang from three different sources—

(*a*) the Punjab claim to additional supplies for the Haveli project to ensure its success as a productive scheme,

(*b*) the claims of Khairpur State to perennial water,

(*c*) the Bahawalpur demand that clause 4. D. 2 of the Tripartite Agreement should be deleted and various adjustments made in its irrigable areas authorized discharges, etc., to place the Bahawalpur canal system on a productive basis.

Obviously, the claims set out as (*b*) and (*c*) above, required immediate settlement.

18. It is impossible to describe these developments in chronological order. A clear understanding of the position will be possible only by taking each claim and reviewing briefly how it arose and what it implied.

In *para.* 13, it is stated that the Government of Bombay had agreed to the reservation of the following supplies for the Haveli project.

Rabi	..	..	1,250	cusecs	maximum withdrawal.
Kharif	..	..	7,500	ditto	ditto ditto

A subsequent review of the project in the light of the existing agricultural depression, led to the Government of the Punjab revising its demands on the Chenab water for the Haveli, to ensure that the full rabi area should be sown in October and November and thus present a remunerative project.

The new demands were as under :—

Rabi	..	..	2,750	cusecs	maximum withdrawal.
Kharif	..	..	7,500	ditto	ditto ditto

(*Kharif demand now increased to* 7,750 *cusecs in Punjab Brief.*)

19. In *para.* 12 the authorized withdrawals for Khairpur feeders, are stated.

In connection with the financial settlement between Khairpur State and the Government of Bombay, in respect of the Sukkur Barrage Project, it was contended on behalf of Khairpur State that unless a perennial supply were given, the State would in fact, receive little benefit from the Barrage. Their old inundation

(1) At the meeting of the Committee on "Distribution of Waters of Indus and its Tributaries" 1st to 8th March 1935, Mr. Nicholson (Punjab) explained that this was done to protect the interests of the Haveli and Thal Projects.

canals had been most efficient and had given a supply almost equivalent to that described in *para.* 12. It was urged that the State was entitled to perennial supply.

Additional Supplies of Water allowed temporarily to Khairpur.

20. While this dispute was in progress, the Government of Bombay (Sind) had permitted the Khairpur State to withdraw an enhanced rabi supply for their feeders, as a temporary measure as an act of grace.

This was rendered possible by reason of the water allocated to the Haveli, not being utilized and therefore reaching Sukkur, by the fact that no supplies had been allocated to the Thal,—*vide para.* 7 (13), and by reason of the Barrage canals not having attained their full development.

Consequently, the Sind authorities did not anticipate any serious shortage. Moreover, sanction had been accorded to their utilizing supplies available at Sukkar subject to no " prescriptive right" being claimed subsequently to the increased monthly withdrawals (*paras.* 12 *and* 24).

In their letter No. P. W. D. 3079/27--IV, dated the 30th August 1934, addressed to the Government of India, Foreign and Political Department, the Government of Bombay expressed their inability to guarantee to Khairpur State, the rabi supply which they enjoyed temporarily, except on certain conditions. The chief of these conditions was an increase in the maximum authorized withdrawal at Sukkur. This letter was one of the principle reasons leading to the decision of the Government of India to investigate the problem *abi-nitio* at the earliest possible moment.

Sutlej Valley Project Enquiry Committee, Bahawalpur, 1932.

21. In Bahawalpur, for reasons only remotely connected with this narrative, a committee had been convened, *viz.*, the "Sutlej Valley Project Enquiry Committee, Bahawalpur , 1932 " to examine what alterations in the Bahawalpur canal system were necessary to place the canals on a productive basis.

The recommendations in the report of the above Committee, comprised :—

(*a*) the abandoning of unfertile lands,

(*b*) the irrigation of certain additional good land not previously served by the State canals,

(*c*) the conversion of suitable non-perennial areas into pernnial,

(*d*) the adjustment *inter se* of the areas served by the various canals to obtain a more efficient service,

(*e*) the construction of certain new feeders,

(*f*) in particular, the deletion of clause 4. D. 2 from the Tripartite Agreement.

22. For purposes of this narrative, the most important of the proposals was in the last recorded recommendation, which had as its object the removal of the restriction on the authorized withdrawals at Panjnad headworks.

Under the Agreement, as interpreted at this time, the average permissible rabi supply for the Abbasia canal in normal years at the Panjnad headworks was 516 cusecs. Bahawalpur demanded a mean supply of 930 (1) cusecs and proposed to take this supply down the Panjnad canal. They further required that the early kharif supply should not be restricted as laid down in the Tripartite Agreement.

Additional Supplies of Water allowed temporarily to Bahawalpur.

For the years 1932-33 to 1934-35 no restriction on the draw-off had been imposed by the Government of the Punjab, as an act of grace. The concession was rendered possible by the fact that the authorized supplies for the Haveli project were not being withdrawn. Nevertheless, to prevent the possibility of any prescriptive claim to the water being established by Bahawalpur, the Government of the Punjab in their letter No. 3841-S. Con., dated 6th September 1934, to the A. G. G. Punjab States, intimated that this concession would not be granted after 1st April 1935 and that after that date the Agreement would be strictly enforced.

(1) Sutlej Valley Project Enquiry Committee, Bahawalpur, Report, Statement No. II, pp. 32.

This ultimatum was another factor in determining the decision of the Government of India to submit the dispute to investigation.

23. So far the Government of India had four disputants to reconcile. It was clear that other interested parties should be invited to participate in the discussions, but equally clearly, it was possible that any one might refuse to do so on the ground that no possible advantage would accrue from altering the existing state of affairs.

Certain minor considerations, however, determined the attitude of the other INTERESTED PARTIES.

Claim by Sind to increased maximum withdrawals at Sukkur.

24. In the case of Sind, an attempt had been made to secure sanction to an increase in the authorized maximum withdrawals at the Barrage.

In their letter No. I. R. -6, dated the 29th June 1929, to the Government of Bombay, the Government of India plainly intimated that sanction to an increase in authorized maxima would not be accorded. But in the same letter, permission was accorded to Sind to make use of excess supplies in the river at Sukkur, subject to no "prescriptive right" to such excesses being claimed subsequently.

Unfortunately, this correspondence was not communicated to the Punjab, and as will be seen later, this omission affected the Punjab attitude in the dispute.

Lastly, owing to a miscalculation in the original Sukkur Barrage Project, allowance for increased withdrawals during the overlapping period kharif-rabi in the month of October on certain canals had been omitted.

The Government of Bombay agreed to participate in the enquiry, because they considered, on the grounds advanced by the Government of India, that such an enquiry to settle all outstanding questions, was desirable, indeed necessary.

25. In the case of the North-West Frontier Province, the only reason for their participation was that their commitments on the Indus, the Paharpur canal in particular, rendered the presence of a representative with a watching brief, advisable in their own interests.

Attitude of Bikaner State.

26. Bikaner State was in a very different position. Whatever readjustment in the supplies allotted to Bahawalpur might eventuate Bikaner was vitally interested as a signatory to the Tripartite Agreement. No modification to the Agreement was possible without the consent of Bikaner and no such modification would be agreed to, unless it brought some amelioration of the conditions referred to in para. 16.

Genesis of the Committee on the Distribution of the Waters of the Indus and its Tributaries.

27. The urgent necessity to secure a settlement of the Bahawalpur and Khairpur claims led to the issue of letter No. I. R. -18, dated the 8th November 1934 (1) from the Government of India, to the Governments of Bombay and the Punjab. A copy of this letter was subsequently endorsed to the Foreign and Political Department to communicate to the States concerned.

In this letter, the Government of India reviewed the situation as then existing and stated briefly, the matters in dispute. The formation of the Committee was proposed and certain administrative matters in this connection, were discussed. The terms of reference were stated. Observations on the proposed Committee, the procedure and terms of reference were invited.

28. In due course, the INTERESTED PARTIES accepted the proposals *in toto*, in some cases with small reservations.

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(1) Owing to the importance of this letter, as the immediate origin of the Committee, it is reproduced *in extenso* as an Appendix to this Part III, see pp. 22.

Province.	Letter No. and date.	From	To
Bombay (Sind ..	997/27-I, dated the 19th December 1934.	Secretary to the Government of Bombay, P. W. D., Bombay.	Secretary to the Government of India, Department of Industries and Labour, P. W. Branch.
Punjab ..	10561-Nor., dated the 6th December 1934.	Secretary to the Government of the Punjab, P. W. D., Irrigation Branch.	Ditto.
N.-W. F. P. ..	5170-P.W.-355-W., dated the 11th December 1934.	Secretary to the Government of N.-W. F. P., P. W. D.	Ditto.
Bahawalpur ..	I.G.-2004-C. 1263-33, dated the 20th December 1934.	Agent to the Governor-General, Punjab States.	Political Secretary to the Government of India, Foreign and Political Department.
Bikaner ..	3571, dated the 11th December 1934.	Secretary, Foreign and Political Department, Bikaner State.	Secretary to the Hon'ble the Agent to the Governor-General in Rajputana.
Khairpur ..	C.-114, dated the 11th December 1934.	Minister, Khairpur State.	Secretary to the Hon'ble, the Agent to the Governor-General, Punjab State.

29. The Committee was to be formed of two members of the Central Board of Irrigation as INDEPENDENT MEMBERS, nominated by the Government of India.

Each INTERESTED PARTY was to nominate one member, who might bring with him such advisers as he deemed necessary, but such advisers would not be members of the Committee.

Secretary, Central Board of Irrigation was *ex-officio* Secretary to the Committee.

30. The final composition of the Committee was as under.

For convenience, gentlemen " in attendance " are also listed.

Central Board of Irrigation Members nominated by Government of India—

F. Anderson, Esq., C. I. E. (U. P.)., I.S.E., *Chairman.*

F. A. Betterton, Esq., I. S. E. (B. & O.), *Vice-Chairman.*

Bombay (Sind)—

W. L. C. Trench, Esq., I. S. E., *Member.*

Mr. Gurmukhsingh J. Butani, B. S. E. *In attendance.*

Punjab—

H. W. Nicholson, Esq., C. I. E., I. S. E., *Member.*

J. P. Gunn, Esq., I. S. E. *In attendance.*

North-West Frontier Province—

A. Oram, Esq., I. S. E., *Member.*

Bahawalpur—

Sir Bernard Darley, Kt., C. I. E., *Member.*

C. A. H. Townsend, Esq., C. I. E. *In attendance.*

Bikaner—

T. A. W. Foy, Esq., I. S. E., *Member.*

Rai Bahadur Jai Gopal. *In attendance.*

Khairpur—

J. M. Sladen, Esq., I. C. S., *Member.*

Khan Bahadur J. R. Colabawala } *In attendance.*

F. Wright, Esq. }

Secretary, Central Board of Irrigation—

A. M. R. Montagu. Esq., I. S. E., *Secretary.*

31. The first meeting of the Committee took place at Old Delhi at the Cecil Hotel. The Secretary arrived in Delhi on the 24th February and the members of the Committee between the 25th and 28th February.

Proceedings were opened formally by the Hon'ble Sir Frank Noyce, Member for the Department of Industries and Labour, at 10-30 on the morning of the 1st March. With this exception, business was conducted generally between the hours 9-00 a.m. and 5-00 p.m. daily, with a short interval for luncheon.

Procedure.

32. The procedure adopted was laid down by the Chairman. From a study of the BRIEFS, the Chairman framed provisional ISSUES which covered the whole field of the enquiry without relation to the TERMS OF REFERENCE.

On the first day, these provisional ISSUES were examined and modified. These and the final ISSUES are recorded as an Appendix (1) to this volume. Thereafter the first business of each day, was the correction and confirmation of the recorded proceedings of the previous day.

Evidence was taken upon these ISSUES in turn. By mid-day on Wednesday 6th March evidence was concluded, and the Chairman framed five POINTS FOR DISCUSSION, which are recorded as an Appendix (2).

The meeting was then adjourned to allow of the INTERESTED PARTIES discussing these POINTS informally with the evidence before them.

33. The INTERESTED PARTIES formed themselves into informal sub-committees to discuss these POINTS. The Committee as a whole re-assembled on Friday morning, 8th March.

The agreements reached by the informal sub-committees were then recorded. POINTS on which the INTERESTED PARTIES were still at variance, were then discussed and agreement reached.

Certain matters, which strictly speaking, were outside the TERMS OF REFERENCE were then discussed, their importance, in the opinion of the Committee, justifying their place in the record.

At the conclusion of the session on Friday 8th March 1935, the Chairman adjourned the Committee *sine die*.

34. Owing to the importance and urgent necessity of implementing certain of the agreements reached, the Chairman directed the preparation of an INTERIM REPORT. The draft was circulated to members of the Committee with letter No. 1301-F.47, dated the 13th March 1935, from Secretary, Central Board of Irrigation.

The INTERIM REPORT was despatched to the Government of India with letter No. 2090-F.-47, dated the 20th April 1935, from the INDEPENDENT MEMBERS, Committee on Distribution of Waters of the Indus and its Tributaries.

Second Meeting.

35. At the conclusion of the first meeting of the Committee at Delhi the Secretary prepared, in consultation with the INDEPENDENT MEMBERS, a draft of the Findings and Recommendations of the Committee, copies of which were forwarded to all Members for their approval or for suggestions for amendment. Upon receipt of replies from the Members it was evident that there were many points which remained to be discussed and settled before a unanimous report could be prepared. The INDEPENDENT MEMBERS, therefore, instructed the Seretary to call a second meeting of the Committee, which was held at Simla from the 17th to the 20th June, 1935. Messrs. T. A. W. Foy, and J. M. Sladen, representatives of Bikaner and Khairpur States, respectively, had by this time proceeded on leave, so their places at the second meeting were taken by Rai Bahadur Jai Gopal, Colonization Minister, Bikaner State, and Mr. J. Booth,I. C. S., Minister, Khairpur State. The North-West Frontier Province did not send a representative to this meeting as the

(1) Appendix II (A) & (B), pp. 99 & 100.

(2) Appendix III, pp. 101.

question with which they were concerned had been fully discussed at the first meeting. Mr. M. T. Gibling, I.S.E., who took over the post of Secretary, Central Board of Irrigation, on the 1st May, 1935, acted as Secretary to the Committee.

36. The procedure adopted at the second meeting was rather different from that of the first. The Secretary had prepared a revised draft of the Findings and Recommendations, based on the original draft and the remarks of the Members thereon, and it was decided at the commencement of the second meeting, to adopt the revised draft for discussion paragraph by paragraph. The proceedings were corrected where necessary and confirmed, in accordance with the procedure adopted at the first meeting. The discussion of the re-drafted Findings and Recommendations brought out several points which had not been dealt with at the first meeting, and all the questions were discussed in more detail. Unanimous decisions were reached on almost all points arising out of the discussion and they are produced in the Final Report as the Findings of the Committee. The INDEPENDENT MEMBERS have recorded their opinion on one or two points which could not be dealt with by the Committee as a whole.

37. Owing to the untimely death of Mr. H. W. Nicholson, C.I.E., Punjab representative, after a short illness, before the issue of the Final Report, Mr. F. J. Waller, C.I.E., who was deputed in his place on the Committee, has signed the Final Report as the representative of the Punjab Government.

APPENDIX TO PART III

Vide NOTE (4) pp. 18.

GOVERNMENT OF INDIA

DEPARTMENT OF INDUSTRIES AND LABOUR

PUBLIC WORKS BRANCH.

No. I. R.-18.

Dated New Delhi, the 8th November 1934

FROM

E. M. JENKINS, ESQ., I.C.S.,

Deputy Secretary to the Government of India,

TO

The Secretary to the Government of Bombay/the Punjab,

Public Works Department,

Irrigation Branch.

Subject :—Apportionment of the waters of the Indus and its tributaries between the parties interested.

SIR,

I am directed to refer to the report of the Indus Discharge Committee, 1929, on the subject mentioned above. The recommendations of the Committee which are summarised in this Department's letter No. I.R.-61, dated the 22nd of March, 1929, were accepted by the Governments of Bombay and the Punjab and form the basis of the understanding now in force under which important fresh withdrawals—

(*a*) from the main Indus, and

(*b*) from the tributaries of the Indus (in excess of the limited supply allowed to the Punjab for the Haveli Project)

are not to be considered until 1939. It is unnecessary to discuss the Bhakra Dam Project which has been dealt with separately.

2. The Government of India are reluctant to reopen the very difficult question of prescriptive rights within the period of ten years which the Committee considered necessary for the collection of adequate discharge data. The Governments of Bombay and the Punjab are, however, aware that the Khairpur and Bahawalpur Darbars are most anxious to obtain increased supplies, the former with a view to regular *rabi* irrigation and the latter in consequence of readjustments which have proved necessary in the irrigation from the canals taking off at Panjnad. The Khairpur demand, which is based partly on administrative grounds and partly on the assertion that no claim can lie against the State for a share in the cost of the Sukkur Barrage unless *rabi* water can be granted, is understood to be for an additional 2,000 cusecs in January, February and March. The Bahawalpur Darbar are admittedly bound by the tripartite agreement of 1920 between themselves, the Bikaner Darbar, and the Government of the Punjab and their present request is that the terms of that agreement may be relaxed in order to ensure the success of the Panjnad Canal system, in which the Government of India are naturally interested. In connection with the requirements of Bahawalpur, the Government of the Punjab are now advised that the limited supply allowed in 1929 for the Haveli project would be insufficient to ensure the success of the project in existing agricultural conditions. They are, therefore, anxious to obtain an additional supply. The requirements of Bahawalpur and the Punjab taken together may, it is understood, be put at 1,934 cusecs for *rabi* and 4,500 cusecs for *kharif*. It is evident that additional withdrawals on the scale contemplated, whether in Sind or in the Punjab, could be authorised only as a result of an agreement between the parties concerned or of an expert finding, accepted by the Government of India, that such withdrawals could be permitted without real detriment to any of the parties.

3. The urgency of the matter arises mainly from the claims of the Khairpur and Bahawalpur States. Hitherto, the Governments of Bombay and the Punjab have afforded these States provisional supplies to the extent required. An arrangement of this kind is admittedly unsatisfactory —to the recipient of the water because uncertainty interferes with colonization and agricultural progress generally, and to the authority making the concession because a provisional supply continued over a series of years may in practice become impossible to discontinue. The Government of India understand that the Governments of Bombay and the Punjab are anxious to reach some final settlement with the two States, and they themselves have important financial interests in the Bahawalpur canals. If the settlement of 1929 is to be adhered to rigidly no permanent arrangement with the States will be possible, and incidentally no further progress can be made with the Haveli Project in the Punjab. What is required is either an agreement between the parties concerned, or a definite decision based on expert advice as to—

(*a*) the extent to which additional supplies are actually required, and

(*b*) the possibility of affording such supplies without real detriment to the other parties interested in the Indus and its tributaries.

4. The parties interested in the Indus and its tributaries are numerous. In addition to the Khairpur and Bahawalpur Darbars and the Governments of Bombay and the Punjab, the Bikaner Darbar are interested both in the Sutlej Valley project generally and in the tripartite agreement of 1920. The Government of the North-West Frontier Province have to also to be considered. A settlement by negotiation through the medium of correspondence would be exceedingly difficult and the Government of India believe that the most expeditious method of reaching a decision will be to refer the whole question of the additional supplies to an expert committee. It is important that the difficulties which have arisen should be approached in a conciliatory spirit, the object being if possible to secure a settlement which will be acceptable to all parties and injurious to none. If the suggestion that an expert committee should be appointed is acceptable to the Governor in Council, I am to enquire whether the enclosed draft terms of reference will be suitable. It will be seen that in addition to the claims of Khairpur and Bahawalpur the question of additional supplies for the Haveli Project has been included.

5. As regards the composition of the Committee, the Government of India have considered the possibility of constituting an entirely independent body before which the representatives of the Local Governments and Darbars interested would appear as witnesses. They believe, however, that a satisfactory settlement is more likely to be reached by a Committee consisting of one representative nominated by each of the Local Governments and Darbars, and two representatives (who would be irrigation engineers of standing, entirely unconnected with the Indus controversy) nominated by the Government of India. The representatives of the Local Governments and Darbars would then be in a position not only to present their respective cases, but to take part in the discussions. I am to enquire whether the Governor in Council agrees that the Committee should be constituted on these lines.

6. Although the Committee would not consist exclusively of members of the Central Board of Irrigation, I am to suggest that it should be treated for purposes of procedure, and for the allocation of expenditure, as a Sub-Committee of the Board.

The Secretary to the Board would act as Secretary to the Committee, and would collect the material required and convene the first meeting in communication with the officers nominated to serve as members. The Committee would endeavour to arrive at a unanimous decision on the points referred to it, and would report to the Government of India.

As regards the details of the Committee's procedure it is essential, if meetings are not to be prolonged unduly, that the material to be considered should be circulated as soon as possible. The Local Governments and Darbars are, it is believed, fully acquainted with the facts relevant to the proposed terms of reference. But it will be necessary for the Secretary to submit without delay to the two independent members the material required for a general appreciation of those facts, and it is possible that the two independent members may wish to meet before the Committee begins its work, and to call for further information. These preliminaries will necessarily take some time, and I am to suggest that the opportunity might be taken by the Local Governments and Darbars to prepare statements of their views on the terms of reference, which should be forwarded (with a sufficient number of spare copies) to the Secretary well in advance of the date fixed for the first meeting of the Committee. The Committee would meet at New Delhi, and it is anticipated that the first meeting might be held on four or five consecutive days. There would then, in all probability, be an interval for the collection of further information and the settlement of details, followed by a second and final meeting lasting also for four or five days. The procedure proposed is summarised in the rough programme attached, and the Government of India will be glad to know if the Governor in Council considers this to be suitable.

7. When a Sub-Committee of the Central Board of Irrigation is convened, the Local Government or Local Governments interested should, in accordance with paragraph 7 of this Department's letter No. I/39/45, dated the 19th July 1926, pay the travelling allowance of the members, and other incidental expenses. In the present case the Government of India propose that each Local Government or Darbar interested should pay the travelling allowance of its own representative. The travelling allowance of the two members nominated by the Government of India and the incidental expenses (for example, the pay of a stenographer and clerk, and the travelling allowance of the Secretary) would be shared between the Local Governments and Darbars. Should the meetings of the Committee last for periods much in excess of the eight or ten days for which the programme allows, or should the preparation of the report present special difficulty, the Government of India would be obliged to consider the grant of suitable honoraria to the members nominated by them. The expenses are in any case not likely to be heavy, and I am to enquire whether the Governor in Council is prepared to meet a reasonable share in them. The Government of India consider that the Governments of Bombay and the Punjab might suitably contribute one-third of the total expenses each, the balance being contributed in equal shares by the other parties interested.

8. If the Committee is to complete its deliberations by the end of March next, very early action will be necessary, and I am to request that if there is no objection the Government of India

may be furnished as soon as possible with the views of the Local Government on the points discussed in this letter. To recapitulate, these are :—

(*a*) the necessity for the appointment of an expert committee ;

(*b*) the suitability of the draft terms of reference ;

(*c*) the composition of the Committee ;

(*d*) the suitability of the procedure proposed; and

(*e*) the allocation of the expenditure.

If it is agreed that a Committee should be appointed, I am to request that the name of the representative selected may be communicated to the Government of India. I am to add that copies of this letter are being forwarded to the Government of the North-West Frontier Province and to the Political Officers concerned, and that the views of the Government of the North-West Frontier Province and the Darbars will be communicated to the Government of $\frac{\text{Bombay}}{\text{the Punjab}}$ in due course.

I have the honour to be,

SIR,

Your most obedient servant,

E. M. JENKINS,

Deputy Secretary to the Government of India.

D. A. : Referred to.

Draft Terms of Reference.

To examine, and report to the Governn ent of India upon, the following matters :—

I. The extent to which additional supplies of water are actually required for :—

(*a*) the Khairpur State ;

(*b*) the Bahawalpur State ;

(*c*) the Haveli project.

II. The possibility of finding such supplies without detriment to the praties interested in the waters of the Indus and its tributaries, and the effect upon the existing or prospective rights of those parties of any fresh withdrawals, the authorization of which the Committee may recommend.

Programme.

Stage of proceedings.	*Approximate date by which to be completed.*
(1) Supply of material by Secretary to two members nominated by Government of India	As soon as possible, but not later than 15th December 1934.
(2) Preliminary meeting (if necessary) of two members nominated by Government of India, and requisition for any further information required	15th January 1935.
(3) Circulation of statements by Local Governments and Darbars (through Secretary)	15th February 1935.
(4) First meeting of Committee (four or five days)	First week in March 1935
(5) Second and final meeting of Committee (four or five days)	Last week in March 1935

Province.	Letter No. and date.	From	To
Bombay (Sind) ..	937/27-I, dated the 10th December 1934.	Secretary to the Government of Bombay, P. W. D., Bombay.	Secretary to the Government of India, Department of Industries and Labour, P. W. Branch, Delhi.
Punjab ..	10561-Nor., dated the 6th December 1934.	Secretary to the Government of the Punjab, P. W. D., Irrigation Branch.	Do.
N. W. F. P. ..	5170-P.W.-34S.W., dated the 11th December 1934.	Secretary to the Government of N.W.F.P., P. W. D.	Do.
Bahawalpur ..	I.G. 2004-C. 1982-33, dated the 20th December 1934.	Agent to the Governor General, Punjab States.	Political Secretary to the Government of India, Foreign and Political Department.
Bikaner ..	3571, dated the 11th December 1934.	Secretary, Foreign and Political Department, Bikaner State.	Secretary to the Hon'ble the Agent to the Governor-General in Rajputana.
Khairpur ..	C-114, dated the 10th December 1934.	Minister, Khairpur State.	Secretary to the Hon'ble, the Agent to the Governor-General, Punjab State.

29. The Committee was to be formed of two members of the Central Board of Irrigation as INDEPENDENT MEMBERS, nominated by the Government of India.

Each INTERESTED PARTY was to nominate one member, who might bring with him such advisers as he deemed necessary, but such advisers would not be members of the Committee.

Secretary, Central Board of Irrigation was *ex-officio* Secretary to the Committee.

30. The Committee met at Simla on the 17th September 1935.

For convenience, gentlemen in attendance are also listed.

Central Board of Irrigation: Members nominated by Government of India—

F. Anderson, Esq., C. I. E. (U. P.), I. S. E., *Chairman.*

F. A. Betterton, Esq., I. S. E. (B. & O.), *Vice-Chairman.*

Bombay (Sind)—

W. L. C. Trench, Esq., I. S. E., *Member.*

Mr. Gurmukhsingh J. Butani, B. S. E. *In attendance.*

Punjab—

H. W. Nicholson, Esq., C. I. E., I. S. E., *Member.*

J. P. Gunn, Esq., I. S. E. *In attendance.*

North-West Frontier Province—

A. Oram, Esq., I. S. E., *Member.*

Bahawalpur—

Sir Bernard Darley, Kt., C. I. E., *Member.*

C. A. H. Townsend, Esq., C. I. E. *In attendance.*

Bikaner—

T. A. W. Foy, Esq., I. S. E., *Member.*

Rai Bahadur Jai Gopal. *In attendance.*

Khairpur—

J. M. Sladen, Esq., I. C. S., *Member.*

Khan Bahadur J. R. Cobalawala } *In attendance.*

F. Wright, Esq. }

Secretary, Central Board of Irrigation—

A. M. R. Montagu, Esq., I. S. E., *Secretary.*

PART IV.

BRIEFS OF THE INTERESTED PARTIES.

BRIEF OF BOMBAY (SIND)

1. The decision arrived at in 1929 not to permit additional withdrawal from the Indus and its tributaries for 10 years was acquiesced in by the Bombay Government and this Government has not asked for any revision. It is, therefore, for other Governments affected thereby to prove a case for any modification of that decision.

2. If, however, further withdrawals from the Indus are to be authorized, the Government of Bombay reserves the right to put forward such new figures for the authorized withdrawals of Sind Canals as may be necessary.

Revised Requirements at Sukkur.

3. The revised requirements of the Barrage Canals are given in Annexure A. These show that the ultimate demands are greater by a very small percentage in January, February and March, less in April and early May, more in the latter half of May, less in June, July, August, by small amounts and substantially less in September, but greater in October and November. Except in October and November the additional requirements are comparatively trivial. The revised requirements now put forward are due to greater accuracy of calculation made of the water required.

Supplies available at Sukkur.

4. Information in regard to the behaviour of the river and the water supplies available is now to hand for the years 1930—34 in addition to the information put before the Indus Discharge Committee in 1929.

Annexure B shows the maximum mean and minimum discharges of each month, and Annexure C shows days on which the available discharge at Sukkur was less than the authorized and required discharges.

Rabi Supply for Khairpur State.

5. Government of Bombay considers that it is essential before an extra rabi discharge is sanctioned for Khairpur that the terms on which this rabi discharge is given shall be settled. These terms are given in Government of Bombay, Public Works Department, No. 3079/22-IV of 30th August 1934 and are :—

(1) that the minima discharges of the Indus at Sukkur to which Sind shall have a prescriptive right shall be those mentioned in Government of Bombay letter No. 6590/27-I. W. of 26th June 1933;

(2) that the Khairpur State shall also agree to pay an increased share of the cost of the Lloyd Barrage according to the formula already accepted by the Government of India in paragraph 7 of their despatch No. 23-P.W., dated the 16th December 1920, to the Secretary of State, *i.e.*, that the cost of the Barrage proper shall be shared between the Khairpur Durbar and the Bombay Government, in the ratio of the ultimate anticipated area of Kharif *plus* Rabi cultivation in the State to the ultimate area of Kharif *plus* Rabi cultivation in the whole Barrage area.

6. The Government of Bombay considers that if a rabi supply is made available* for the Khairpur State, the water supply to be allowed in each month shall be revised to the same scale as in force on the other Barrage Canals; the object being to minimize the extent and possibility of waterlogging. This would have to be worked out in detail but the maximum Kharif discharge would amount probably to 2,500 cusecs.

Discharges for British Sind.

7. The Government of Bombay is not prepared to agree to a reduction in the admissible discharges by increasing the estimated ultimate duty or by decreasing the estimated ultimate intensity of the Barrage Canals. The former are already high for Sind conditions and any reduction of anticipated intensity would affect the financial stability of the Barrage Scheme.

*The present rate of water supply is 2·8 cusecs per thousand acres at outlet head in dry crop lands (*i.e.* all except rice canal areas) and this cannot be reduced and is believed to be less than elsewhere.

*See Note at bottom of page 28.

Other Interested Parties.

8. In regard to withdrawals by the Punjab, Bahawalpur or the North-West Frontier Province, the Bombay Government is not prepared to agree to such additional withdrawals except :—

(*a*) on the same conditions as No. 1 in the case of Khairpur, and

(*b*) unless it can be shown that available supplies at Sukkur will not be so reduced as to make these required discharges unavailable or precarious.

Leakage at Sukkur.

9. Experience having shown that at the critical period during the first fall of the river, the available discharge is about 3,000 cusecs less than the actual discharge in the river at Sukkur, this figure should be added to the authorized withdrawals in estimating the availability of the water supply. This difference can be somewhat reduced when the gates have been artificially staunched but as there are 66 gates of 60′ span each this hand staunching takes some time and its effect may not be available when required.

Sind Inundation Canals.

10. If additonal withdrawals are demanded for the latter half of May and June, September and 1st—15th October, the Government of Bombay considers that it will be necessary to consider the effect of such withdrawals in relation to the inundation canals of Sind.

11. Investigation show that since 1912 there has been a trend towards a reduced period of high water without, however, affecting the height of the peak and that this effect was well defined before the opening of the Barrage Canals.

Any additional withdrawals in these months will tend to prolong the period of low water in May and June and shorten the period of high water in September-October.

There are three gauges in Sind to which groups of Canals can be referred—

(*a*) the Sarhad gauge for the Upper Sind Canals ;

(*b*) the Kotri gauge for the Canals taking off near Hyderabad; and

(*c*) the Aghimani gauge for the Karachi Canals.

The fair irrigation levels at these gauges for various critical periods are as follows :—

	15th May.	1st June.	30th June.	1st September.	15th September.	30th September.
Sarhad	5·0	7·0	11·0	11·0	9·0	7·0
Kotri	11·0	13·0	16·0	20·0	18·0	15·0
Aghimani	12·5	15·5	20·0	23·0	21·0	18·0

Any withdrawals which would tend to reduce these levels would be harmful to the interests of the inundation canals and would therefore be opposed by the Bombay Government.

W. L. C. TRENCH,

Chief Engineer in Sind.

NOTE.—In the BRIEF as finally approved by the Government of Bombay the following alterations were made :—
Para 6—*For* "a rabi supply is made available" *read* "an enhanced or extended rabi supply is authorized.
Para 7—Omit last sentence.

ANNEXURE A

Statement showing discharges of the Lloyd Barrage Canals including the Khairpur Feeders as originally authorized and as per revised requirements.

Month.	Total authorized British Canals.	Total authorized Khairpur State	Total authorized withrawal at Sukkur (2+3)	Revised requirements British Canals	Existing Khai pur as in column 3	Total revised British + original Khairpur State discharges	Additional requirements British Canals (7—4)	Khairpur State's new Demand	Total revised requirements British & Khairpur State Canals	Remarks
1	2	3	4	5	6	7	8	9	10	11
January	22,756	..	22,756	23,269	..	23,269	+513	2,000	25,269	To the figures in Col. 10 must be added 3,000 cusecs against losses due to leakage through the Barrage Gates. *1st 15 days. †2nd 15 days.
February	22,756	..	22,756	23,269	..	23,269	+513	2,000	25,269	
March	23,454	..	23,454	23,164	..	23,164	—290	2,000	25,164	
April	27,029	2,000	29,029	26,176* 27,076†	2,000	28,176* 29,076†	—853* +47†	..	28,176* 29,076†	
May	36,541	3,000	39,541	34,859* 38,724†	3,000	37,859* 41,724†	—1,682* +2,183†	..	37,859* 41,724†	
June	41,826	.. 4,030	45,926	41,734	4,030	45,764	—162	..	45,764	
July	41,896	.. 4,030	45,926	41,734	4,030	45,764	—162	..	45,764	
August	41,896	.. 4,030	45,926	41,734	4,030	45,764	—162	..	45,764	
September	41,896	.. 4,030	45,926	38,519	4,030	42,549	—3,377	..	42,549	
October	22,897	3,000	25,897	29,770* 29,270†	3,000	32,770* 32,270†	+6,873* +6,373†	.. ..	32,770* 32,270†	
November	20,540	3,000	23,540	22,396	3,000	25,396	†1,856	..	25,396	
December	22,756	3,000	25,756	23,181	3,000	26,181	+425	..	26,181	
Total ..	366,313	30,120	396,433	371,933	30,120	402,053	..	..	408,053	
Average (rounded) ..	30,500	2,500	33,000	31,000	2,500	33,500	..	..	34,000	

W. L. C. TRENCH.

ANNEXURE C

Statement showing number of days in the months of January to April and September to December since the year 1929 on which the discharges in the Indus at Sukkur (including the old Head Eastern Nara up to March 1933 when it was finally closed) fell short of—

(a) *present authorized discharges + 3,000 cusecs allowed for leakage through the Barrage gates;*

(b) *new British and Khairpur State canals requirements + 3,000 cusecs allowed for leakage through the Barrage gates.*

Year	January		February		March		April		September		October		November		December		Total	
	No. of days		No. of days		No. of days		No. of days		No. of days		No. of days		No. of days		No. of days		No. of days	
	a	b	a	b	a	b	a	b	a	b	a	b	a	b	a	b	a	b
1929	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
1930	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
1931	..	..	..	..	..	1	..	..	..	..	..	..	..	..	1	1	1	1
1932	4	6	6	18	8	12	..	..	..	..	..	..	..	..	22	24	40	60
1933	12	30	25	28	19	19	..	..	..	..	..	..	..	..	2	3	53	80
1934	1	9	7	21	18	20	13	13	..	..	..	..	..	..	3	2	47	70
Average of last 5 years.	3	9	8	1	9	10	4	4	..	..	..	..	..	..	6	6	29	42

W. L. C. TRENCH

ANNEXURE B

STATEMENT SHOWING MAXIMUM, MINIMUM AND MONTHLY MEAN DISCHARGES OF THE INDUS AT SUKKUR FROM AUGUST 1929 TO JANUARY 1935.

Month		1929-30			1930-31			1931-32			1932-33			1933-34			1934-35		
		Maximum	Mean	Minimum	Maximum	Mean	Minimum	Maximum	Mean	Minimum	Maximum	Mean	Minimum	Maximum	Mean	Minimum	Maximum	Mean	Minimum
August	O. ..	591,204	494,736	347,373	502,694	434,599	343,186	433,697	373,664	316,858	571,986	483,629	393,587						
	E. ..	7,381	7,356	9,764	7,607	6,965	6,214	11,535	10,883	9,369	13,025	12,341	11,933						
	T. ..	598,585	502,092	357,137	510,591	441,564	349,400	445,232	384,547	326,227	585,011	495,970	405,520	627,454	570,082	484,110	521,005	458,532	356,442
September	O. ..	701,685	354,768	131,375	373,514	209,607	104,684	374,193	249,623	107,372	414,975	180,587	86,889						
	E. ..	7,624	5,673	3,896	8,131	6,038	3,921	9,256	7,526	5,018	13,941	10,864	10,217						
	T. ..	709,309	360,441	135,271	381,645	215,645	108,605	383,449	257,149	112,390	428,016	191,551	97,106	593,302	319,505	197,719	320,321	187,377	121,789
October	O. ..	118,716	85,210	64,290	108,635	72,388	53,761	103,669	87,250	64,253	89,809	53,636	32,779						
	E. ..	3,752	2,680	1,713	3,735	2,604	1,624	4,802	3,812	2,595	10,285	10,032	9,909						
	T. ..	122,468	87,890	66,003	112,370	74,992	55,385	108,471	91,062	66,848	99,994	63,668	42,688	173,098	99,898	51,759	132,449	73,345	44,436
November	O. ..	63,321	50,696	41,952	54,535	47,735	39,325	62,618	50,486	40,851	37,888	28,973	21,310						
	E. ..	1,662	1,178	930	1,675	1,744	1,234	2,537	1,968	1,522	9,231	7,477	7,145						
	T. ..	64,983	51,874	42,882	56,210	49,479	40,559	65,155	52,454	42,373	47,119	36,450	28,455	57,421	46,072	37,442	46,427	40,911	34,023
December	O. ..	43,679	39,082	35,521	38,821	35,716	33,438	40,771	33,227	24,433	23,514	21,528	15,932						
	E. ..	836	693	547	1,175	891	646	1,444	2,551	3,225	7,172	6,373	6,461						
	T. ..	44,515	39,775	36,068	39,996	36,607	34,084	42,215	35,778	27,658	30,686	27,901	22,393	39,386	34,981	27,587	38,258	33,096	28,263
January	O. ..	54,594	39,283	33,619	33,231	30,791	28,747	54,120	30,596	15,515	23,678	21,104	17,034						
	E. ..	1,120	618	486	635	586	532	1,495	2,972	3,658	4,583	4,919	6,000						
	T. ..	55,714	39,901	34,105	33,866	31,377	29,279	55,615	33,568	19,173	28,261	26,023	23,034	32,735	29,197	25,408	34,510	30,465	27,279
February	O. ..	56,739	44,759	34,120	40,452	33,557	28,590	43,386	24,522	11,838	25,392	16,809	13,100						
	E. ..	1,553	922	436	1,122	814	532	3,314	3,233	2,165	1,255	5,288	6,100						
	T. ..	58,292	45,681	34,556	41,574	34,371	29,122	46,700	27,755	14,006	26,647	22,097	19,200	30,366	27,173	24,136			
March	O. ..	85,215	61,398	33,470	42,196	32,623	27,550	65,321	36,358	21,683	42,534	23,010	12,835						
	E. ..	756	1,160	436	1,154	779	538	1,532	1,870	3,105	1,150	3,709	6,400						
	T. ..	85,971	62,558	33,906	43,350	33,402	28,088	66,853	38,228	24,788	42,684	26,719	19,235	30,295	25,925	22,114			
April	O. ..	333,690	158,668	83,736	88,761	51,777	31,689	65,915	47,818	32,039									
	E. ..	2,216	2,879	3,300	3,352	1,826	693	6,744	5,711	4,400									
	T. ..	335,906	161,547	86,736	92,113	53,603	32,382	72,659	53,529	36,439	56,224	53,251	43,208	48,662	33,555	25,615			
May	O. ..	284,000	199,467	154,210	193,957	115,747	77,798	88,624	61,134	49,928									
	E. ..	6,740	5,342	4,152	8,032	5,118	3,639	8,005	7,681	7,824									
	T. ..	290,740	204,809	158,362	201,989	120,865	81,437	96,629	68,815	57,752	116,290	77,997	51,291	62,988	50,982	42,288			
June	O. ..	361,445	248,132	188,250	281,941	164,914	100,070	236,156	176,133	101,800									
	E. ..	9,012	6,980	6,360	10,551	6,735	4,171	10,618	9,770	8,825									
	T. ..	370,457	255,062	194,610	292,492	171,649	104,241	246,774	185,903	110,625	380,824	229,968	138,540	351,424	178,930	50,505			
July	O. ..	657,101	522,093	381,894	446,606	305,054	195,513	467,705	276,446	151,526									
	E. ..	9,658	10,537	9,013	11,535	10,129	6,715	13,231	11,653	10,031									
	T. ..	666,759	534,230	390,907	458,141	315,183	202,228	480,936	288,099	161,557	581,838	454,988	362,931	584,945	451,662	324,111			

O=Outfall E.=Eastern Nara old head. T=Total

Hold Head Easteru Nara bunded up and new head working from 1st April 1933.

W. L. C. TRENCH.

ANNEXURE D

Statement showing gross and culturable areas commanded by each canal system in Sind.

	Lloyd Barrage Canals					Inundation Canals							
	Rohri Canal System	Eastern Nara System	N. W. Canal System	Rice Canal System	Dadu Canal System	Mancher Dreinage System	Desert Canal	Uner Wah	Begari Canal	Canals in Rohri	Sind Canal	Rajib Chitti and Garang Canals	Indus Canals, Right Bank	Indus Canals, Left Bank
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
	Acres	Acres	Acres	Acres	Acres	Acres	Acres	Acres	Acres	Acres	Acres	Acres	Acres	Acres
Gross area commanded	2,720,262	2,165,258	1,022,278	543,614	658,458	73,264	448,955	246,970	660,617	203,400	170,710	47,148	194,000	104,224
Culturable area commanded	2,472,616	2,691,000	896,310	455,067	483,700	37,218	448,955	203,244	565,246	175,975	145,715	28,260	65,206	72,794
Area irrigable by complete project ..	2,187,050	1,780,064	720,220	402,600	394,400	37,218	129,660	112,025	340,260	119,257	98,589	26,560	150,000	80,000

(continued)

	Inundation Canals—*concld.*								
	Pinyari Canal	Baghir Canal	Sattah Canal	Fuleli Canal	Other Canals (Fuleli Division)	Mahi Wah	Kalri Canal	Hassanali Canal	
1	16	17	18	19	20	21	22	23	
	Acres	Acres	Acres	Acres	Acres	Acres	Acres	Acres	
Gross area commanded	191,600	112,057	36,971	1,571,537	163,644	200,251	63,707	98,905	
Culturable area commanded	108,085	99,603	21,793	1,191,056	90,087	152,431	63,707	74,390	
Area irrigable by complete project ..	180,000	90,000	30,000	400,000	30,000	106,873	39,413	19,000	

W. L. C. TRENCH

PUNJAB GOVERNMENT BRIEF.

No. 1398-Nor.

FROM

H. W. NICHOLSON, Esq., C.I.E.,
Secretary to Government, Punjab,
Public Works Department, Irrigation Branch,

To

THE DEPUTY SECRETARY TO THE GOVERNMENT OF INDIA,
DEPARTMENT OF INDUSTRIES AND LABOUR,
PUBLIC WORKS BRANCH, NEW DELHI.

Dated Lahore, the 30th January, 1935.

Irrigation.
Works.

SUBJECT—*Apportionment of the waters of the Indus and its tributaries between the parties concerned.*

SIR,

WITH reference to your letter No. I. R.-18, dated 8th November, 1934, and in continuation of this office letter No. 10561-Nor., dated 6th December, 1934, I have the honour to enclose for your information a Memorandum on the terms of reference of the Committee on the apportionment of the waters of the Indus and its tributaries. Spare copies of this Memorandum for use of the members of the Committee are being forwarded direct to the Secretary of the Committee together with copies of the following printed documents for use of the Independent Members of the Committee appointed by the Government of India :—

1. Thal Major Project, 1924.
2. Thal Lesser Project, 1925.
3. Haveli Project, 1915.
4. Haveli Project, 1932.
5. Woolar Lake Barrage Scheme, 1915.
6. Report on Projected Bhakra Dam and other possible storage sites between the Rivers Jumna and Chenab, 1928.
7. Report of the Committee on the probable effect of the Bhakra Dam Scheme on the inundation canals of the Indus between Mithankot and Sukkur.
8. Sutlej Valley Project, 1920.

2. The Punjab Government representative will be instructed to place before the Committee the material on which the Punjab Government claims first, that the supplies asked for by them are available, and second, that the Punjab has a prior claim to supplies which are not required for the canals included in the Sukkur Barrage Project as sanctioned by the Secretary of State in 1923, which, for instance, did not include the rabi supply which it is understood it is proposed to give to Khairpur.

3. As regards the Punjab claims for water, the Punjab representative will probably be instructed to explain at the first meeting the nature of the variation in the demand for water that is experienced in arid climates such as the south-west Punjab as compared with the north-east Punjab where rain is comparatively common.

4. He will be instructed to place at the disposal of the Committee any data that may be required regarding the rise of the sub-soil water-table in irrigated tracts and the benefits obtained in the past by restricting rabi supplies in areas of high sub-soil water-table.

5. It is not at present possible to say in what respects it will be necessary to elucidate the Punjab irrigation practice for the benefit of those members of the Committee to whom the conditions of the Punjab are unfamiliar, but the representative will be instructed to give every assistance to the other members of the Committee to appreciate to the full the bearing of the arguments on which the Punjab base their claims to further withdrawals from the Indus and its tributaries.

I have the honour to be,

SIR,

Your most obedient servant,

H. W. NICHOLSON,
Secretary to Government, Punjab,
Public Works Department, Irrigation Branch.

Memorandum, dated 25th January 1935, on the Terms of Reference for the Committee on apportioning the waters of the Indus and its tributaries.

Haveli Project

The Haveli Project is designed to irrigate the land lying along the banks of the Chenab below the junction of the Chenab and the Jhelum. It will take up the inundation canal areas as well as the Sidhnai System. It originated from the fear that the opening of the Triple Canal System would adversely affect the inundation canals taking off the Chenab.

By the time the Haveli Project came into the field as a definite Project, the irrigation situation in the Punjab had become somewhat complex and now-a-days the canals are so inter-linked that there is scarcely a canal in the Punjab taking off the Indus and its tributaries that is not affected by the Haveli Project.

2. The Project submitted to the Government of India for sanction in 1915, which did not contemplate any perennial irrigation, was returned unsanctioned owing to the objection of Bahawalpur that the Project, if executed, would adversely affect the Bahawalpur Chenab Inundation Canals.

At that time, the Triple Canal Project was not functioning and it was assumed that there would be no Rabi supply available in the river at Trimmu when no water was passed below Rasul in the Rabi. It was anticipated that only kharif irrigation and rabi first watering could be given in the Haveli Area.

The capacities of the proposed canals were :—

	Cusecs.
Right Bank	1,161
Left Bank	5,386
Total ..	6,547

3. When investigations in connection with the Sutlej Valley Project were commenced in 1919, it was found that in spite of the Jhelum being closed off at Rasul during the Rabi, there was a regeneration of supply at Haveli far in excess of anything anticipated. It appeared that an ensured mean Rabi supply in excess of 516 cusecs would be available at the Panjnad site from regeneration below Trimmu; which would enable the whole of the Rabi supply reaching Trimmu to be utilized in the Haveli Project up to the capacity of the canals proposed. At the same time, the construction of Panjnad Headworks ensured that the Bahawalpur Inundation Canals would not be adversely affected by any extra withdrawals for the Haveli.

4. In the 1920 Sutlej Valley Project Report on page xlviii, a note is given on the details of the Haveli Project as then envisaged and a statement of supplies passing Balloki given on page liii shows the benefit anticipated to the Triple Canals, and daily records for the last 12 years confirm the benefit which would accrue by utilizing water at Balloki for the Triple Canal Project. Not only could intensity of irrigation be increased in areas already colonized, but by utilizing the water made available in new areas of crown waste which exist on the Quintuple Canals, a credit can be obtained from the sales of land, in addition to water rates and land revenue which is fluctuating on these canals.

5. In order to ensure that the Haveli or other Projects would not be held up by any objection that they might affect supplies to the Bahawalpur Inundation Canals, the Punjab Government agreed to pay part of the cost of the Panjnad Headworks and has in fact paid 76 lakhs of rupees. These Headworks ensured to Bahawalpur the supplies allotted to and accepted by that State in the 1920 Sutlej Valley Project Agreement.

There is also a material benefit from the Haveli Scheme as regards water-logging in that a stretch of the Ravi, 240 miles in length, in which heavy losses of water occur at present, would remain dry for many months in the year so that the inflow into the sub-soil would be stopped; further owing to less supplies being

run in the Upper Chenab Canal to feed the Lower Bari Doab Canal when the latter was supplied from the Ravi there would be an amelioration of the water-logging conditions on the Upper Chenab Canal.

6. There is also another indirect benefit that in the early Kharif when the supplies for the Sutlej Valley Project are low the supply at Madhopur from the Ravi in excess of the requirements of the Upper Bari Doab Canal could easily be passed into the Beas for utilization in the Sutlej Valley Project. At present these supplies passing below Madhopur must be passed down to the Sidhnai and the greater part is lost in the dry river bed on the way.

7. When the financial aspect of the Haveli Project was under examination it became obvious that the limitation of the Ravi withdrawals to a maximum of 1,250 cusecs was fatal to the success of the scheme.

8. It must be remembered that the larger portion of this area has already an established system of agriculture. Even in the area now dependent on the Sidhnai Canals the crops are largely assisted from wells except in a very good year when the canal gives an adequate supply throughout the year. These wells keep down any rise in the water table and to put them out of action would increase the danger of waterlogging. On the other hand the wells are not by themselves sufficient either to sow a large area in the Rabi or to mature a large area if sown. The prosperity of the tract is now dependent on canal supplies at the time of sowing and again on similar supplies at the time of maturing. The weakness of the tract arises from the fact that these supplies are not certain and vary greatly from year to year.

A statement is attached (Annexure A) showing the areas on the Haveli Project which was submitted to the Indus Discharge Committee in 1929 when the present restriction of Rabi supplies to a maximum of 1,250 cusecs was agreed to.

9. The 1932 Haveli Project was prepared to utilize the restricted Rabi supply, but it was found that the scheme would not be productive, since a supply of 1,250 cusecs would not ensure an adequate supply in October and November, and again during March, to enable a sufficient area to be sown and matured as would produce in land revenue and water rates a sufficient return to make the scheme remunerative. It is, however, possible to improve the financial aspect by a very small modification of supplies.

10. It is not proposed to alter the capacities of the perennial or non-perennial channels, which are based on the standard allowances of four cusecs per thousand acres gross for perennial channels at canal head, and six cusecs per thousand acres gross for non-perennial, giving capacities of 2,750 cusecs perennial and 5,000 cusecs non-perennial. All that it is proposed to ask for is, that if supplies are available in the river, the perennial canal of 2,750 cusecs capacity should be allowed to run full supply in the Rabi period up to 30th November and again from 1st March to 1st April, the canal being run in the intervening period from 1st December to 1st March with a capacity factor of 0·3 giving a mean discharge during these three months of 825 cusecs.

The effect of this would be to increase the perennial area sown, but at the same time since there would be an intervening period during which the canal supply would be restricted, it would still be necessary to work the wells. These number very nearly 5,000 in the Sidhnai area alone and would continue to have a great effect on the water-table.

11. The Punjab Government claim that the arbitrary restriction of the Rabi supply in the 1932 scheme, which it is understood, was the result of a misapprehension in the proceedings of the 1929 Indus Discharge Committee, should be removed and a supply given which in fact would not represent a greater supply than that furnished by the Sidhnai Canal in good years under existing conditions. The proposal is thus roughly in accordance with the existing agricultural practice of the tract.

The supply as claimed at present will give the most efficient use of the Rabi water and by ensuring that the wells remain in action, will avoid danger of waterlogging.

Thal Project

12. The idea of irrigating the Doab lying between the Indus and the Jhelum is no new one. The first scheme for the irrigation of this Sind Sagar Doab or Thal as it is called was prepared in 1871.

A complete Project was prepared and submitted to the Government of India for sanction with No. 0995-W.I., dated 25th Septmber, 1919, involving a Canal of 14,000 cusecs discharge utilizing a mean Rabi supply of 5,880 cusecs.

This was followed by the 1924 Project which involved a canal of 16,043 cusecs capacity and a mean Rabi supply of about 8,000 cusecs. An experimenta canal project was then prepared to demonstrate the irrigability of the Thal but it was found to be unproductive. The Lesser Thal Project was submitted to the Government of India under No. 01237-N.I., dated 2nd October 1925, with a head capacity of 6,750 cusecs and a mean rabi supply of just over 3,000 cusecs. This Lesser Project comprised the western portion of the Major Project, as a first step, as it was hoped the Major Project would ultimately be sanctioned.

13. There is, however, the Patti Project prepared by the Superintending Engineer in charge of the 1924 Project Surveys on his own initiative which was not put forward as it did not form an integral part of the Main Project but only contemplated irrigating the areas, which he considered were economically irrigable. Subsequent experience has confirmed the correctness of his appreciation of the fact that the greater part of the Thal is not economically or practically irrigable. The Patti Project, is, therefore, accepted as being the best solution for irrigating the Thal. The Patti Project involves a canal of 6,000 cusecs head capacity and a mean rabi supply of 3,600 cusecs.

14. The Punjab, therefore, claim the right to a canal of 6,000 cusecs capacity with a rabi capacity factor of 0.6, the actual monthly capacity factor will vary in the same way as the capacity factor on the other perennial canals in the province where experience has shown the most economical way in which water can be used.

Bhakra Dam Scheme

15. The Bhakra Dam Storage Scheme contemplates impounding 5,750,000 ft. acres of water on the main Sutlej 40 miles above Rupar. The effect of this scheme on the inundation canals in Sind has been fully investigated and reported on by Messrs. Nicholson and Trench. This report has been accepted by the Governments of Bombay and Punjab and it is not, therefore, necessary to deal with this scheme in this Committee.

Woolar Lake Scheme

16. In addition to the Bhakra Dam there are certain other small storage projects which are possible on various affluents of the main rivers and one, the Woolar Lake Scheme, proposes to store water on the main Jhelum. The suggestion to impound water from the Jhelum in the Woolar Lake in Kashmir during August and September arose first in 1902 as a means of reclaiming swamps in the south of the Lake and for improving the navigation in the Jhelum River.

At this time, the Triple Canals Projects was under discussion in the Punjab and it was believed that a good deal of storage water would be required to meet the requirements of the new canals. The possibilities of the Woolar Lake Scheme were investigated by the Irrigation Branch in 1903 and it was concluded that the equivalent of 1,000 cusecs for 6 months could be stored at a cost of Rs. 49 lakhs and would give a return of 5.1 per cent on the capital cost.

17. The discussions with the Durbar took a new turn with the proposals to dredge the outfall bar at Baramulla by electric power generated close by. At the same time, it was proposed that the State should construct the Barrage and get an annual contribution of Rs. 2 lakhs from the Punjab for the use of the water stored.

The Punjab did not accept the proposal as the charge was considered high and at that time (July 1905) it was considered that storage was not necessary for the Triple Canals.

18. The scheme, however, was not finally disposed of as the dredging of the Baramulla Outfall Channel had the effect of letting the water out of the Woolar Lake earlier than had been the case in 1905. By 1914, there was definite evidence that the dredging of the Bar had altered the flow of the Jhelum at Baramulla, causing a decrease of supply from October to December and an increase from January to March when compared with the flow of the pre-dredging period.

19. The 1915 Woolar Lake Project was prepared under the authority of the Government of India and provides for a storage capacity of 334,000 foot acres at an estimated cost of Rs. 14 lakhs.

The Project was prepared solely from the point of view of allowing a uniform supply to run for six months and no account was taken of the possibility of increasing the value of the water by supplying it at critical periods, or of holding up supplies when they were in excess during the winter.

The flexibility of control that would be given by such a barrage is great and considering the small amount of water it is proposed to abstract in August and September to give the supply (about 6 per cent of the total run-off of the Jhelum at Mangla during these months), the scheme is, therefore, included in the claims of the Punjab.

Other Storage Schemes

20. A list of smaller storage schemes is given in Table 2 of the "Report of the Committee on the projected Bhakra Dam and other possible storage sites between the Rivers Jumna and Chenab". Certain of these sites have had observations made for the past 6 years which indicate that generally the annual run-off has been over-estimated. Nothing more has been done with regard to these storage sites on the affluents and there are no definite proposals in hand at present, to build any dams.

No general investigation has been done of storage sites in the Salt Range and the hills north of the Chenab, but these storages are of small capacity of much the same order as those mentioned in Table 2 of the Report.

Feeder Canals

21. In addition to these storage works there are possibilities of constructing feeder canals, for example, the water which now passes Madhopur on the Ravi in the early kharif must at present be allowed to find its way 435 miles to the Sidhnai. Most of this water is wasted on the way and on the construction of the Haveli Project it would be possible to divert this water *via* the Upper Bari Doab Canal to the Beas for use in the Sutlej Valley Project. This is purely a matter of transferring water which at present never passes out of the Punjab.

22. On the other hand there are possibilities of constructing a feeder canal from the Chenab to transfer to the Beas early Kharif water which at present does pass Panjnad. The existence of such a feeder would, in addition to increasing supplies for the Sutlej Valley Project, also enable a canal to be constructed to irrigate the Jullundur Doab where the water-table has been falling for many years. Such a feeder from the Chenab to the Beas would enable water to be supplied in the months of April, May, and June to any extent that experience may prove it is possible to withdraw water from the Chenab during these months.

ANNEXURE A

HAVELI PROJECT

STATEMENT SHOWING AREAS DETERMINED IN 1928

Canal or Tract	Blue Book Statistics				Details of area from 1" map tracing						Capacity required at canal head		
	Semi-perennial		*Inundation*										
	Gross area	Full supply	Gross area	Full supply	Existing area	New area	Transferred area	Total area	Perennial area	Non-perennial area	Perennial at 4 cusecs per thousand	Non-perennial at 6 cusecs per thousand	Total capacity
1	2	3	4	5	6	7	8	9	10	11	12	13	14
	Acres	Cusecs	Acres	Cusecs	Acres	Acres	Acres	Acres	Acres	Acres	Cusecs	Cusecs	Cusecs
LEFT BANK CANAL													
Khadir	..	....	..	..	..	85,000	..	85,000	..	85,000	..	510	510
Shorkot	..	..	..	..	..	80,000	..	80,000	80,000	..	320	..	320
Korangga	30,356	210/230	..	..	39,000	7,000	..	46,000	46,000	..	184	..	184
Total North of the Ravi ..	30,356	210/230	..	..	39,000	N. P. 85,000 P. 87,000	..	85,000 126,000	.. 126,000	85,000	504	510	1,014
Abdul Hakim	16,775	105/115	..	..	16,100	19,700	..	35,800	35,800	..	143	..	143
Sidhnai	341,617	2,100	..	..	345,400	76,700	+71,300	493,400	493,400	..	1,974	..	1,974
Fazal Shah	31,100	190/210	..	..	30,300	10,000	..	40,300	40,300	..	161	..	161
Total South of the Ravi ..	389,492	2,395/2,426	..	..	391,800	106,400	+71,300	569,500	569,500	..	2,278	..	2,278
Total Semi-perennial or perennial..	419,848	2,605/2,656	..	..	430,800	193,400	+71,300	695,500	695,500	..	2,782	..	2,782
Matti Thal	..	..	419,040	300/420	34,700	..	..	34,700	..	34,700	..	208	208
Durana Langana including Shahpur Branch.	..	..		874/910	126,000	..	—71,300	54,700	..	54,700	..	328	328
Wali Muhammad	..	..		607/742	70,500	..	..	70,500	..	70,500	..	423	423
Sikandrabad..	..	..		1,600/1,840	75,300	..	..	75,300	..	75,300	..	452	452
Gajju Hatta	..	..		655/804	129,760	..	..	129,700	..	129,700	..	778	778
Biloch Wah	..	..		300/480	14,700	20,500	..	35,200	..	35,200	..	211	211
Total Inundation or Non-perennial South of Ravi.	..	..	419,040	4,399/5,196	450,900	20,500	—71,300	400,100	..	400,100	..	2,400	2,400
Total South of Ravi ..	389,492	2,395/2,426	419,040	4,399/5,196	842,700	126,900	..	969,600	569,500	400,100	2,278	2,400	4,678
TOTAL LEFT BANK CANAL ..	419,848	2,605/2,656	419,040	4,399/5,196	881,700	298,900	..	1,180,600	695,500	485,100	2,782	2,910	5,692
RIGHT BANK CANAL													
Karam	..	..	19,325	197/296	19,325	194,775	..	214,100	..	214,100	..	1,285	1,285
Ganesh	..	..	22,963	224/336	88,510	73,390	..	161,900	..	161,900	..	971	971
Tallri	..	..	65,547	770/1,155									
TOTAL RIGHT BANK CANAL ..	..	..	107,835	1,191/1,787	107,835	268,165	..	376,000	..	376,000	..	2,256	2,256
GRAND TOTAL, RIGHT AND LEFT BANK CANALS.	419,848	2,605/2,656	526,875	5,590/6,983	989,535	567,065	..	1,556,600	695,500	861,100	2,782	5,166	7,948
Total Existing ..	946,723 acres.		8,193/9,639 cusecs.										

H. W. NICHOLSON.

BAHAWALPUR STATE BRIEF.

Agreement of 1920.

The Sutlej Valley Project canals which have been constructed to irrigate Bahawalpur State territory may be divided into two categories, *viz.*, those taking off the Sutlej river at the Sulemanki and Islam Weirs, and those taking off the Panjand river at Panjnad Weir. The supplies which can be drawn off by the canals taking off the Sutlej river are regulated by an agreement signed in 1920 before the Sutlej Valley Project was sanctioned, which gives Bahawalpur 57 and 42.2 per cent of the supplies available during the rabi and kharif seasons, respectively. The corresponding figures for the British partner in this Agreement are 26·5 and 50.5 per cent for rabi and kharif respectively and the Gang Canal, which feeds Bikaner State, receives the remainder.

2. These percentages were based on the gross area which, it was estimated, could be commanded by the various canals which were to be constructed by each partner.

This criterion could not be applied when fixing the supplies which could be drawn off by the canals taking off at Panjnad Weir. On the other hand it was considered necessary when the agreement was signed to limit these supplies, firstly in the interests of Sind, where the construction of the Sukkur Barrage canals was about to be undertaken and secondly in the interests of the Punjab, where the prospects of the proposed Haveli canal to take off the Chenab river above might be adversely affected if the Panjnad canals were allowed to acquire a prescriptive right to more than their fair share of water.

3. A clause 4 D·2 was therefore inserted in the 1920 Agreement which limited the supplies which could be drawn for the perennial and non-perennial Bahawalpur canals taking off from the Panjnad river to a mean draw-off in each crop which should be maintained at the same fraction of their authorized maximum capacity in cusecs, as that of the British Sutlej Valley Project canals taking off the Sutlej river above.

4. This clause, if applied rigidly, would limit the supplies which could be drawn off by the Panjnad canals at many periods of the year when there is ample water available both for the requirements of Sind and the Haveli Project and a considerable quantity is passing unused to the sea.

Subsequent Arrangement.

5. The Sutlej Valley Project Committee, Bahawalpur, therefore recommended in 1932 that the whole situation should be reviewed and a new arrangement come to, with the concurrence of the Governments of the Punjab and Bombay which would enable the canals taking off at Panjnad to draw more reasonable supplies than those proposed under the 1920 Agreement.

6. As a result of this recommendation considerable correspondence has passed between the three Governments concerned and there have been informal discussions, but so many interests are involved that it has been impossible to come to any mutual agreement.

7. In the meantime the Governments of Bombay and the Punjab have permitted the Panjnad canals to draw water in excess of the amount permissible under the 1920 Agreement, since they realized that, if supplies were restricted to the extent proposed in that Agreement, this would greatly retard the development of the Panjnad canals, and further it seemed unnecessary to refuse water which could not be utilized elsewhere.

8. The Government of the Punjab have intimated, however, that they are not prepared to give unrestricted supplies after 31st March 1935, lest Bahawalpur State should acquire a prescriptive right to water which might some day be required for the Haveli canal, if that canal is ever constructed.

9. It is very necessary therefore to come to some final agreement before that date, or the Panjnad canals may suffer severely because the supplies available in the Sutlej river at some of the most important periods of the year are often far

below those anticipated when the 1920 Agreement was signed and thus supplies in the Panjnad canal, if made to depend on the draw-off of the British S. V. P. canals would be restricted to an extent never contemplated when this Agreement was signed.

Findings of 1929 Committee

10. The question of further withdrawals from the Indus river and its tributaries was the subject of much discussion and controversy between the Governments of Bombay and the Punjab for many years; finally the recommendations of the Indus Discharge Committee 1929 were accepted by both Governments, and the Secretary of State ordered that the question was not to be reopened until 1939, by which time the effect of the draw-off by the new Sut.ej Valley canals and the requirements of Sind would be more clearly known. Further, as a result of more accurate and continuous observations of discharges at various sites on the rivers over a period of more than 15 years, the supp.ies available would also be more definitely known.

Extra Demands in Rabi.

11. Under one of the recommendations accepted in 1929 the Punjab Government have the right to draw-off 1,250 cusecs during the Rabi season from 15th October to 20th April for the Haveli canal and a kharif supply of 7,500 cusecs during the remainder of the year.

12. It is understood that a remunerative project can not be prepared with such restricted rabi supplies, and that that Government are anxious to increase these to 2,600 cusecs, while leaving the kharif maximum permissible draw-off at 7,500 cusecs as at present.

13. Sind also is anxious for a right to draw-off 2,000 cusecs during the rabi season to meet the demands of Khairpur State.

It is thus in the interests of all parties to reopen the whole question once more.

Redistribution within the State.

14. It is now necessary to study how far the supplies of the Panjnad canals would be restricted if the present clause 4 D·2 of the 1920 Agreement were enforced and to see the extent to which additional supplies are required, also how these can be found without unduly prejudicing the claims of the Punjab and Sind the the additional supplies required by them.

15. Two canals have been constructed taking off at Panjnad Weir *viz.* the Panjnad, a non-perennial canal designed to carry a maximum discharge of 9,567 cusecs for a gross commanded area of 14,55,500 acres, of which it was estimated that 10,18,850 acres of 70 per cent would be irrigated annually. The second canal, the Abbasia, a perennial canal, was designed to carry a maximum discharge of 1,032 cusecs for a gross commanded area of 2,70,000 acres, of which it was estimated that 1,50,390 acres or 55.7 per cent would be irrigated annually.

16. The Panjnad canal was intended primarily to take the place of a number of old inundation canals which used to draw water from the Panjnad and Indus rivers between the Panjnad Weir and the Sind border during the kharif season. The Abbaisa canal on the other hand was constructed into new desert State waste lands with a view to developing new country.

17. Unfortunately it has been found that the area commanded by the Abbasia, is, for the most part, composed of soil of such quality that it can not be reclaimed economically, and it has been necessary to abandon this canal except for a very small area at the head which is given kharif water only and a further small area which can be commanded by one of the tail channels of the Panjnad canal.

18. On the other hand, a large area South-East of the Bahawalpur-Karachi Railway line, which was designed to be irrigated by the Panjnad canal, is desert land and most of it State waste. There is much good land here, but it can not be developed with a non-perennial supply because almost everywhere the subsoil water is brackish, and the cultivators must depend on canal water for their drinking supplies and thus they can not settle down if the canals are to be closed for part

of the year. The Sutlej Valley Project Committee therefore recommended that this area should be given the perennial supplies intended for the abandoned Abbasia canal.

19. In order to conserve the Rabi supply and give more efficiently perennial irrigation to this area a new feeder channel has, as shown on the accompanying map (Annexure A) been constructed from the tail of Minchin Branch parallel to the railway line. This feeder will take up the distributaries at the tail of Rahimyarkhan Branch and feed the tail reach of Sadiq Branch in the Rabi season. Thus the whole Rabi supply will be passed into the Minchin Branch, which has been widened where necessary for this purpose.

20. The area now commanded are as follows:—

Canal	Perennial		Non-perennial		Total Culturable Area	Remarks
	Gross Area	Culturable	Gross Area	Culturable		
Panjnad ..	4,19,032	2,75,790	9,95,268	8,66,272	11,42,062	It is proposed to irrigate a small N. P. area near the head which can not be commanded by the Panjnad Canal.
Abbasia ..	..	..	20,725	18,989	18,989	
Total ..	4,19,032	2,75,790	10,15,993	8,85,261	11,61,051	

These figures are slightly different from those given in the Sutlej Valley Committee's report, page 32: they are however the result of a more detailed investigation and the latest soil surveys. Also that Committee recommended that the rabi supply should be run down the Abbasia canal and taken across to the new area by means of an extension from the tail of that canal. It has been found cheaper, however, to run it down the Minchin Branch of the Panjnad canal, and close the Abbasia canal except for a small kharif supply given for a high lying non-perennial area near the head.

21. For these areas the combined canals may only draw-off in any crop under the 1920 Agreement the same share of their full capacity as the British S. V. P. canals draw-off from the Sutlej River above. As stated, the draw-off of these British canals is a fixed percentage of the supply available in the Sutlej which, omitting gains or losses in the river may be taken as the discharge in the river at Ferozepur just above the Ferozepur Weir. In other words, the supplies which can be drawn off at Panjnad Weir under the agreement are normally a fixed percentage of discharge in the Sutlej river at Ferozepur excluding regeneration water or losses in the river between Ferozepur and Islam. The Chief Engineer, Punjab, in his endorsement No. 1678-S/Con., dated the 23rd June 1933, copy attached (Annexure B), has thus fixed the permissible draw-off at Panjnad as 8 and 25 per cent of the discharge of the Sutlej at Ferozepur during the rabi and kharif seasons respectively.

Supplies available in recent Years.

22. Annexures C and D show the average discharges over 10-day periods in the Sutlej river at Ferozepur during the past 5 years and the discharges which could have been drawn off by the Panjnad canals during the rabi and kharif seasons under the Agreement based on the percentages worked out by the Chief Engineer, Punjab. A glance at these will show how inadequate these supplies would have been in many periods, more particularly during the late rabi and early kharif seasons, when Sutlej river discharges are often far below those on which the Project was based. This is largely due to the fact that the estimate of available supplies was based on the average discharge in the river at Ferozepur for the years 1899 to 1920.

23. Unfortunately no allowance was made for additional supplies which might be drawn off by the Sirhind canal above. Actually that canal now draws off considerably more during March, April, May and June than it used to do previously, *vide* statement below, and this coupled with decreased river discharges in the Beas river has led to a chronic shortage of water during certain seasons of the year in the Sutlej Valley canals. This shortage amounted almost to a water famine in April, May and part of June during 1932, and again, in 1934.

24. In addition to this there are heavy losses in the river during this period of the year between Ferozepur and Islam Weirs of which no account was taken in the Project. The following tables show the position clearly:—

TABLE No. I

Draw-off of Sirhind Canal for the period 1909—1920 *compared with the period* 1920—1931

Year	AVERAGE DAILY DISCHARGES OF THE SIRHIND CANAL		
	March	April	May
	Cusecs	Cusecs	Cusecs
1909—20	3,826	3,895	4,117
1920—31	4,721	5,554	7,068
Average increased draw-off ..	895	1,659	2,951

TABLE No. II

Actual draw-off by S. V. P. Canals during the last 4 years compared with the average discharges assumed in the Project

Year	APRIL			MAY		
	Average discharge above Ferozepur Weir	Average discharge received by all S.V.P. canals	Loss in river	Average discharge above Ferozepur Weir	Average discharge received by all S.V.P. canals	Loss in river
	Cusecs	Cusecs	Cusecs	Cusecs	Cusecs	Cusecs
Average discharge assumed in the Project ..	9,524	9,524	*Nil*	19,827*	15,227*	*Nil*
Actual 1931	7,960	7,101	861	10,018	9,005	1,013
Actual 1932	3,219	2,800	419	3,786	2,827	959
Actual 1933	7,581	7,206	375	11,005	8,763	2,242
Actual 1934	4,680	3,840	840	4,751	3,929	822
Average	5,860	5,237	623	7,390	6,131	1,259
Less than assumed in the Project	3,664 =38%	4,287 =45%	.. ..	12,437 =63%	9,096 =59%	.. ..

*NOTE—It was assumed that out 19,827 cusecs available, 4,600 cusecs would be required for the Bhakhra Dam canals leaving 15,227 cusecs for the S. V. P. canals.

Insufficient Supplies for S. V. P.

25. The Sutlej Valley canals taking off from the Sutlej River have a total capacity of 29,611 cusecs. A glance at the figures will show the alarming state of affairs. During the past four years the S. V. P. canals taking off the Sutlej River have drawn only 55 and 41 per cent of the water assumed in the project during the months of April and May respectively, and in May 1932 the average discharge available was less than 10 per cent of the capacity of the canals.

26. The development of cotton and sugarcane, probably the most important money crops in the year, has been sadly retarded, particularly on the non-perennial canals which must inevitably bear the burnt of the shortage.

Unfairness of 1920 Agreement.

27. It would be grossly unfair therefore to limit the supplies for the Panjnad canals to the extent, which would be necessary if Clause 4-D (2) of the 1920 Agreement were rigidly applied. Indeed it is preposterous to tie the discharges which may be drawn off at Panjnad in any way to those available in the Sutlej river above.

28. If this view is accepted, it is necessary only to consider what supplies should be given at Panjnad to develop the area commanded efficiently without unfairly affecting the Sind canals or the prospects of future Punjab canals which may be constructed at any future date.

Sind Requirements.

29. Sind is concerned during the rabi season only with supplies for the canals taking off at the Sukkur barrage. During the kharif season there is always ample water for the Sukkur canals, and thus only the inundation canals in Upper and Lower Sind need be considered.

30. Annexure E attached shows the average discharge over 10-day periods in the Indus at Sukkur from September until April for the past 13 years. It also shows the maximum requirement of the Sukkur canals during each of these months.

31. As will be seen in normal years there is a considerable volume of water over and above the maximum requirements of the Sukkur canals throughout the rabi season. During the past three years the discharge has sometimes fallen below these maximum requirements for some periods during February and March.It seems likely, however, that we are passing through a cycle of years with abnormally low rainfall in the Punjab hills and Kashmir, and consequently low river discharges. A similar cycle occurred at the beginning of the present century.

Be this as it may, the authorities in Sind are natuarally anxious to protect the supplies to which they are entitled even during these years of depression.

Sind and Rabi Supplies.

32. For this reason, pendiug the reopening of the whole question in 1939 Bahawalpur have only put forward a request so far extra water during the Rabi season whenever the Sukkur Barrage is open, and water is being passed unused to the sea. Now, however, that the whole case is to be reviewed, it is suggested that the water available should be distributed more equitably according to the areas commanded by all the canals concerned.

33. As far as is known no canal in India receives its full maximum requirements all the year round, and excellent crops are reaped in Northern India without such supplies. The condit ons on the Panjnad canal are in many respects identical with those in Sind, the average rainfall being only four to five inches a year. Thus in equity the Panjnad canals should receive the same volume of water per unit of area as that given to the country commanded by the Sukkur canals.

34. It must not be forgotton also that absorption losses will be very great during the Rabi season in the Panjnad canal and Minchin branch, since the water will have to be carried 55 miles before irrigation begins.

35. Also it is now beyond doubt that additional perennial supplies taken off at Panjnad would have practically no effect on the Sukkur canals. A study of the gauges and discharges at Bukkar will show how little these have been affected during the rabi season by the enormously increased draw-off by Punjab canals since the middle of the last century. It is an admitted fact that the greater is the draw-off the greater is the regeneration water in the river below. Thus, if the Panjnad perennial canal were allowed to draw oft the extra 500 to 600 cusecs necessary for it to obtain its fully supply of 1,032 cusecs, when available during the rabi season, the discharge at Sukkur would not be affected by anything approaching this amount.

36. In normal years there is spare water going waste to the sea throughout the rabi season, and so in such years the extra draw-off would in no way affect the Sukkur canals. On the other hand in years of low supplies, during periods when there would not be sufficient water for the maximum requirements of the Sukkur canals, there would generally not be sufficient water for the maximum requirements of the Panjnad and Haveli canals, as will be seen from Annexure F which gives the discharges of the river at Panjnad and at Trimmu (where the Haveli canal will take off) for the past 6 years.

37. Sind might well agree therefore to the Panjnad and Haveli perennial canals drawing off their maximum requirements respectively whenever this supply is required and available.

38. Even if this were agreed to, there would still be times during years of ample supply, when much water would be passed below the Sukkur Barrage unused to the sea. Now, if even one canal watering could be given between January and March to the crops on the non-perennial areas of the Panjnad canal, there would result a very great increase in the yield of Rabi crops in those areas. It seems wrong therefore that water, which could be usefully employed, should be allowed to run to waste.

39. It is, therefore, suggested that the Chief Engineer in Sind should inform the Chief Engineers of the Punjab and Bahawalpur by wire ahead stating the extra discharge, which might be drawn off during any coming period of 10 days after allowing for his requirements for the Sukkur canals. Arrangements could then be made between the Chief Engineers of the Punjab and Bahawalpur for sharing this extra water equitably as will be explained later.

Sind and Kharif Supplies.

40. The supply of extra water during the kharif crop is a more difficult problem as far as Sind is concerned. As stated already there is always ample water for the Sukkur Barrage canals during this crop, and therefore the requirements of the inundation canals in Upper and Lower Sind only need be considered. These depend for their supplies on the level of the water surface in the river rather than on the actual volume passing, though of course, apart from any variations in river bed, the water level depends on the discharge.

41. The Indus is undoubtedly raising its bed, but the process is slow; on the other hand the increased draw-off at Sukkur has seriously affected the discharge and consequently the water levels below the Barrage during the early kharif season. Later when floods arrive the water levels rise in lower Sind to a higher level than formerly, because the old inundation canals which used to irrigate the country between Sukkur and Kotri have been closed and these were capable of drawing off far more than the Sukkur Barrage canals which now irrigate this area.

Sind Inundation Canals.

42. The important period for all concerned, however, is the period from 20th April to 31st May. During this period a reduction of 1,000 cusecs in the discharge of the Indus at Kotri would probably make a difference of only about half an inch in the water level and a corresponding difference in the water level entering the inundation canals. These canals could thus only draw off a very small fraction of the 1,000 cusecs and the remainder must pass unused to the sea.

43. The question therefore arises how far it is justifiable to deprive a large area upstream, where the supply is controlled, for the sake of inundation canals lower down, which can only draw off a fraction of this supply, the major portion inevitably running to waste to the sea. This problem faces Sind as regards her own Barrage canals and it is one which must be faced now if the Panjnad canal is to be given any extra supplies.

Expansion of Cotton Cultivation.

44. The prospects of the Panjnad canal largely depend on the cultivation of cotton and this in turn will depend on the supply of water which the canal will

receive during the showing period from 20th April until 31st May. The Panjnad canal was opened in 1932, and the area of cotton sown has risen as follows :—

	Acres.
1932	23,900
1933	48,824
1934	86,745

This increase is largely due to the fact that no restriction has been placed on the supplies which may be drawn off during May, and, provided reasonable supplies are permitted, the cotton area will continue to expand since the soil is admirable for cotton cultivation.

Haveli Project Requirements.

45. It is difficult to make any suitable proposal for limiting supplies in the Panjnad canals as far as Sind is concerned, but the proposal made later to restrict supplies in the interests of the Haveli canal will also probably meet the situation as far as Sind is concerned, both now and after the Haveli canal has been constructed. For the present this would mean that the Panjnad canals would draw off not more than 49 per cent of the discharge above the weir during the Kharif period. Annexure G shows that this would be limiting the Panjnad canal in years of low supplies to a far greater extent than the Sukkur Barrage canals, but at least in normal years it would get reasonable supplies for the cotton area.

46. The Government of Bombay have permitted the Panjnad non-perennial canal to remain open till the 31st October for the last two years, on the understanding that it would not be opened until the 15th April. This is a mutually satisfactory arrangement, and it makes possible the sowing of considerably greater areas of rabi crops on the non-perennial channels of the Panjnad canal.

47. It is suggested, therefore, that for the future the kharif period might be considered to extend from 15th April to 31st October instead of the present period, 1st April to 15th October.

48. If the Government of Bombay would concede these points it would then be necessary to see how far Panjnad canal supplies would have to be still further restricted to safeguard the interests of the proposed Haveli canal.

49. Annexure F shows the discharges for the past six years during the Rabi period at Trimmu, the proposed head of the Haveli canal, and at Panjnad. Also the amount of regeneration water by deducting the upper discharge from the lower. This of course does not take into account time lag. If these discharges are correct, there will be, except on rare occasions, ample water from regeneration to meet the needs of the Panjnad perennial canal during the rabi season.

50. On the other hand, if there is any lessening of this regeneration water due to any cause, the supplies at Panjnad might be unfairly affected at times if the Haveli canal were permitted to draw off all the water available at Trimmu throughout the rabi season. And further if the Government of Bombay are prepared to accept the proposal made above, that extra supplies may be drawn off for the non-perennial canals when the Sukkur Barrage is open and water is being passed unused to the sea, then any water available must be shared with the Haveli canal.

51. Such supplies should obviously be split up in proportion to the culturable area commanded by the Haveli and Panjnad canals. Unfortunately the Haveli canal is only in the project stage, and probably the exact culturable commanded area is unknown. In the project it has been assumed that 85 per cent and 90 per cent of gross commanded areas is culturable for the new and existing canal areas respectively. If soil surveys have been made, possibly a more accurate figure could now be given. If not, then the water available should be shared according to the gross commanded areas given in the table below until accurate figures for the culturable commanded area is known.

TABLE No. III

Item	Haveli project Gross commanded area	Gross commanded area of project estimate	Panjnad Canal — Actual area now: Gross Commanded area	Panjnad Canal — Actual area now: Culturable area
	Acres	Acres	Acres	Acres
Perennial area	6,85,341	2,70,000	4,19,032	2,75,790
Non-perennial area	8,27,385	14,55,500	10,15,993	8,85,261
Total	15,12,726	17,25,500	14,35,025	11,61,051

52. Thus the Panjnad canal should get $\frac{4,19,032}{11,04,373} = 38\%$ of the water available for the perennial canal during the rabi season and $\frac{14,35,025}{29,47,751} = 49\%$ during the kharif season. Provided always that the Panjnad canals should be allowed to draw off at all times the full amount of the regeneration water between Trimmu and Panjnad, subject to any restrictions imposed by Sind as mentioned above.

53. It is understood that the Punjab Government are asking for 2,600 cusecs for the perennial area commanded by the Haveli canal, but, on the basis of gross areas commanded if Bahawalpur is to get 1,032 cusecs for 4,19,032 acres the Punjab should only get 1,683 cusecs for 6,85,341 acres. Possibly, however, the percentage of culturable area is greater in the Haveli than the Panjnad area; until however a final soil survey is made gross areas should be accepted as the basis of distribution.

54. Any extra water given during the rabi season for the non-perennial canals should be distributed in proportion to the area commanded by those canals, *i.e.* Panjnad 8,85,261 acres, Haveli 8,27,385 acres.

55. It is suggested that a simple convention might be agreed to, under which the Haveli canal would get all such water during the first half and the Panjnad during the second half of each month and *vice versa* in alternate years.

56. During the kharif season until the Haveli canal is built, or until the culturable commanded area is accurately known, the Panjnad canals might be permitted to draw of 49% of the water passing Panjnad.

State Canal Requirements.

57. Apart from cotton, which is a new importation, the Panjnad non-perennial area has always during the kharif season been a rice-growing country. This crop was encouraged by the large systems of inundation canals which previously poured vast quantities of water, most efficiently for this purpose, into this area during the flood season. In order, therefore, to meet the demand for water for the existing rice areas it has been necessary to run the canal almost up to full designed capacity during July, August and September although the gross commanded area on which the canal was designed has been reduced as shown in Table III above.

58. The maximum capacity for which the Panjnad canal has been constructed may, therefore, stand, but the maximum capacity of the Abbasia non-perennial canal may be reduced from 1,032 to 250 cusecs for the present. This may seem rather high, but there is a proposal to add some of the tail area of the Ahmedpur Branch of the Bahawalpur Canal, which has suffered severely owing to

shortage of Sutlej supplies on to the Abbasia canal. Later the maximum capacity will be fixed when the exact area which can be commanded is known.

Proposals

59. To sum up therefore, the following are the proposals for a fresh agreement which it is suggested should govern the supplies which may be drawn off at Panjnad:—

(*a*) The kharif season shall be considered to extend from the 16th April to 31st October each year, and the rabi season from 1st November until 15th April.

(*b*) During the kharif season 49 per cent of the discharge upstream of Panjnad Weir may be drawn off. The draw-off would be subject to a combined maximum discharge of 9,750 cusecs in the canals.

(*c*) During the rabi season either (*i*) 38 per cent of the discharge upstream of Panjnad Weir, or (*ii*) the difference between the discharge in the river at Trimmu and the discharge in the river above Panjnad Weir, whichever be greater on any day, may be drawn off, due allowance having been made for time lag. This draw-off would be subject to a maximum discharge of 1,032 cusecs in the canal.

NOTE—Supplies would not necessarily be regulated under clauses (*b*) and (*c*) from day to day, but over considerable periods, an account being maintained and balancing periods fixed in agreement with the Punjab.

(*d*) During the rabi season, of additional water, which may be available above Panjand, and for the withdrawal of which the Chief Engineer in Sind may from time to time give permission, when the Sukkur Barrage would be open passing water unused to the sea, 50 per cent may be drawn off. Thus, if the discharge in the river above Panjnad were 4,000 cusecs, and if the Chief Engineer in Sind gave permission for the withdrawal of the whole of this, then supplies, which might be drawn off at Panjnad would be 1,032 cusecs under proposal (*c*) above plus additional supply of $\frac{50}{100}\{4,000-(1,032+X)\}$, where X is the full rabi discharge of the Haveli canal. These supplies would be regulated as proposed in paragraph 54 or by means of a water account as found most suitable in consultation with the Punjab. The total draw-off under this proposal and proposal (*c*) above would be subject to a combined maximum discharge of 9,750 cusecs in the canals.

60. The percentages 49 and 38 mentioned above would be subject to revision when the exact culturable commanded area of the Haveli canal is known. Also when this canal has been constructed the actual culturable area commanded by the Panjnad and Haveli canals would be the basis for sharing the supplies available. The percentages would then apply to the discharge in the river above Panjnad plus the discharge drawn off by the Haveli.

The Thal Project.

61. It may be argued that the proposals made above would prejudice adversely the prospects of the Thal Project should that ever be taken up once more. It would appear however from Annexure E which gives the discharges at Sukkur, that in dry years there is little hope of water being available during the rabi maturing period to meet the needs of such a large canal as that proposed for the Thal area, unless of course Sind is prepared to reduce the requirements of the Sukkur Barrage canals.

62. It would be better, therefore, to make a success of the Haveli and Panjnad canals rather than embark on what is generally considered a most doubtful canal scheme. If, however, it were decided to build at any future, date, what must inevitably be at best, a semi-perennial canal for the Thal area, then of course there would seldom if ever be any water going to waste to the sea during the rabi season, which could be given as additional supplies to the Panjnad and Haveli canals under proposal (*d*) above, and the proposal is for the utilization of surplus water and does not, if accepted, constitute a claim on the additional supplies. It would meanwhile be very unfair to withhold this water indefinitely and let it to go to waste on account of the remote possibility of the construction of the Thal canal.

Sind to take Indus Supplies only.

63. Undoubtedly a very simple solution would be for the Bombay Government to drop all claim to Chenab and Panjnad water on condition that the Punjab dropped all claim to Indus water.

64. A study of the discharges at Panjnad will show that the extra water which could be drawn off under such an arrangement by the Haveli and Panjnad canals would not affect Sind to the extent, which might at first be supposed. During the last three years the total water available at Panjnad varied from about 1,800 to 4,000 cusecs over long periods from 1st November until the middle of March. Taking into account the draw-off already sanctioned for the Panjnad and Haveli canals, the proposals now made for additional supplies would, if accepted, have hardly any effect on supplies in Sind.

65. If this were agreed to, Sind could leave the Punjab and Bahawalpur Governments to settle their claims between themselves. They would only be left to meet any small claims which the North West Frontier Province might make; and these, it is believed, would hardly affect appreciably the discharges so far down the river in Sind.

66. This proposal therefore should be considered first ; then, only if rejected by the Governments concerned, would it be necessary for Sind to consider any proposals concerning the division of the water available for the Panjnad and Haveli canals.

67. From what has been said above it will be seen that the Bahawalpur Durbar propose to share on an equitable basis whatever water can be made available between the Panjnad and Haveli canals. A reasonable time, however, should be fixed within which the Haveli canal should be constructed, because it is not fair that water should be reserved indefinitely for a project which may never be undertaken.

B. DARLEY
Chief Engineer
Bahawalpur Government

Dated 4th January 1935

ANNEXURE B

COPY OF A LETTER FROM THE CHIEF ENGINEER, IRRIGATION WORKS, PUNJAB, S. V. P., TO THE SUPERINTENDING ENGINEER, 3RD BHAWALPUR, CIRCLE, BHAWALPUR, No. 1677-S./CON., DATED THE 23RD JUNE 1933.

Panjnad Canals Water Account

I have the honour to issue te following instructions regarding the distribution of supplies to the Punjab Canals and the maintenance of the water account to obviate a certain indefiniteness which has characterized the keeping of this account during the Kharif sowing period now closed.

2. The distribution of supplies at Punjab is governed by para. 4. D (2) of the Agreement between Bhawalpur, Bikaner and the Punjab, possibly modified by the second portion of para. 4 E. Para. 4. D (2) fixes the limit which the Panjnad Canals may draw-off as a proportion of the amounts which the draw-off of the British canals on the Gharra reach of the Sutlej bears to their authorized maximum capacities.

If X—actual draw-off of British Canals the amount which the Panjnad Canals may draw off is—

(*a*) for Rabi $X/3440 \times 1032$ .. .. = .30X.

(*b*) for Kharif $X/20724 \times 10599$ .. .. = .51X.

The modification as per para. 4 E would necessitate the keeping of a secondary water account for the period at the commencement of the Kharif and at its close when the supply in the river is below the share capacities of the non-perennial canals. The appropriate fraction would be

$$\frac{X}{14963} \times 7410 = .495X.$$

The keeping of a secondary water account is a refinement which the comparative small percentage differences would not appear to warrant so that for the present and without prejudice to any action which may be taken in the future it will suffice to keep a simple water account with the percentage.—

(*a*) Rabi .. .. .30X.

(*b*) Kharif .. .. .51X.

3. With regard to the method of distribution and balancing there are two possibilities—

(*a*) a day-to-day balancing based on the draw-offs of the previous day.

(*b*) A regular programme, which will ensure a definite supply, with the necessary concomitant balancing turns at stated intervals.

Method (*a*) is obviously an inferior one as with it the daily discharge will fluctuate and the officers responsible for the internal distribution will not be able to make satisfactory arrangements. Method (*b*) is superior but its use necessitates the indents in non-balancing periods being such that the operation of balancing can be carried out with the supplies available or likely to be available during the balancing period.

It is so for the Chief Engineer, Bahalwalpur State, to decide which method he prefers, but the arguments for (*b*) are so overwhelming that it may be assumed that he will choose this alternative.

It remians to fix the balancing periods and this is being discussed with Chief Engineer' Bahalwalpur. For the present the balancing period of Kharif 1933 may be taken as from 6th to 15th October inclusive.

4. Executive Engineer, Panjnad Division, should ordinarily accept and meet the indents for the Panjnad Canals as framed by the indenting officers but he should warn the latter if the indents are likely to render balancing impossible and report the matter to Chif Engineer, Irrigation Works, Sutlej Valley Project, direct.

5. The water accounts for the Panjnad Canals should be submitted punctually at 10-day intervals by Executive Engineer, Panjnad Division, direct to the Chief Engineers, Panjnad and Bahawalpur in the following form :—

Period.	Sum of British Canals on Gharra.	Panjnad Canal. Share.	Panjnad Canals Draw-off. Canals.			Excess or deficit.	
			Abbasia.	Panjnad.	Total.	In period.	Up to date.

Daily discharges are not required and the abstract of the 10-day period will suffice.

The abstracts of the kharif sowing period 1933 should now be submitted on these lines.

ENDORSEMENT BY THE CHIEF ENGINEER, IRRIGATION WORKS, PUNJAB, NO. 1678-S./CON., DATED THE 23RD JUNE 1933.

COPY forwarded to the Chief Engineer, Bhawalpur State, for information and favour of opinion of the following points :—

(*a*) The method of interpretation of the water account as outlined in para 2. This is distinctly favourable to the Bhawalpur partner during the early Kharif. It is suggested that the matter might be simplified further by working on the discharge of the river at Ferozepur instead of actual supplies taken by British Canals in the Gharra reach. The British shares of the river supplies are 26·5% during Rabi and 50·5% during Kharif, and Bahawalpur would be entitled to draw-off at Panjnad :—

During Rabi	..	·31×26·5% of supply at Ftrozepur, say ·08 of supply at Ferozepore.
During Kharif	..	·51×50·5% of supply at Ferozepur, say ½ of supply at Ferozepur.

(*a*) The maintenance of a regular distribution programme in preference to spasmodic day-to-day distribution.

(*c*) Assuming a regular distribution programme it is suggested that the following will be the most suitable balancing periods :—

(*i*) For Rabi Sowings	..	..	..	25th December to 3rd January.
(*ii*) For Rabi maturing	..	..	..	22nd to 31st March.
(*iii*) For Kharif Sowings	..	..	..	31st May to 9th June.
(*iv*) For Kharif maturing	..	..	..	6th to 15th October.

If after 9th June in any year the river is insufficient to ensure full supplies to the British canals it will be necessary to resort to day to-day balancing as a normal procedure. In years of exceptional water shortage in the Sutlej it might be necessary to postpone the balancing period if it appeared probable that day-to-day balancing would not yield the Panjnad Canals a minimum useful supply which may be taken as 2,500 cusecs.

ANNEXURE C

STATEMENT SHOWING SUPPLIES WHICH COULD HAVE BEEN DRAWN OFF BY THE PANJNAD CANALS UNDER THE 1920 AGREEMENT FOR THE PAST 5 YEARS DURING THE RABI

Years	1929-30		1930-31		1931-32		1932-33		1933-34		1934-35	
Months	Supply at Ferozepur	Supply which could have been drawn off by the Panjnad Canal under the 1920 Agreement	Supply at Ferozepur	Supply which could have been drawn off by the Panjnad Canal under the 1920 Agreement	Supply at Ferozepur	Supply which could have been drawn off by the Panjnad Canal under the 1920 Agreement	Supply at Ferozepur	Supply which could have been drawn off by the Panjnad Canal under the 1920 Agreement	Supply at Ferozepur	Supply which could have been drawn off by the Panjnad Canal under the 1920 Agreement	Supply at Ferozepur	Supply which could have been drawn off by the Panjnad Canal under the 1920 Agreement
	Cusecs	Cusecs	Cusecs	Cusecs	Cusecs	Cusecs	Cusecs	Cusecs	Cusecs	Cusecs	Cusecs	Cusecs
16th October to 25th October	9,260	741	8,140	651	13,004	1,032	9,013	721	18,835	1,032	6,817	445
26th October to 4th November	7,113	569	6,272	502	8,451	676	7,306	584	13,785	1,032	5,459	437
5th November to 14th November	6,150	492	5,673	454	6,709	537	6,099	488	9,009	721	4,968	397
15th November to 24th November	5,686	455	5,280	422	5,345	428	5,622	450	7,322	586	4,547	364
25th November to 4th December	5,082	407	4,863	389	4,968	397	5,039	403	6,703	536	..	..
5th December to 14th December.	4964	397	4,501	360	4,412	353	4,860	389	6,181	494	..	..
15th December to 24th December.	10,794	864	4,044	324	4,146	332	4,395	352	5,250	420	..	..
25th December to 3rd January	9,978	798	3,624	290	3,873	310	5,740	459	4,339	347	..	..
4th January to 13th January	8,316	665	4,141	331	3,879	310	4,606	368	4,750	380	..	..
14th January to 23rd January	11,006	880	6,484	518	4,493	359	5,954	476	4,471	358	..	..
24th January to 2nd February	6,778	542	4,701	376	3,618	289	5,029	402	4,943	395	..	..
3rd February to 12th February.	9,639	771	4,677	374	3,933	315	4,211	337	4,681	374	..	..
13th February to 22nd February.	6,886	551	4,847	388	3,532	283	4,067	325	4,933	395	..	..
23rd February to 4th March	6,626	530	5,997	480	3,226	258	6,858	548	4,263	341	..	..
5th March to 14th March ..	9,927	794	9,528	762	3,226	258	6,416	513	4,511	361	..	..
15th March to 24th March ..	8,329	666	6,199	496	3,093	247	6,697	536	4,398	352	..	..
25th March to 31st March ..	9,655	772	7,146	572	3,312	265	9,875	790	4,165	333	..	..

B. DARLEY,
Chief Engineer, Bahawalpur Government

ANNEXURE D

STATEMENT SHOWING SUPPLIES WHICH COULD HAVE BEEN DRAWN OFF BY THE PANJNAD CANALS UNDER THE 1920 AGREEMENT FOR THE PAST 5 YEARS DURING THE KHARIF SEASON

Years	1929-30		1930-31		1931-32		1932-33		1933-34	
Months	Supply at Ferozepur	Supply which could have been drawn off by the Panjnad Canal under the 1920 Agreement	Supply at Ferozepur	Supply which could have been drawn off by the Panjnad Canal under the 1920 Agreement	Supply at Ferozepur	Supply which could have been drawn off by the Panjnad Canal under the 1920 Agreement	Supply at Ferozepur	Supply which could have been drawn off by the Panjnad Canal under the 1920 Agreement	Supply at Ferozepur	Supply which could have been drawn off by the Panjnad Canal under the 1920 Agreement
	Cusecs	Cusecs	Cusecs	Cusecs	Cusecs	Cusecs	Cusecs	Cusecs	Cusecs	Cusecs
April 1st to 10th	9,220	2,405	7,523	1,881	3,453	864	7,807	1,952	4,183	1,046
April 11th to 20th	15,652	3,913	6,976	1,744	3,218	804	7,570	1,892	5,028	1,257
April 21st to 30th	15,916	3,909	9,699	2,425	3,557	889	7,346	1,336	4,832	1,208
May 1st to 10th	17,721	4,430	10,110	2,527	3,480	870	8,783	2,196	4,833	1,208
May 11th to 20th	29,853	7,464	10,883	2,721	3,293	824	10,718	2,679	4,411	1,103
May 21st to 30th	20,446	5,111	9,020	2,255	4,437	1,109	12,854	3,213	4,778	1,194
May 31st to June 9th	28,388	7,097	9,027	2,257	9,235	2,309	27,352	6,838	9,016	2,254
June 10th to 19th	37,095	9,274	14,742	3,687	16,175	4,044	33,787	8,447	21,631	5,408
June 20th to 29th	41,619	Full Supply	26,500	6,625	19,546	4,886	69,788	Full Supply	44,619	Full Supply
June 30th to July 9th	103,026	Do.	34,462	8,615	16,319	4,080	83,917	Do.	1,06,207	Do.
July 10th to 19th	Ample	Supplies								
July 20th to 29th										
July 30th to August 8th										
August 9th to 18th										
August 19th to 26th										
August 27th to September 5th ..										
September 6th to 15th										
September 16th to 25th	35,598	8,899	32,228	8,057	30,690	7,672	80,427	Full Supply	23,484	5,871
September 26th to October 5th ..	18,028	4,507	27,427	6,856	27,977	6,994	47,233	Do.	17,932	4,490
October 6th to 15th	11,729	2,932	20,612	5,154	13,809	3,452	24,724	6,181	10,163	2,541

B. DARLEY,
Chief Engineer, Bahawalpur Government

ANNEXURE E

STATEMENT SHOWING THE AVERAGE DISCHARGE AT *SUKKUR* OVER 10 DAY PERIODS DURING THE PAST TWELVE YEARS

Months		Maximum requirements of Sukkur Canals	Average Discharges at Sukkur in cusecs over 10 day periods for the years											
			1921-22	1922-23	1923-24	1924-25	1925-26	1926-27	1927-28	1928-29	1929-30	1930-31	1931-32	1932-33	1933-34
September	1	45,761	347,800	415,600	477,500	487,900	253,500	457,700	302,000	366,700	639,300	321,300	343,300	293,900	488,036
	2		233,500	392,400	258,000	363,900	209,700	404,800	196,500	274,700	274,000	158,300	266,900	147,400	241,444
	3		195,000	354,300	147,800	212,600	126,700	212,400	133,000	140,600	151,000	149,100	138,600	100,500	229,035
October	1	27,121	1,05,600	1,64,500	94,000	1,36,500	97,300	1,25,600	83,700	89,000	1,04,900	91,900	94,500	*71,000	1,43,609
	2		76,700	98,200	70,300	97,900	62,800	86,700	64,100	65,300	82,900	70,000	91,300	*51,300	92,621
	3		74,100	69,100	60,800	76,900	53,000	85,900	50,100	53,500	69,400	58,800	77,000	*39,900	66,795
November	1	24,604	58,200	55,500	54,700	63,300	52,600	64,000	46,400	47,500	57,900	51,900	58,400	*33,000	53,351
	2		50,300	48,000	49,600	55,900	56,900	48,300	41,000	41,900	50,500	48,700	49,600	*29,800	45,044
	3		41,900	43,100	43,300	49,900	51,400	44,300	37,100	42,600	43,700	42,500	43,500	*24,100	39,822
December	1	26,714	37,600	40,500	38,100	44,600	44,700	40,600	34,100	41,700	40,000	37,200	39,500	30,386	36,244
	2		38,100	86,500	39,800	41,000	40,900	39,500	32,000	31,600	36,400	35,400	34,700	26,436	37,983
	3		59,600	37,700	43,200	43,400	37,900	43,400	32,000	43,900	40,700	34,300	31,600	26,982	31,104
January	1	23,802	56,600	36,900	38,500	42,500	35,000	35,800	31,800	39,300	37,100	32,000	31,400	26,386	30,636
	2		49,300	36,300	36,400	45,900	35,200	34,100	30,800	35,700	34,500	30,400	29,300	25,009	29,197
	3		42,600	38,000	33,000	43,500	34,000	36,900	30,300	33,200	45,600	30,100	31,100	26,615	27,888
February	1	25,339	38,600	42,900	31,500	43,000	31,600	31,300	28,100	35,600	43,800	36,500	23,100	22,308	25,698
	2		40,000	53,600	58,700	39,400	30,900	30,100	30,300	37,600	51,100	33,500	26,900	22,767	24,888
	3		44,700	65,400	46,900	37,000	30,000	29,000	47,100	36,500	38,100	30,000	23,500	20,993	24,548
March	1	25,339	49,400	84,400	39,300	38,100	28,000	36,600	42,800	32,400	44,300	28,300	23,900	21,070	23,065
	2		49,200	84,900	59,900	34,000	28,200	27,600	59,700	33,700	59,000	36,100	40,400	21,784	27,463
	3		41,400	63,600	58,900	32,600	60,800	29,100	47,600	38,100	79,100	33,300	44,000	35,360	30,033
April	1	30,871	62,100	81,500	68,400	35,700	42,700	31,600	64,100	59,800	1,03,200	40,100	42,500	48,910	23,837
	2		74,200	127,900	106,400	45,300	62,500	35,100	71,900	48,800	2,16,800	51,100	49,200	58,620	29,563
	3		82,900	121,300	110,200	47,300	70,600	50,300	142,900	65,200	156,000	64,100	51,700	52,224	44,962

*Does not include draw-off by Eastern Nara Canal.

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ANNEXURE F

STATEMENT SHOWING THE AMOUNT OF WATER REGENERATED BETWEEN THE HEAD OF THE HAVELI CANALS AT TRIMMU AND PANJNAD DURING THE PAST 5 YEARS. THE FIGURES INCLUDE THE SMALL DISCHARGE RECEIVED AT PANJNAD FROM THE SUTLEJ

Month	1928-29			1929-30			1930-31			1931-32			1932-33			1933-34		
	Trimmu	Panjnad	Regeneration	Trimmu	Panjnad	Regeneration	Trimmu	Panjand	Regeneration	Trimmu	Panjnad	Regeneration	Trimmu	Panjnad	Regeneration	Trimmu	Panjnad	Regeneration
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19
	Cusecs	Cusecs	Cusecs	Cusecs	Cusecs	Cusecs	Cusecs	Cusecs	Cusecs	Cusecs	Cusecs	Cusecs	Cusecs	Cusecs	Cusecs	Cusecs	Cusecs	Cusecs
October 16—20 ..	5,585	12,343	6,758	15,029	24,096	9,067	13,345	11,493	*	13,050	14,320	1,270	3,145	3,607	*462*	21,404	24,812	3,408
„ 21—31 ..	3,632	9,716	6,084	10,931	19,557	8,626	13,127	9,259	*	7,393	12,969	5,576	2,677	3,896	1,219	14,872	19,022	4,150
November 1—10 ..	3,001	6,904	3,903	9,423	15,775	6,352	20,570	9,874	*	3,340	7,613	4,273	2,070	4,553	2,483	8,212	11,946	3,734
„ 11—20 ..	2,332	5,754	3,422	6,074	12,621	6,547	6,124	9,572	3,448	2,507	5,358	2,851	1,748	3,254	1,506	4,011	8,921	4,910
„ 21—30 ..	2,125	5,117	2,992	4,648	9,949	5,301	2,184	6,589	4,405	2,411	4,213	1,802	1,508	2,878	1,370	3,713	6,442	2,729
December 1—10 ..	14,423	9,579	*	2,943	7,081	4,138	1,958	4,847	2,889	2,282	3,433	1,151	1,397	1,937	*540*	4,190	6,440	2,250
„ 11—20 ..	9,822	15,728	5,906	4,767	5,318	*551*	1,769	4,302	2,533	1,882	2,841	*959*	1,150	2,388	1,238	3,350	5,997	2,647
„ 21—31 ..	4,289	8,996	4,707	4,030	7,968	3,938	1,584	3,783	2,199	1,643	2,539	*896*	1,144	2,783	1,639	3,425	4,993	1,568
January 1—10 ..	3,614	6,235	2,621	4,641	7,028	2,387	1,781	3,911	2,130	1,552	3,302	1,750	1,295	2,825	1,530	3,434	4.413	*979*
„ 11—20 ..	2,540	6,037	3,497	11,844	9,769	*	2,302	4,265	1,963	5,068	3,906	*	1,037	2,407	1,370	3,192	5,418	2,226
„ 21—31 ..	5,428	7,902	2,474	10,214	19,224	9,010	8,126	4,153	*	2,464	4,645	2,181	1,294	2,171	*877*	2,034	4,611	2,577
February 1—10 ..	10,111	13,721†	3,610	15,823	21,924	6,101	6,613	8,227	1,614	1,751	4,325	2,574	1,041	2,202	1,162	1,788	3,028	1,240
„ 11—20 ..	8,119	11,808	3,689	8,021	15,860	7,839	3,387	5,496	2,109	3,174	3,983	*809*	882	1,978	1,096	1,485	3,071	1,586
„ 21—28/29	4,794	8,121	3,327	6,163	7,866	1,703	3,038	4,183	1,145	3,375	4,491	1,116	873	1,827	*954*	1,687	2,770	1,083
March 1—10 ..	6,852	6,670	*	17,603	15,097	*	13,171	5,444	*	1,857	3,951	2,094	2,099	1,789	.	2,022	2,452	*430*
„ 11—20 ..	10,552	9,908	*	28,696	26,260	*	11,004	12,681	1,677	11,022	4,832	*	9,315	4,925	*	5,671	3,408	*
„ 21—31 ..	16,989	15,729	*	42,485	44,493	2,008	11,696	8,408	*	10,307	9,416	*	19,679	11,206	*	2,238	5,438	3,200
April 1—10 ..	15,562	20,154	4,592	55,418	56,667	1,249	21,125	16,208	*	15,540	12,551	*	18,672	15,084	*	4,191	3,340	*
„ 11—20 ..	23,236	22,770	*	– 71,560	105,565	34,005	31,733	22,978	*	16,634	14,393	*	28,052	19,422	*	13,785	5,611	*

Remarks :—

*When there is a sudden rise in the river at Trimmu, there is a lag at Panjnad. During all the periods marked * there would have been ample water for all canals.

†Had the Haveli Canal been in operation and had it drawn off *all* the water passing Trimmu, there would still have been ample water for the Abbasia Canal in all periods except those in italics. The Abbasia full supply is *1,032 Cusecs*, and so the shortage, even in those periods would not have been marked.

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ANNEXURE G.

Discharges of Panjnad River during early and late Kharif period during the past 4 years

Period.	1931.	1932.	1933.	1934.	Remarks.
April 1—10 ..	16,208	12,722	15,244	3,340	These figures for 1932-33 were taken from the Indus Bulletin from which a few days here and there were missing and the average of the remainder had to be taken. They are therefore subject to slight correction.
April 11—20 ..	22,976	17,788	19,430	5,611	
April 21—30 ..	31,460	17,038	22,990	13,939	
May 1—10 ..	34,097	16,390	22,320	20,428	
May 11—20 ..	44,522	19,814	33,922	14,799	
May 21—30 ..	41,863	18,289	36,911	12,946	
May 31—June 9 ..	41,472	32,343	53,370	22,463	
September 21—30 ..	51,665	15,138	105,180	24,182	
October 1—10 ..	25,701	6,729	54,430	15,996	
October 11—20 ..	17,329	1,860	23,420	9,168	
October 21—31 ..	12,969	3,936	14,900	6,630	

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NOTE—*Reference is invited to Appendix IV pp. 102 for revised figures supplied later by Mr. Gunn, Punjab.*

BIKANER STATE BRIEF.

Sanctity of agreements.

1. An agreement when once signed must be executed. If in the course of execution it becomes evident that some of the clauses of the agreement are capable of improvement or bear unfairly on one or other of the parties to the agreement, then it is possible to re-examine the agreement and by mutual assent between the parties to adjust its defects. In agreements affecting more than two parties, it is not permissible for two of the parties mutually to adjust those portions of the agreement which they find inconvenient and ignore the claims of the remaining parties to a simultaneous amelioration of the defects which affect the latter. Nor is it permissible for two of the contracting parties to make a supplementary or subsequent agreement, any of the clauses of which override or negative any of the clauses of the original agreement. In other words an agreement is sacred until altered by the unanimous consent of all the contracting parties.

2. The Sutlej Valley Agreement of the 4th September 1920 is a tripartite agreement. The Bikaner Government hold that modifications of it should include the removal of defects experienced by any of the partners, and fear that without this comprehensive modification it will not be possible to obtain that mutual assent of the partners which is essential for the alteration of the Agreement.

Rights of Usage of Water

3. At this juncture it would be timely to state the position with regard to the uses of water for irrigation. By Indian practice non-riparian owners of land have exercised from time immemorial equal rights of irrigation with the riparian owners :—

e.g. (*a*) The irrigation from hill streams is not confined to lands contiguous with the stream but is shared by all lands within a convenient distance.

(*b*) The Shahpur private canals in the Punjab irrigate the lands of non-riparian owners and in some cases the canal is owned and controlled by an owner who has no river frontage.

That this practice was also extended to cover non-riparian States as distinct from individual owners is evident from the irrigation given by Moghal Rulers from the Western Jumna to the non-riparian States of Bikaner and Jind.

During recent times their British successors have continued the same practice :—

(*a*) When the Western Jumna was re-opened in about 1825 a supply was given to the non-riparian States of Bikaner and Jind.

(*b*) In 1865 the Government of India returned unsanctioned an early project for the Sirhind Canal, and issued orders for the preparation of a revised project. They directed that the only project they would entertain would be the best that could be devised irrespective of the territorial boundaries of British and Indian States.

(*c*) In Despatch No. 76 of 30th September 1870, the Secretary of State in sanctioning the Sirhind Canal project added—

"The just and liberal view that you have taken with reference to the benefit to be derived from the Canal Works by Native States is undoubtedly correct in principle. The scheme will be the best that can be devised irrespective of territorial boundaries as was urged by the late Colonel Dyas."

(*d*) When the Sirsa Branch of the Western Jumna Canal was built in about 1895, a supply was given to the non-riparian State of Patiala.

5. It will be observed from these many instances extending over three-quarters of a century that it has been accepted as an axiom that waters made availabe for irrigation should be utilized in the best interests of the public irrespective of territorial boundaries, and irrespective also of whether the State owning the land to be irrigated did or did not possess a frontage on the river from which the supplies were drawn. The correctness of this practice is confirmed independently by modern American irrigational practice which endeavours, whether as between States or individuals, to secure the utilization of available water resources for the benefit of the largest number within the zone of economic command.

Distribution of Sutlej Supplies.

6. At the Conference held at Delhi on 16th, 17th and 18th October 1918, between the representatives of the Punjab, Bahawalpur and Bikaner to arrive at an agreement on the distribution of Sutlej supplies, the following basic principle which had been suggested by the Chairman, Sir Claude Hill, representing the Government of India, was accepted after amendment to incorporate the wishes of the Bahawalpur Representatives. The basic principle reads :—

"That in considering the method of disposing of the waters made available for irrigation by the Sutlej Valley Project, the general principle is recognised that these waters should be distributed in the best interests of the public at large, irrespective of Provincial or State boundaries, subject always to the proviso that established rights are fully safeguarded or compensated for, and that full and prior recognition is given to the claims of riparian owners, and that their rights in the existing supplies or in any supplies which may hereafter be made available in the Sutlej river below the junction of the Beas and Upper Sutlej are fully investigated and are limited only by the economic factor."

7. Since the Sutlej Valley Project Agreement of 1920 is under review, the Bikaner State claims a re-distribution of the waters available on the Gharra reach of the Sutlej on two grounds :—

(*a*) The areas suitable for irrigation and fit for cultivation (*i. e.*, Culturable Commanded Areas) bear no relation whatever to the Gross Areas on which the supplies in the river were shared. It follows from the principle of limitation by the economic factor that an acre of sand-hill perched 20 feet above the surrounding country side, or an acre of salt impregnated indurated clay on which no vegetation will grow, can have no title to water. Hence the only correct basis for sharing water must be the culturable commanded area.

(*b*) If the present disproportionate shares of the river are allowed to remain, the supply allowed to the Bahawalpur partner is so generous relative to his Culturable Commanded Area that water will be used uneconomically and wastefully, thus again infringing principle of the economic factor.

8. The areas on the Sutlej Valley Project have been carefully surveyed as to command and qualities of soil, and it is now practicable to restate the basic principle more correctly in the following terms :—

"The waters made available for irrigation by the Sutlej Valley Project should be distributed in the best interests of the public at large, irrespective of Provincial or State Boundaries. All culturable commanded area within the perennial zones shall share the available supplies rateably during the Rabi. All culturable commanded area whether in the perennial or non-perennial zones shall share the available supplies during Kharif in amounts which are judged suitable for these two different classes of canal, but all culturable commanded area within one class will be treated uniformly."

9. An agreement between parties whose claims are as conflicting and as hotly contested as were those of the Province of the Punjab and the States of Bahawalpur and Bikaner must always be in the nature of a compromise. While accepting this, it is desirable to bring on record that the Bikaner State desired to have the weir, corresponding to the present Ferozepore Weir, situated at Harike just below the confluence of the Sutlej and Beas. From a weir at this site it would have been possible to command the entire block of land in the State which lies North of the Ghaggar, and would have rendered unnecessary, as far as Bikaner is concerned participation in another weir to utilize any water rendered available by the Bhakra Dam Storage Scheme. Also as the Ghaggar bed forms on the left bank the natural limit for irrigation, all Bikaner land commanded from Harike and lying North of the Ghaggar would have been entitled to contend on equal terms with similar areas belonging to the other parties for the waters of the Sutlej *cum* Beas available for distribution in 1920 and on which the present project is based. The Sutlej Valley Project is now a *fait accompli* as far as weir construction is concerned, but the effect of placing the weir at Ferozepur instead of at Harike has been to exclude very large areas of Bikaner land from laying claim to Sutlej Valley Project supplies.

Limits of Irrigation.

10. With the uppermost weir at Ferozepore and with a weir constructed at Panjnad below the confluence of the Chenab and Sutlej, the area dependent on Sutlej water is that lying between the limits of command from these two weirs.

The irrigation boundary to the North is formed by the Sukh Beas a well defined drainage beyond which lie the lands already irrigated by the Upper and Lower Bari Doab Canals, and by the Sidhnai and Multan Inundation Canals.

To the South the irrigation boundary is the dry bed of the Ghaggar or Hakra, which now for obscure reasons is a poor non-perennial stream. South of the Ghaggar the land rises eventually to the low rolling hills of Rajputana and irrigation becomes physically impossible.

11. The area lying within the irrigation boundaries mentioned in the previous paragraph is divisible into two classes of land :—

(*a*) The low-lying or Khadir land adjacent to the river.

(*b*) The Bar or Higher Lands in the interior.

In the Khadir areas spring level is high, and, in consequence, owing to the dangers of waterlogging, irrigation must be restricted.

In the Bar the sub-soil water level is found at great depths and these restrictions do not apply.

12. This natural division has forced the framers of the project to provide two classes of canals. The perennial canals flow all the year round for the Bar lands and the non-perennial canals flow from 1st April to 15th October when supplies permit for the Khadir areas.

At the time of preparation of the project the boundary between the Perennial and the Non-Perennial areas was fixed on the plans, and the areas thus fixed formed the basis of the 1920 agreement. It will be shown later how they have since been departed from in an unauthorized manner.

Economic Interdependence of Partners and Canals.

13. The Khadir lands were for the most parts proprietary and had already provided with a means of irrigation by inundation canals. These channels could only flow when the river levels permitted and the supply was subject to interruption for various reasons. They could not of themselves be improved by the provision of weirs as the cost would have been prohibitive. But they had established rights of usage of water in the kharif seasons.

14. On the other hand the perennial canals commanded large areas of crown waste which could be sold to defray the costs of construction and so were economically attractive. But before they could be constructed it was necessary to ensure that there should be no interference with the existing rights of the non-perennials. In short the perennial canals made financially possible the construction of the weirs which secured the established rights of the non-perennial areas and proivded facilities for their improvement.

In the same way the interests of the three partners were interlocked and without the co-operation of all three, development wold not have been possible.

1920 Agreement Provisions.

15. The agreement of 1920 provided for the irrigation of the following areas with the intensities shown against each :—

Partner.	Gross Area.	Intensity.	Proposed Annual Irrigation.
British Perennial	900,000	55·7	501,300
British Non-Perennial	2,880,846	50	1,440,423
Bahawalpur Perennial	1,730,000	62·6	1,082,980
Bahawalpur Non-Perennial	1,272,216	50	636,108
Bikaner	500,000	62·6	313,000

Divergences from the Agreement.

16. Construction had not proceeded very far when it was found that the perennially commanded areas in Bahawalpur State were short of the areas claimed by the State and on which the Agreement of 1920 was based. In order to raise the revenue to that anticipated in the Project Estimate the area on the Eastern Sadiquia Perennial Canal was increased by the transfer of 103,915 acres from the Fordwah Non-Perennial Canal. This is a distinct breach of the Agreement, which stipulated the areas of each class of land and fixed the intensities for that class.

17. The agreement further laid down :—

> "The average perennial supply available will be allotted entirely to the perennial channels from 15th October up to 31st March and the non-perennial channels will be shut down on 15th October."

If therefore, as was the case, the limits of the non-perennial channels were defined, and it was agreed that those channels should be closed from 15th October to 31st March, then it is clear that the non-perennial areas were not intended to receive water between those dates. To transfer them, therefore, to a perennial canal is a breach of the Agreement. The Bikaner State urges that this land be returned to its proper class and that if as is believed to be the case the transfer of further large blocks of non-perennial land on the Sutlej to perennial canals is contemplated, such transfer should be stopped or if already carried out the process be reversed.

18. Further it is a matter of common knowledge that large areas of the commanded land in Bahawalpur have proved quite unfit for cultivation and that in fact the channels on these lands have been abandoned. This was very frankly admitted by the Hon'ble the Finance Member for the Government of India in his speech of 29th March 1934 in the Legislative Assembly. He there stated—

> "The main cause of the loss of money in connection with this project is the fact that the Bahawalpur State, in order to secure to itself a large share of the waters of the Sutlej, and in order to prevent rivals—either another Indian State or the Punjab Government—from claiming a larger share of those waters, grossly overstated the area which was fit for irrigation and cultivation. They always maintained that they had an area fit for irrigation and cultivation of over two million acres. That was their statement and they refused to consider any plan which did not include the canalisation of the whole of that area and the allocation of water sufficient for that area. One of the reasons why the scheme has gone wrong is that it has now been established that not more than a maximum of about 900,000 acres is really fit for cultivation, and a great part even of that is of very doubtful value at the present level of prices."

19. The Bikaner State has pointed out the deficiency of irrigable land in Bahawalpur on more occasions than one and now insists that the latest correct figures of culturable commanded area be placed before the Committee, and that on these areas the Agreement be revised.

In order to give the Committee some idea of the magnitude and importance of these issues the following figures are given. The Bikaner State understands that if unculturable lands are rejected and the non-perennial areas restored to their correct status, the areas which would be found to be entitled to perennial water during rabi are—

Punjab	800,000	acres.
Bahawalpur	900,000	acres.
Bikaner	650,000	acres.
	2,350,000	acres.

20. Except for their own area Bikaner State cannot guarantee the accuracy of the figures but believes that they are a very close approximation to the truth. They may be compared with the 1920 figures :—

Punjab	900,000 acres.
Bahawalpur	1,730,000 acres.
Bikaner	500,000 acres.
	3,130,000 acres.

Revised Requirements.

21. On these reduced figures accepting the project data of—

Rabi duty at distributary head	.. = 210 acres per cusec.
Absorption Main Canal and Branches	.. = 20 per cent.
Mean Rabi Supply	.. = 6,500 cusecs.

it would possible to provide a rabi intensity of 48·4 per cent, say 48 per cent on the culturable commanded areas actually available if the water were spread uniformly and so used with maximum efficiency.

Assuming a 48 per cent rabi intensity, with a 210 acre duty, *plus* 20 per cent absorption allowance, the mean discharges required for the canals would be—

Punjab (Pakpattan)	1,829+366=2,195 cusecs.
Bahawalpur	2,057+411=2,468 cusecs.
Bikaner	1,486+297=1,783 cusecs.
	5,372+1,074=6,644 cusecs.

The existing channels have been designed with maximum authorized supplies of 3,440, 7,416 and 2,144 respectively and are intended to run in rabi with a capacity factor of 0·5 and mean discharges of 1,720, 3,708 and 1,072 cusecs respectively.

22. In considering the re-organisation which is required in kharif the situation depends upon 4 factors :—

(*a*) The shortage in perennial culturable commanded areas already mentioned.

(*b*) A less pronounced shortage in non-perennial areas.

(*c*) There is a decided shortage in available average supplies in kharif as compared with supplies anticipated in the project.

(*d*) There are enormous fluctuations in the early kharif supply, some years being so very much below average as to demand special consideration.

23. As on the reduced culturable commanded areas actually available the rabi supplies, which approximate closely enough to the anticipated project supply of 6,500 cusecs, are sufficient to give a rabi intensity of 48 per cent, and as the early kharif supplies are admittedly short, it may be advisable to work to a smaller kharif-rabi ratio than the 1 to 1½ that was assumed in the project. If we assume a ratio of 1 to 2 then—

Kharif Intensity	= 24% of C.C.A.
Rabi Intensity	= 48% of C.A.A.
Annual Intensity	= 72% of C.C.A.

The required Perennial Kharif Irrigation becomes—

Punjab	192,000 acres.
Bahawalpur	216,000 acres.
Bikaner	156,000 acres.
	564,000 acres.

24. If we retain the Project kharif full supply factor of 70, the discharge required for the perennial canals becomes—

Punjab	2,746+549=3,295 cusecs.
Bahawalpur	3,086+617=3,703 cusecs.
Bikaner	2,229+446=2,675 cusecs.
	8,061+1,612=9,673 cusecs.

The Project provided for the following non-perennial gross areas, giving to them an intensity of 50 per cent with a crop ratio of 1 : 1—

Punjab	2,880,846 acres.
Bahawalpur	1,272,216 acres.
Bikaner	*Nil.*
	4,153,062 acres.

25. In arriving at these areas the boundary lines between the Punjab and Bahawalpur Canals were taken at the centre of the river, thus including not only the river itself, but also the Sailab lands bordering on it, which being regularly inundated, it is not necessary to irrigate. The Sailab areas accounted to—

Punjab	219,434 acres.
Bahawalpur	195,582 acres.

When the 1926 Revised Project was being prepared these areas were excluded, but the shares of the river were retained and used to increase the intensities on the balance areas. This again is a breach of the Agreement.

26. Then there are on the non-perennials areas which have proved to be unirrigable whether on account of the quality of the soil or on account of the dangers of waterlogging, which has already materialised and is likely to extend.

27. The Bikaner State would insist that the figures of culturable commanded area after excluding Sailab areas, and all bad land, and land already waterlogged or liable to waterlogging should be produced and should form the basis for a correct re-distribution of the waters of the river during kharif. If this is done the reduced areas of non-perennial culturable commanded land would approximately amount to—

Punjab	2,400,000 acres.
Bahawalpur	900,000 acres. 100,000 acres reverted from perennial.

28. Now the 1920 Agreement and Project provided an intensity of 50 per cent on the gross areas and a discharge at distributary head of 5 cusecs per ‰ acres gross. The channels have been designed and built to give a supply of 6 cusecs per 1,000 acres C. C. A. at distributary head and this is certainly ample for the requirements even of non-perennial channels. Allowing these data to stand the discharge required for the non-perennial canals running at full supply becomes :—

Punjab	14,400+2,880=17,280 cusecs.
Bahawalpur	6,000+1,200=7,200 cusecs.

The share capacities up to which the perennials and non-perennials share equally are 2/3 of these figures—

Punjab	11,520 cusecs.
Bahawalpur	4,800 cusecs.

The total draw-off from the river up to share capacity—

	Perennial.	*Non-Perennial.*	*Total.*
Punjab	3,295	11,520	=14,815
Bahawalpur	3,703	4,800	=8,503
Bikaner	2,675	..	=2,675
	9,673	16,320	=25,993

29. If therefore the culturable commanded areas prove to be—

Punjab	Perennial =	800,000 acres.
	Non-Perennial =	2,400,000 acres.
Bahawalpur	Perennial =	900,000 acres.
	Non-Perennial =	1,000,000 acres.
Bikaner	Perennial =	650,000 acres.

the relative shares of the river and the mean supplies required in the canals should be :—

Crop.	Partner.	Discharge Mean for Crop.	Share of River.
Rabi	Punjab	2,195	34
	Bahawalpur	2,468	38
	Bikaner	1,783	28
	Total	6,446	100
Kharif	Punjab Perennial	3,295	12·7
	Punjab Non-Perennial	11,520	44·3
	Bahawalpur Perennial	3,703	14·2
	Bahawalpur Non-Perennial	4,800	18·5
	Bikaner	2,675	10·3
	Total Perennial	9,673	37·2
	Total Non-Perennial	16,320	62·8
	GRAND TOTAL (SHARE)	25,993	100

The perennial canal head capacities per thousand acres culturable commanded areas are illuminating. Taking the existing capacities of the canals and the above culturable commanded areas, the capacities are :—

Punjab	4·30 cusecs.
Bahawalpur	8·24 cusecs.
Bikaner	3·30 cusecs.

Priority to Perennial Canals

30. Now the average river supplies above Ferozepore in April, May and June are shown at page 73 and from these must be deducted absorption in the river between Ferozepore and Islam at say 20 per cent to get the figure available for distribution :—

April	5,852
May	9,454
June	22,220

From these figures it is obvious that in average years, and even with the shares of each canal adjusted in accordance with the reduced areas, the canals can only expect to flow for a very short time during April and May.

But, there are large variations from the normal, particularly in May. In 1932 and 1934 for instance the supplies above Ferozepore did not exceed 5,000 cusecs until the beginning of June.

31. When such conditions occur, a very serious situation arises on the perennial canals which have no alternative source of supply even for drinking water. The non-perennial canals are in theory entitled to share equally with the perennials from 1st April to 15th October except when there is surplus water in the rivers when they may draw up to 50 per cent in excess of their share capacity. Now the non-perennial areas are provided with wells and have a high spring level and can in consequence face shortages which would wreck a perennial canal

colony. Also perennial irrigation is more profitable to the State than non-perennial irrigation. Consequently the British and Bahawalpur partners, who alone have non-perennial canals, have in practice fed their perennials at the expense of their non-perennials, and have granted the Bikaner Canal an excess above its share when the river supplies are short. It would be as well to codify this practice.

Now though it is not an excessive amount as compared with other canal systems, where kharif supplies are more bountiful we may take $\frac{1}{3}$rd the distributary discharge *plus* half of the full absorption as minimum amount which will keep a perennial colony area in existence. This comes to—

Punjab	915+275=1,190
Bahawalpur	1,027+309=1,336
Bikaner	743+223=966
	2,685+807+3,492 cusecs.

Proposals

32. It is urged that a solution of the difficulties will be that until the river supplies available for distribution exceed this figure the non-perennial canals will not open. Above this the non-perennials take all the discharges until they reach their equivalent supply of $\frac{1}{3}$rd distributary share capacity *plus* half absorption. After this the two classes of canal should share equally until full capacity of the perennials and share capacity of the non-perennials is reached. Then the non-perennials may draw off to their maximum capacity.

33. The net result of these proposals in kharif is best exhibited by the table below :—

Canal.	Month.	Mean Daily Supply	
		As at present 44·2%	As proposed 37·2%
Perennial	April	2,587	3,492
	May	4,179	3,517
	June	9,821	8,266
	Total ..	16,587	15,275
Non-Perennial	April	3,265	2,360
	May	5,275	5,937
	June	12,399	13,954
	Total ..	20,939	22,251

That is, the perennials surrender an average daily supply of 146 cusecs during April, May and June of an average year and obtain a priority which will be of great advantage to them in lean years.

Supplies available for Canals

34. The supplies reaching Ferozepore and available for distribution after all the necessary adjustments for inevitable losses, absorption and regeneration are made, are shown in Annexures A, B, C and D. They are based on the average of 15 years ending 1934. From these it will be seen that the following supplies are available for the perennial canals, which under the present agreement are entitled to the whole supply from 16th October to 31st March and to $\frac{13,000}{29,21}$ *i.e.*, 44·2% of the supplies during the remainder of the year.

These amount to :

	Month	Whole Supply	Share of Perennials	Share of Non-Perennials
Kharif	April	5,852	2,587	3,265
	May	9,454	4,179	5,277
	June	2,220	9,281	12,399
	July to 25th September	Full supplies available		
	26·9—5·10	26,520	11,722	14,798
	6·10—15·10	19,435	8,590	10,845
Rabi	.. ..	6,666	6,666	*Nil*

35. The details of the perennial rabi supply are shown below for ready reference, the rabi period for perennials being assumed to commence on 1st October :—

1·10—5·10	11722×5=58610
6·10—15·10	8590×10=85900
16·10—31·12 (*Vide* Annexure C)	=550053
1·1—31·3 (*Vide* Annexure D)	=518602
Total	1213165
Mean Daily Supply Rabi	6671 cusecs.

36. During kharif the supplies which will be actually utilized are more difficult to forecast as even though ample supplies are available in the river it is not usual for canals to run to full capacity owing to lack of demand. In this we can only be guided by experience.

Annexure E gives for four important canals the monthly capacities utilized during the four years ending 1931-32.

The results are abstracted below :—

Canal	April	May	June	July	August	September
Lower Bari Doab ..	·47	·90	·91	·66	·80	·84
Lower Chenab	·77	·93	·88	·79	·86	·81
Lower Jhelum	·68	·71	·84	·69	·90	·80
Sirhind	·60	·83	·82	·55	·77	·79
Average ..	·65	·84	·86	·63	·82	·81
S. V. P. Perennials ..	·19	·30	·70	?	?	?

37. On the Sutlej Valley Project the paucity of supplies during the early kharif determines the low capacity factors in April, May and June. In consequence it is probable that a capacity factor of ·8 will rule during July. It is likely that a capacity factor of ·85 will be obtained in August and September, but conservatively a factor of ·80 is assumed in the following calculations. The discharges utilized thus become on present distribution and capacities :—

April	2,587	Average actuals available in river.
May	4,179	
June	9,281	
July	10,400	Capacity factor of 0·80 on 13,000 cusecs.
August	10,400	
September	10,400	

	Cusecs.
which give an average daily supply of	7,938
Rabi actual supply for Perennials=	6,671
Kharif actual supply for Perennials=	7,938

Effect of Rainfall on Duties

38. It has frequently been urged in the past that owing to the poor rainsfall of the S. V. P. perennials the duties to be adopted will be less than on other Punjab Canals. Annexure F shows the rainfall experienced on the S. V. P. perennial areas during the four years ending 1931-32.

The averages are abstracted below :—

			Inches.
Pakpattan	..	Punjab	9·07
E. Sadiquia	..	Bahawalpur	9·24
Bahawal	..	Bahawalpur	6·55
Gang	..	Bikaner	9·77

It should be recollected that approximately 7/9 of the Bahawalpur perennial area is on the E. Sadiquia and lies in the 9″ to 10″ zone of rainfall.

39. Accordingly statistics of irrigation in tracts lying around these limits of rainfall for the four years ending 1931-32 were examined. They are tabulated in Annexure G. Examination of the figures will show that there is certainly no obvious relationship between the rainfall for any particular tract and the duties whether in kharif or rabi, and that areas with much the same rainfall have widely differing duties. There is therefore no case for differentiating between different areas of the S. V. P. on account of variation in rainfall, though as the Bahawal Canal area is such a relatively small one and as this area is the only one where the rainfall differed markedly from the other tracts, any such differential treatment would not greatly affect the results.

Absorption Allowances

40. From time to time it has been stated that as the irrigation of the S. V. P. perennials is at a greater distance from the Headworks the absorption allowances should be increased. The correctness of this proposition is on the face of it untenable as the four weirs on the project were introduced largely to obviate this possibility. However the centres of irrigation of each system were approximately determined and the distance from the headworks scaled off with the following results :—

	Miles.
Lower Jhelum	75
Lower Bari Doab	68
Lower Chenab	90
Sirhind	87
E. Sadiquia	75
Bahawal	75
Pakpattan	88
Bikaner	105

It is clear that on the score of length no additional absorption is required than for any other canal system, except possibly on the Bikaner Canal.

The actual absorption in main canals and branches on most Canals runs at about 10% so that we shall be amply safe in assuming an absorption of 20% in the following calculations.

Probable Irrigation with Supplies Available

41. We may now consider the areas which can be cultivated on the supply available—

(*a*) With the present distribution of river supplies.

(*b*) With the distribution proposed in the preceding paras.

The irrigation duties from Annexure G are abstracted below by canals :—

Canal	Kharif Duty.	Rabi Duty.
Western Jumna Canal (Dry Tract)	157	213
Sirhind Canal	168	241
Lower Jhelum Canal	153	233
Lower Chenab Canal	132	256
Lower Bari Doab	113	189

It will be seen that the Lower Bari Doab Canal has by far the lowest duties of the series. If then we base the expected irrigation of the S. V. P. perennial canals on the actuals of L. B. D. C. figures we shall have adopted the most conservative basis that can reasonably be expected. Now the table below shows the discharges utilized at Canal head of the L. B. D. C. and the irrigation obtained :—

Year	Mean Supply		Irrigation	
	Kharif	Rabi	Kharif	Rabi
1928-29	5,197	3,963	5,66,000	6,96,858
1929-30	5,172	4,202	5,54,503	7,12,483
1930-31	5,205	3,891	5,42,248	6,96,128
1931-32	5,605	3,990	5,17,001	6,80,345
Mean	5,295	4,012	5,44,938	6,96,454

42. The mean S. V. P. perennial supply during kharif is 7,938 cusecs and if the S. V. P. perennials only work up to the relatively low standard of the L. B. D. C. the irrigation which will be obtained is

$$\frac{38}{5295} \times 544{,}938 \;..\;..\;..\;.. = 816{,}944 \text{ acres.}$$

The mean S. V. P. rabi supply is 6,671 cusecs so that S. V. P. rabi irrigation obtainable is

$$\frac{\quad}{4012} \times 696{,}454 \;..\;..\;..\;.. = 1{,}158{,}037 \text{ acres}$$

43. The present shares of the partners in the river supplies (perennial canals) are 26·5, 57, 16·5 for the Punjab, Bahawalpur and Bikaner respectively. The averages obtainable work out as under :—

Partner	Irrigation			Actual C. C. A.	Actual Intensity
	Rabi	Kharif	Total		
Punjab	3,06,880	2,16,490	5,23,370	8,00,000	65
Bahawalpur	6,60,081	4,65,658	11,25,739	9,00,000	125
Bikaner	1,91,076	1,34,796	3,25,872	6,50,000	50

It will be seen that the Bahawalpur Partner is allowed under the present agreement a supply of water which, if utilized with the minimum efficiency of any of the Punjab perennial canals in dry tracts, will suffice to provide him with an intensity of 125% on the actual culturable commanded area which he has and to which he is entitled. Such a high intensity is of course impracticable even with a very high class of cultivator, and if the present agreement shares are permitted to stand, the duties in Bahawalpur will never reach those which should be obtained, and the precious supplies of the Sutlej will be wasted.

44. We may now consider the irrigation with the distribution proposed in the preceding paragraph. The kharif supplies will be :—

Month	Whole supply	Share of Perennials	Share of Non-Perennials.
April	5852	3492	2360
May	9454	3517	5937
June	22220	8266	13954
July	..	8606	19854
August	..	8606	19854
September	..	8606	19854
Mean		6904	13661

The total capacity of the perennials having been reduced a higher capacity factor during July, August and September is likely and ·9 is used for the perennial and ·80 as before for the non-perennial

Kharif Supply Perennial .. 6904 cusecs

Kharif Irrigation Perennial .. $\frac{6904}{5295} \times 544938 = 715{,}030$ acres.

i.e., the total kharif irrigation on the perennials would decrease but owing to the greater security of supply in April, May and June a greater proportion of the more valuable crops would be sown. Owing to the reduced capacity proposed for kharif (9,673 cusecs) the rabi supply is reduced by 98 cusecs to 6,671—98= 6,573 cusecs. It is of course presumed that the channels will be remodelled to take the reduced kharif supply.

45. The rabi irrigation with 6,573 cusecs would be

$\frac{6573}{4012} \times 696454 = 1{,}141{,}025$ acres.

Annual Irrigation .. = 1,856,055 acres.

intensity $\frac{1835808}{2350000} = 79\%$ (all partners).

46. As a further check on the adequacy of the proposals we may compare the distributary capacity allowance per $^0/_{00}$ acres with that of other channels.

S. V. P.	$\frac{8061}{2350}$ .. 3·43 (Now proposed).
Sirhind Canal	.. 2·36
Lower Jhelum Canal	.. 2·70
Hansi Branch, Western Jumna Canal ..	.. 3·42
Sirsa Branch, Western Jumna Canal ..	.. 2·27
Lower Bari Doab Canal—	
(*a*) Montgomery	.. 4·02
(*b*) Multan	.. 4·51
Lower Chenab Canal—	
(*a*) Rakh Branch	.. 3·35
(*b*) Lower Gugera	.. 3·73
(*c*) Burala Branch (P)	.. 3·20
(*d*) Jhang Division	.. 3·10

47. The water utilized at distributary head on these channels per thousand acres C.C.A. on the average of the 4 years ending 1931-32 is:—

	Kharif	*Rabi*	*Intensity*
Sirhind canal	1·75	1·38	63
Lower Jhelum Canal	2·01	1·95	71
Lower Bari Doab Canal	3·08	2·33	82·5
Western Jumna Canal—			
(*a*) Hansi Branch	2·16	1·38	62
(*b*) Sirsa Branch	1·36	0·93	40
Lower Chenab Canal—			
(*a*) Rakh Branch	2·87	2·59	109
(*b*) Lower Gugera Branch	1·05	2·76	110
(*c*) Burala Branch (P)	2·74	2·12	100
(*d*) Jhang Division	2·67	2·23	86
S.V.P. Perennials (proposed)	2·40	2·33	78

Financial Implication of the Proposals

48. Under the agreement the partners contribute towards the cost of the headworks in which they are interested in the ratio of the share capacities of their canals. One cusec non-perennial capacity is taken as equivalent to $\frac{3}{4}$ of a cusec for perennial capacity. The cost of the Suleimanke and Islam headworks are approximately 200 lacs each and that of the Ferozepore headworks is 180 lacs.

The presnt approximate cost of the headworks to each partner is:—

Punjab ..	(1) Ferozepore ..	71 % of 180 = 128 lacs.
	(2) Suleimanke ..	39 % of 200 = 78 lacs.
	(3) Islam ..	37 % of 200 = 74 lacs.
		Rs. 280 lacs.
Bahawalpur ..	(1) Suleimanke ..	61 % of 200 = 122 lacs.
	(2) Islam ..	63 % of 200 = 126 lacs.
		Rs. 248 lacs.
Bikaner ..	(1) Ferozepore ..	29 % of 180 = Rs. 52 lacs.

49. With a change in the maximum capacities of the canals there will of necessity be financial re-adjustment in the share of the cost of the headworks which each partner will pay. We may for the purpose of these calculations take the equivalent capacity of a perennial canal as twice the rabi mean supply as

was taken in the Agreement, the ratio of the value of 1 cusec non-perennial to 1 cusecs perennial remaining at 3/4.

Capacity.

Partner	Rabi Mean Supply	Equivalent Rabi Capacity	N.P. Share Cap city	Equivalent N.P. Capacity	Total equivalent Capacity	Share of cost in lacs.
Ferozepore Weir						
Bikaner	1783	3566	..	..	3566	71
Punjab	..	..	6847	5135	5135	106
Suleimanke and Islam Weirs						
Punjab	2 95	4390	4649	3487	7877	191
Bahawalpur	2468	4936	4526	3695	8631	209

NOTE:—(1) N. P. Share capacity as per 1926 Project = 16421
" " " " present proposal = 16320
This small difference is neglected in the present calculations.
(2) Rabi Equivalent Capacity = 2 × Rabi Mean Supply.
(3) Kharif " " = ¾ × Kharif Share Capacity.

It will be observed that if Bahawalpur surrenders the excess share of water above its economic requirements its bill for the cost of the headworks will be reduced by 39 lacs of rupees.

Further, the share of the annual cost of maintenance of the headworks is proportional to the share of the capital cost. Figures are not available of the shares of annual charges, but assuming as is probable that these charges would result in a saving on works and establishment of 1 lac to Bahawalpur, this sum capitalized at 3½% is equivalent to a capitalized saving of 29 lacs, making a total saving of 68 lacs.

50. If for any reason the Punjab partner does not wish to carry its share of the increase consequent on the reduction to Bahawalpur, the Bikaner Government is prepared to assume the full responsibility conditional on getting the increased share of water which the Punjab would otherwise obtain. It can easily make full use of this water in extensions of irrigation in the State.

Summary of Conclusions

51. In conclusion Bikaner State urges that the sanctity of the present Agreement should be maintained. The Bikaner Government are prepared to assent to such modifications as may be found desirable provided that the waters available are re-distributed in the ratio of culturable commanded areas of all parties.

52. In order to remedy the difficulties experienced during early kharif owing to the available supplies being so short of project expectations, the State suggests that a small priority be given to the perennial channels, and if this is done it is prepared to consider a reduction of the kharif rabi ratio and a consequent diminution of the maximum capacities of the perennial canals.

DATED, SRI GANGANAGAR;
The 8th February 1925

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ANNEXURE A.

Average discharges over 10 *day periods of river Sutlej above Ferozepore Weir for the Years* 1920—1934.

KHARIF SOWING PERIOD.

Year	1st April to 10th April	11th April to 20th April	21st April to 30th April	1st May to 10th May	11th May to 20th May	21st May to 30th May	31st May to 9th June	10th June to 19th June	20th June to 29th June
Periods	I	II	III	IV	V	VI	VII	VIII	IX
1920	7178	6849	8919	11040	9669	15785	20271	34926	43459
1921	4520	5236	5357	6547	8974	19556	11553	9824	32877
1922	8233	6978	8565	11474	15079	20520	16914	48639 (45000)	79524 (45000)
1923	10385	10170	12912	15387	18139	15591	14119	23910	34462
1924	6137	6597	6131	6074	5245	5684	8814	21553	56136 (45000)
1925	4444	5137	11006	11840	7898	14248	45445 (45000)	28495	80381 (45000)
1926	6719	6125	7304	8424	11630	21137	17548	18730	20987
1927	5696	5540	5867	6628	6993	9896	15400	15008	14435
1928	6412	9222	13838	11869	17148	27685	34356	51208 (45000)	40441
1929	4974	4923	5842	7985	6886	7220	25046	44649	29464
1930	9220	15652	15916	17721	29853	20446	28388	37095	41619
1931	7523	6976	9699	10110	10883	9020	9027	14742	2650
1932	3453	3218	3557	3480	5293	4437	9235	16175	1956
1933	7807	7570	7346	8483	10718	12854	27352	33787	69788 (45000)
1934	4183	5028	4832	4833	4411	4778	9016	21631	44619
Total ..	96884	105221	127091	142195	176819	208857	292039	401525	528609
Average	6459	7015	8472	9480	11788	13924	19469	27368	35240
Deduct—Absorption at 20 %.	1292	1403	1694	1896	2358	2875	389	5474	7043
Net Available ..	5167	5612	6778	7794	9430	11139	15573	21894	28192
Mean Monthly ..		5852			9454			22220	

1926 Revised Project :—

Capacity of Perennial Canals	13000	cusecs.
Capacity of Non-Perennial Canals	24632	,,
	37632	,,
Absorption in River at 20 %	7526	,,
Total Utilizable ..	45158	,, say 45,000.

When river supplies exceed 45,000 cusecs, this figure is used for striking the average.

T. A. W. FOY

ANNEXURE B.

Average discharges of river Sutlej above Ferozepore Weir.

KHARIF MATURING PERIODS.

Year	6th September to 15th September	16th September to 25th Sepember	26th September to 5th October	6th October to 15th October
Periods	XVII	XVIII	XIX	XX
1920	29850	22565	13571	9288
1921	74229 (38000)*	76931 (38000)	22749	13349
1922	144986 (38000)	136398 (38000)	58775 (38000)	27486
1923	44549 (38000)	24985	18148	13764
1924	94470 (38000)	48794 (38000)	79448 (38000)	32865
1925	33176	20972	14245	8139
1926	91540 (38000)	31568	17597	13544
1927	62384 (38000)	30567	19587	14788
1928	46906 (38000)	25710	13977	8381
1929	45035 (38000)	26243	18536	16380
1930	47532 (38000)	35598	19028	11729
1931	83675 (38000)	32228	27427	20612
1932	60675 (38000),	30690	27977	13803
1933	71571 (38000)	80427 (38000)	47233 (38000)	24724
1934	43817	23568	17962	10163
Total	552873	456697	343804	239021
Average 15 years	36858	30446	22920	15935
Add Regeneration	3500	3600	3600	3500
Supplies Available	40358	34046	26520	19435

*Capacity of Perennial Canals .. .. .. 13,000 cusecs

Capacity of Non-Perennial Canals .. .. .. 24,632 „

Total .. .. 37,632 „ say 38,000.

NOTE—Figures in brackets represent maximum supplies in canals, where river supplies exceed these the maximum utilizable supplies are used for striking the averages as there is no absorption but regeneration in the river at the time of the year. This amounts to an average daily supply of 2,550 cusecs over these periods.

T. A. W. FOY

ANNEXURE C

Average discharges of river Sutlej above Ferozepore Weir.

RABI SOWING PERIOD.

Year	16th October to 25th October	26th October to 4th November	5th November to 14th November	15th November to 24th November	25th November to 4th December	5th December to 14th December	15th December to 24th December	25th December to 31st December 7 days Period
Period	I	II	III	IV	V	VI	VII	VIII
1920-21	6684	5996	5455	5043	4681	4310	3887	3810
1921-22	1300	8790	7368	6380	5954	57 4	5733	6160
1922-23	11018	8822	6770	6329	613	5293	5769	5298
1923-24	7910	7261	6493	5646	5971	8899	6791	5219
1924-25	13000	13000	10297	8448	7078	7756	7964	6180
1925-26	7850	7275	9523	7400	6458	5384	5271	5021
1926-27	10249	7165	6567	6390	5857	5454	5252	4870
1927-28	10001	7017	6367	5886	5715	5593	5192	4472
1928-29	7048	6164	5364	5430	5344	7215	5091	4758
1929-30	9261	7113	6150	5686	5083	4964	9884	931
1930-31	8241	6317	5741	5280	4863	4725	4214	3057
1931-32	13000	8456	6869	5411	5040	442	4146	3890
1932-33	9004	7325	6192	5612	5042	4865	4398	6051
1933-34	13000	13000	9001	7322	6708	6170	237	4391
1934-35	6820	5459	4976	4567	4223	3925	4695	4731
Total ..	1460 6	119160	103123	90830	84147	84678	83524	7772
Average 15 years	9739	7944	6876	6055	5610	5645	5568	5182
Gain in River	1406	1123	839	839	471	102	102	102
Total Available	11145	9067	7715	6894	6081	5747	5670	5284

Total available .. .. 560178 cusec days.

Deduct unavoidable losses due to closure of Islam Weir .. .. 5000 cusec days.

Net available .. 55517 cusec days.

Mean Supply .. 7210 cusecs.

T. A. W. FOY

N. B.—These figures have been corrected from Punjab records and differ from those in the original Bikaner BRIEF.

E D.

Average discharges over 10 *day periods of the river Sutlej at Ferozepore.*

ABOVE WEIR.

Year	JANUARY			FEBRUARY			MARCH		
	1st to 10th	11th to 20th	21st to 31st	1st to 10th	11th to 20th	21st to 28th or 29th	1st to 10th	11th to 20th	21st to 31st
1920	4970	4663	4261	5441	6947	5063	5219	6488	6491
1921	4102	4222	5772	4706	4088	3769	3671	4198	3724
1922	7687	6891	7280	9018	8609	9324	7377	6847	8290
1923	4750	7997	8437	8450	11066	11889	7978	7640	9298
1924	5114	8002	6351	6766	8633	6781	6524	6648	6603
1925	6391	8918	8953	6101	4997	4700	4285	4029	4446
1926	4495	4766	4306	4098	3733	3422	4054	11676	6635
1927	4379	4241	3831	4036	4746	4756	4753	5156	5036
1928	4856	4569	5282	7700	9003	7125	6620	6070	6517
1929	5056	4161	4656	5321	5295	6079	4931	4906	5497
1930	9820	10048	7569	9034	6912	6748	8944	8409	9243
1931	3888	5780	5434	4402	4714	5496	9224	6378	6951
1932	4076	4319	3746	4042	3325	3378	3121	3166	3151
1933	4612	5843	5305	4275	4094	4770	7221	6598	8882
1934	4456	9302	5645	4616	4856	4494	4206	4715	4073
1935	4319	3812	7559	13000	7651	8973	..	..	..
Total ..	78752	93722	86788	88006	91018	97794	88128	92924	93837
Average 15 years ending 1934.	5243	6248	5786	5867	6068	5853	5875	6195	6256
Gain or Loss ..	+108	+108	+108	—35	—35	—35	—623	—623	—623
Net Available ..	5351	6356	5894	5832	6033	5818	5252	5572	5633

Total available all Partners .. .. 517301 cusec days.
Mean Daily Supply all Partners .. .. 5748 cusecs.
Mean Perennial Supply Both Periods .. .. 6671 cusecs per day.

T. A. W. FOY

N. B.—These figures have been corrected from Punjab records and differ from those in the original Bikaner BRIEF.

ANNEXURE E.

Kharif Capacity Factors on various Canals.

Year	April	May	June	July	August	September
(a) Lower Bari Doab Canal						
1928-29	·42	·86	·91	·82	·67	·73
1929-30	·42	·90	·92	·58	·76	·91
1930-31	·51	·92	·88	·41	·87	·91
1931-32	·51	·90	·91	·81	·89	·80
Mean	·47	·90	·91	·66	·80	·84
(b) Lower Chenab Canal						
1928-29	·86	·91	·92	·84	·91	·68
1929-30	·46	·94	·88	·77	·79	·78
1930-31	·83	·92	·86	·75	·92	·92
1931-32	·91	·93	·84	·71	·83	·86
Mean	·77	·93	·88	·77	·86	·81
(c) Lower Jhelum Canal						
1928-29	·64	·67	·98	·57	·97	·62
1929-30	*Rejected owing to damage to Rasul Weir*					
1930-31	·69	·63	·94	·58	·90	·98
1931-32	·70	·83	·61	·65	·82	·79
1932-33	..	..	..	..	..	..
Mean	·68	·71	·84	·60	·90	·80
(d) Sirhind Canal						
1928-29	·65	·80	·79	·71	·83	·74
1929-30	·66	·80	·81	·80	·73	·90
1930-31	·76	·89	·78	·49	·62	·87
1931-32	·68	·86	·89	·18	·62	·65
Mean	·69	·83	·82	·55	·70	·79

T. A. W. FOY.

ANNEXURE F.A

Rainfall in Sutlej Valley Project Perennial Areas.

Year	E. Sadiqia	Bahawal	Pakpattan	Bikaner
1928-29	8·71	6·53	9·20	11·81
1929-30	6·35	6·64	7·54	5·18
1930-31	13·55	5·43	11·61	12.68
1931-32	8·33	7·58	7.87	9·42
1932-33	..	..	..	6·52*
1933-34	..	..	..	10·13*
1934-35	..	..	..	4·07*†
Mean	9·24	6·55	9·07	9·77

*Not taken when calculating Mean

†Does not include January to March rainfall which on average amounts to 0·67 inches.

T. A. W. FOY.

ANNEXURE G.

Irrigation Data in Canal Irrigated Tracts.

CANAL	Capacity per 0/00 acres C.C.A.	Year	KHARIF		RABI	
			Duty	Rainfall	Duty	Rainfall
Hansi Branch of Western Jumna Canal ..	3·42	1928-29	138	15·00	246	1·67
		1929-30	177	10·46	143	1·27
		1930-31	171	12·83	2212	0·69
		1931-32	174	13·16	207	3·06
		Mean	165	12·86	202	1·67
Sirsa Branch of Western Jumna Canal ..	2·27	1928-29	139	8·56	261	1·16
		1929-30	161	6·66	172	1·39
		1930-31	149	13·26	216	0·45
		1931-32	146	13·83	235	1·98
		Mean	149	10·58	221	1·25
Ludhiana Division of Sirhind Canal (Perennial).	2·36	1928-29	138	8·05	302	3·05
		1929-30	156	9·56	254	1·68
		1930-31	184	19·72	223	2·47
		1931-32	174	14·70	222	2·27
		Mean	163	13·01	250	2·37
Ferozepore Division, Abohar Branch of Sirhind Canal.	2·36	1928-29	162	7·67	264	0·58
		1929-30	163	6·61	238	1·35
		1930-31	178	10·19	255	1·19
		1931-32	182	14·12	260	1·85
		Mean	171	9·65	254	1·24
Bhatinda Division, Bhatinda Branch of Sirhind Canal.	2·36	1928-29	161	10·95	229	3·00
		1929-30	161	5·82	203	1·85
		1930-31	183	15·45	219	1·20
		1931-32	176	12·34	221	1·90
		Mean	170	11·14	218	1·99
Lower Bari Doab Canal, Montgomery District including Balloki, Okhara and Montgomery Canal Divisions.	4·02	1928-29	126	9·35	209	1·16
		1929-30	120	8·15	204	0·95
		1930-31	123	11·42	213	2·03
		1931-32	111	13·01	199	1·13
		Mean	120	10·48	206	1.32
Lower Bari Doab Canal—Khanewal Division, Multan District.	4·15	1928-29	117	2·89	166	0·74
		1929-39	111	10·58	167	1·31
		1930-31	104	6·31	178	1·29
		1931-32	91	4·40	171	1·12
		Mean	106	6·04	171	1·12
Lower Jhelum Canal	2·70	1928-29	158	6·91	220	2·70
		1929-30	199	10·51	265	2·83
		1930-31	124	9·29	227	1·37
		1931-32	132	9·32	218	3·03
		Mean	153	9·01	233	2·48

(continued on page 80)

ANNEXURE G—CONCLUDED.

Irrigation Data in Canal Irrigated Tracts—con'd.

Canal	Capacity per 0/00 acres C. C. A.	Year	Kharif		Rabi	
			Duty	Rainfall	Duty	Rainfall
Rakh Branch of Lower Chenab Canal ..	3.35	1928-29	146	10·81	265	2·34
		1929-30	157	8·84	260	1·98
		1930-31	132	9·21	265	1·36
		1931-32	138	13·44	266	2·20
		Mean	143	10·58	261	1·97
Lower Gugera	3.73	1928-29	135	10·81	243	2·34
		1929-30	156	8·84	263	1·98
		1930-31	138	9·21	266	1·36
		1931-32	126	13·44	251	2·20
		Mean	136	10·58	256	1·97
Burala Branch	3.20	1928-29	119	10·81	248	2·34
		1929-30	137	8·84	249	1·99
		1930-31	126	9·21	310	1·36
		1931-32	116	13·44	243	2·20
		Mean	132	10·58	263	1.97
Jhang Division	3.10	1928-29	126	5·57	220	2·22
		1929-30	125	9·57	254	1·35
		1930-31	110	4·65	252	0·93
		1931-32	109	8·50	242	2·90
		Mean	118	7·02	242	1·85

T. A. W. FOY.

KHAIRPUR STATE BRIEF

1. The Khairpur State's case in brief is that it gave facilities for the Barrage project to the Bombay Government to its own great inconvenience. It agreed to participate in the project but it has not been allowed to particapate equilly.

2. Correspondence dating from the last century shows that Khairpur Darbar was opposed to the Barrage Scheme

But as the Rohri Canal was an indispensable part of the Scheme, it was necessary for the Government of Bombay to get the Darbar's permission to construct the Canal through the State.

Provision for State in Sukkur Barrage Projects

3. Morever, as the Khairpur State had prescriptive rights to draw water from the Indus and as the mouths of the two Main Canals were situated within a mile of the site of the present Barrage and as the whole existing system of State Canals was intercepted by the construction of the Rohri Canal, it was necessary for the Government of Bombay to make arragements to give the State a new source of supply from above the Barrage.

4. Perennial supply was one of the inducements offered to the Ruler for joining the Scheme. In 1906, the Ruler said he was content with his existing irrigation system with wells for a cold weather supply and did not want a perennial supply, but when the Ruler finally agreed in 1909 to participate in the Scheme he did so on the understanding that the State would receive equal benefits from it with the rest of Sind.

No Rabi Supply in 1919 Project

5. In the 1910 Scheme a supply of 1,675 Cusecs in Rabi was given to the State, but in the 1919 Scheme the authors, presumably with the intention of using the rabi water, the most valuable product of the Scheme, in the most profitable way, retained the whole rabi water supply for British Sind and provided for the State a kharif supply only. It was argued that the Ruler had said in 1906 that he did not require a rabi supply, but no communications was made to the State that the rabi supply to the State had been omitted in the 1919 project. As soon as the Darbar came to know the details of the new Scheme, expostulations were made but all protests have so far proved ineffective.

6. It is desirable at this point to stress the fact that had it not been for the loyal submission of the Ruler to the wishes of the British Government, it would have been impossible to carry out the Barrage project at all, for the Rohri Canal, which had to be aligned through the Khairpur State, was the main object of the Barrage.

7. Nor was the granting of facilities for carrying the Rohri Canal through the State by any means a matter of light consequence to the State. Some of the disadvantages to the State resulting therefrom may be described.

Disadvantages to State of the Sukkur Barrage Project

8. The construction of the Canal implied the compulsory acquisition of about 2,500 acres of land from Khairpur State land-holders, thus putting them to considerable loss and inconvenience and it caused a wide-spread disturbance of the State's irrigation system : the State has been divided into two parts by an obstacle absolutely impassable except by means of a few bridges : cultivators have been cut off from their fields and from their villages : many small patches of land have been isolated between the Rohri Canal and the railway so that it is practically impossible to cultivate them : and the considerable water-borne traffic that used to travel up the Abulwah, Mainwah and Mirwah to the Indus and on to Sukkur has been stopped.

9. Finally there is the seepage trouble, caused by the Rohri Canal, which is clearly a very serious matter.

At present about 20 to 30 square miles of country have been waterlogged two large villages and about 10 small ones have entirely collapsed and have been abandoned and serious damage has been done to the State's capital town of Khairpur and to many other towns and villages.

In spite of the critical condition of the State's finances, of which Bombay Government are aware, no compensation has yet been received for damage done by the seepage.

Project Provision Inadequate

10. The irrigation supply given to the State by the 1919 Scheme is assumed by the authors of the Scheme to be sufficient to cultivate three lakhs of acres annually in kharif and a certain amount of bosi unirrigated) crops in rabi.

11. Three lakhs of acres is about half the cultivable area of the State. Therefore the State at best is to be content with an intensity of (say) 60% made up of kharif crops and a few oil seeds while the adjoining Districts of British Sind are to have an intensity of cultivation of 81%, 27 in kharif and 54 in rabi. That is patently unfair treatment and a breach of the implicit condition on which the Darbar agreed to participate in the Barrage Scheme.

12. Not only is the assumed value of the Barrage supply allotted to the State quite inadequate, but also it will be shown that the actual value to the State is much less than that assumed by the authors of the Scheme.

13. The supply allotted consists of 4,000 cusecs during the months of June, July, August and September, 2,000 in April, 3,000 in May and 3,000 from October to December 31st. It is not denied that an assured supply of this size adequately fulfils kharif requirements and is equivalent to the average pre-barrage abkalani supply of 4,500 cusecs.

14. The supply from October to December is useless for Rabi crops and though it would enable some bosi crops to be grown where the soil is suitable it cannot be assessed as a valuable benefit.

Full Supply Factor Unjustifiable

15. The authors of the 1920 Scheme in assuming that the kharif supply of 4,000 cusecs would suffice for the cultivation of 3 lakhs of acres annually in kharif have apparently further assumed that the Darbar would undertake a complete reconstruction of the canal system on modern lines; therefore they have assumed that the same Full Supply Factor as that adopted for normal parts of British Sind would be suitable for Khairpur State.

16. There are three reasons why these assumptions are unjustifiable.

The first is that the existing State canals are of an old-fashioned type with deep channels, in some places running along the old drainage lines. Though sufficiently effective they are economically inefficient.

To bring these canals and distributaries and water courses dependent on them up to modern standards of efficiency would entail an expensive remodelling scheme, but the cost of such a remodelling scheme, if added to the State's share in the cost of the Barrage, would be prohibitive

17. The second reason is that the Physical features of Khairpur State do not permit the same duty be attained as in adjoining British territory and therefore a lower Full Supply Facotor must be dopted, and the third is that an intensity of 50% in kharif with no rabi crops in agriculturally impossible. The soil in the State is mostly light and kharif crops in alternate years would rapidly exhaust it.

18. The State's new Barrage supply, therefore, amounts to little more than the replacement of its old pre-barrage inundation supply, which was admittedly a peculiarly regular one, and participation in the Barrage Scheme has brought to the State no appreciable advantage but many obvious disadvantages.

State's present requirements

19. What the Darbar asks for now is a revision of the allotment of water so that the State may obtain a supply sufficient for cultivation at an equal intensity to that fixed for British Sind.

20. The British Sind intensity is 81% ; 27% in kharif and 54% in rabi. It is obvious that with only a kharif supply such an intensity would be impossible. Cultivation in both seasons must be done. In this connection another most important point must be made. Khairpur State is now surrounded by British Districts enjoying a perennial supply of irrigation water. If the State were not to get

a perennial supply, emigration from the State to the adjoining British Districts would immediately begin and in a short time the State would be denuded of cultivators. For this reason, therefore, a perennial supply is essential.

21. *The State's cultivable area is 6 lakhs of acres, less 40,000 acres of shikargahs. 81% of 5,60,000 is 4½ lakhs and the State requires a water supply to enable it to cultivate approximately that area annually. According to the Full Supply Factor used in British territory 2,086 cusecs perennially would suffice. It will be shown, however, that it is not correct to apply to Khairpur State the same Full Supply Factor as that used in the adjoining British territory.

22. In the first place the irrigable area of the State has been bisected by the Rohri Canal ; and the Eastern half, that commanded by the East Feeder (Mirwah), is in shape long and narrow : its length being over 70 miles from Begmanji to Kot Laloo in a straight line and its width varying from 5 to 15 miles and averaging about 8. Moreover ¼th of the Mirwah command is interspersed with uncultivable sand dunes and the soil in the cultivable area is mostly sandy and light. Therefore, losses by absorption and evaporation are much heavier than in the adjoining British territory and more frequent waterings are required to mature the crops.

23. In addition the Ruler has about 40,000 acres which are kept as shikargahs and these require watering both in kharif and rabi. The importance attached to the shikargahs by the Talpur Rulers is well-known and a provision of water for the shikargahs cannot be omitted.

For these reasons a Full Supply Factor for the State canals lower than that fixed for British territory is now demanded.

24. The figures suggested are 50 in kharif and 100 in rabi(against 72·5 and 145 in British territory) and these are the figures which were recommended by Dr. Summers in the 1910 Scheme. Based on this Full Supply Factor and on the same proportion of cultivation between kharif and rabi as is adopted in British Sind the State should receive a perennial supply of about 3,000 cusecs.

25. As has been shown this reduction in the Full Supply Factor is reasonable and as an equal participant in the Barrage Scheme, the Darbar has a legitimate claim to a supply of 3,000 cusecs perennially.

26. Although in return for all the facilities given, the Darbar might well have excepted to receive specially favourable terms, no such demand is made. However, the Darbar is prepared to consider some readjustment in the proportions between kharif and rabi cultivation in the State and also a small decrease in the intensity of cultivation. The Darbar has shown its willingness to accept a full supply of 2,000 cusecs only in January, February and March and 4,500 only as a maximum in the kharif season. This will give an annual cultivation figure of 225,000 in kharif and 2 (*a*) lakhs in rabi, i. e., an intensity of 75(*b*)%. It is believed that thereby the State will not be at any appreciable disadvantage with British Sind.

Subsequently changed to:—
(*a*) 2·4
(*b*) 72

Supplies Available

27. There is no shortage of supply of water in the Indus between May and December and by the 1919 Scheme the State receives adequate supplies in these months. The difficulty arises in giving the State a supply in January, February and March.

28. During these months no supply to the State has been provided in the Scheme and the Government of India do not permit the limit of withdrawals from the Indus laid down in the 1920 Scheme to be exceeded. Moreover it is doubtful whether the supply in the Indus will suffice for increased withdrawals.

Proposals

29. For the reasons given in paragraph 2 it is held that the Government of Bombay are under an obligation to allow the State to enjoy equally with

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*Note—After the Committee had met Mr. Sladen desired paragraph 21 to be corrected to read as follows:—

The State's cultivable area is 6 lakhs of acres, and 40,000 acres shikargahs, 81% of 5,60,000 is 5·2 lakhs and the State requires a water supply to enable it to cultivate approximately that area annually. According to the Full Supply Factor used in British territory 2,086 cusecs per annually would suffice It will be shown, however, that it is not correct to apply to Khairpur State the same Full Supply Factor as that used in the adjoining British territory.

British Sind the advantages of the Barrage, and that, therefore, they must supply rabi water to the State in January, February and March, even if it means reducing the rabi area in British Sind.

30. However, the Government of Bombay have suggested that the Government of India should permit an increase in the withdrawals from the Indus in these three months and that in case of shortage of supplies all canals shold be reduced proportionately. The Khairpur Darbar are ready to accept this solution, in order that the Government of Bombay shall not be compelled to reduce the rabi area in British Sind.

31. In regard to further withdrawals in Bahawalpur or the Punjab in the rabi season the Darbar considers that the requirements of the Sukkur Barrage canals are paramount and must be supplied in full before any more withdrawals are allowed from higher up the river.

32. The withdrawals from the Indus in January, February and March shown in the 1920 Scheme were presumably limited by the supply of water believed to be available in the Indus during those months and not by any maximum laid down by the Government of India. If more water is found to be available, then the full Barrage demands deserve to be met first.

The question how much water may be considered to be normally available is one that the Darbar is content to leave to be decided by the Committee.

J. M. SLADEN,
Minister,
Khairpur State.

PART V

INTERIM REPORT

with

TABLES

Letter forwarding the interim Report of the Committee on "Distribution of the Waters of the Indus and its Tributaries" to the Government of India.

No. 2092-F. 47.

GOVERNMENT OF INIDA

CENTRAL BOARD OF IRRIGATION.

"CENTRAL TELEGRAPH BUILDING."

Simla H. O., the 20th April 1935.

FROM

F. ANDERSON, Esq., C.I.E., I.S.E., *Chairman,*
Committee on Distribution of Waters of Indus,
and
F. A. BETTERTON, Esq., I.S.E., *Independent Member,*
Committee on Distribution of Waters of Indus.

TO

THE SECRETARY TO THE GOVERNMENT OF INDIA,
DEPARTMENT OF INDUSTRIES AND LABOUR,
PUBLIC WORKS BRANCH,
NEW DELHI/SIMLA.

Subject:—Committee on "Distribution of the Waters of the Indus and its Tributaries".

SIR,

We have the honour to invite your attention to letter No. I.R.-18, dated 8th November 1934 addressed to Secretary to the Government of United Provinces/ Bihar and Orissa, Public Works Department, Irrigation Branch, in which we were invited to act as Independent Members of a Committee on the subject cited.

2. It is understood that the recommendations of the Committee and the action to be taken thereon is of vital importance to some of the Governments concerned. We have decided, therefore, with the concurrence of the Committee, to forward to you an INTERIM REPORT, which will indicate the general nature of the recommendations arrived at.

3. Certain of the agreements reached at the meetings of the Committee from Ist—8th March 1935, affecting the Punjab, Bahawalpur, and Bikaner have been found upon detailed examination by these three Parties, to operate hardly upon one of them. These agreements have been modified at a subsequent meeting between representatives of the three Parties named, and the final recommendations in this INTERIM REPORT, have been made in accordance therewith.

4. All members of the Committee, including the three mentioned above, have intimated their general concurrence with the matter of this INTERIM REPORT, with trifling modifications which will be dealt with in Part II of our final REPORT headed "Findings and Recommendations".

5. You will readily understand that the volume of this INTERIM REPORT has been reduced, as much as possible. We propose to submit the final report complete with proceedings, as soon as this can be prepared.

We have the honour to be,

SIR,

Your most obedient srvants,

F. ANDERSON
Chairman.

F. A. BETTERTON,
Independent Member.

INTERIM REPORT OF THE COMMITTEE ASSEMBLED TO CONSIDER THE QUESTION OF THE "DISTRIBUTION OF THE WATERS OF THE INDUS AND ITS TRIBUTARIES".

In their letter No. I. R.-18, dated the 8th November 1934, the Government of India proposed the formation of a Committee, to consider the question cited, and laid down the following terms of reference:—

I. The extent to which additional supplies of water are actually required for:—

(*a*) the Khairpur State;
(*b*) the Bahawalpur State;
(*c*) the Haveli Project.

II. The possibility of finding such supplies without detriment to the parties interested in the waters of the Indus and its tributaries, and the effect upon the existing or prospective rights of those parties of any fresh withdrawals the authorization of which the Committee may recommend.

2. The Committee assembled on the 1st of March 1935.

The Committee consisted of—

Mr. F. ANDERSON, C.I.E., I.S.E. ..	Nominated by the Government of India.
Mr. F. A. BETTERTON, I.S.E. ..	Nominated by the Government of India.
Mr. W. L. C. TRENCH, I.S.E. ..	For Sind.
Mr. H. W. NICHOLSON, C.I.E., I.S.E.	For the Punjab.
Mr. A. ORAM, I.S.E. ..	For N.-W. F. P.
Sir BERNARD DARLEY, KT., C.I.E.	For Bahawalpur.
Mr. T. A. W. FOY, I.S.E. ..	For Bikaner.
Mr. J. M. SLADEN, I.C.S., .. and	For Khairpur.
Mr. A. M. R. MONTAGU, I.S.E. ..	Secretary, Central Board of Irrigation as Secretary to the Committee.

3. Prior to the meeting on the 1st of March, the two nominees of the Government of India framed a set of ISSUES. These ISSUES had been determined by the two INDEPENDENT MEMBERS as a result of their study of the BRIEFS, submitted by the INTERESTED PARTIES. During the meetings of the Committee, these ISSUES underwent slight modifications and their final form was as under:—

Issues

1. *A principle*—
Should non-perennial irrigated areas receive perennial waters?

2. *Project areas*—
The representatives of the INTERESTED PARTIES will please give the required information in the form attached:—

Note—The representatives of the INTERESTED PARTIES should be in a position to justify their project intensities as they will be examined on these.

(For definition of "intensity" please see item No. 39 of Central Board of Irrigation Publication No. 5.)

3. *Duties*—
The representatives of the INTERESTED PARTIES should be in a position to state their duties as these will be analysed in respect of quality of land, rainfall, method of cropping and subsoil water-table.

(For definition of "duty", please see item No. 56 of Central Board of Irrigation Publication No. 5.)

4. *A principle*—
At this stage the members of the Committee will be called upon to express their views as to whether the available discharges should be divided on a basis of gross area or culturable irrigable area.

5. *Records*—
What are the available river supplies at all the strategic points on the ndus and its tributaries between September and June?

The Committee will also discuss the question of inundation canals in respect of the minimum levels required.

Regeneration also will be examined at this stage.

6. *A principle—*

Should existing Canals take precedence over future Projects in considering the division of surplus waters found available?

7. *Record—*

The available river supplies for certain existing Canals, both perennial and non-perennial, are said to be inadequate at certain seasons. The Committee will examine this question together with that of the dates of opening and closing of non-perennial channels.

8. With reference to the Haveli project, what are maximum and mean supplies required in (*a*) kharif and (*b*) rabi, and are these supplies available without affecting the efficiency of the existing canal systems?

9. With reference to the Thal Project, what are the maximum and mean supplies required in (*a*) kharif, and (*b*) rabi, and are these supplies available without affecting the efficiency of the existing canal systems?

10 *Control—*

The Committee may be asked to express their view as to the advisability of an independent "water control officer".

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4. On the evidence put forward during the examination of these ISSUES, the INDEPENDENT MEMBERS drew up points for discussion which were put forward as a circular dated the 5th March. On the afternoon of the 6th March, the INDEPENDENT MEMBERS withdrew and left the INTERESTED PARTIES to consider these POINTS FOR DISCUSSION.

5. The POINTS were as under:—

The INDEPENDENT MEMBERS of the Committee on the "Distribution of the Waters of the Indus and its Tributaries" offer the following suggestions as a basis for discussion by the representatives of the INTERESTED PARTIES.

From the hydro-graphs and other records examined, they are of opinion that the water supplies at the critical points are sufficient to justify them in putting forward the suggestions below as a reasonable basis for a solution of the problem.

In doing so the INDEPENDENT MEMBERS have confined themselves strictly to principles leaving details to be worked out after the representatives of INTERESTED PARTIES have recorded their views on them.

Points for Discussion

I. *Khairpur—*

The allotment of water for the irrigation of Khairpur State should be on precisely the same footing as that of British Sind, having due regard to the principles which exclude areas from irrigation, due to high water table or similar causes.

II. *Sind—*

Sind to share the waters of the Indus with the Thal Project when constructed.

(*a*) In this connection the INDEPENDENT MEMBERS are of opinion that the water supplies already guaranteed to Sind are unduly high, and will urge the necessity on several grounds of restricting water supplies to the minimum required for efficient irrigation. Nevertheless, it is not proposed to reduce the project intensity or the maximum authorized discharges.

(*b*) The change in the authorized share of Khairpur will result in a reduction of the water allotted to it in Kharif together with an allotment of rabi water. The amount of the allotment of rabi water will be added to the total authorized withdrawal at Sukkur.

(*c*) Thal and Sukkur will share shortages in proportion to the head capacity or authorized full suplly discharge.

III. *Bahawalpur at Panjnad—*

The INDEPENDENT MEMBERS are fully alive to the reasons which led to the restriction on the withrawals from the Chenab of the Bahawalpur canals at Panjnad. The settlement proposed in its entirety, will remove the necessity for these restrictions. It is proposed, therefore, that the Bahawalpur canals at Panjnad and the Haveli Project should share the available water strictly on a basis of their capacities or authorized full supply discharges. Hereafter the Bahawalpur canals at Panjnad will have no *claim* whatsoever on Sutlej water. Nevertheless, should surplus water pass below Islam, during a period when Haveli and Panjnad are below indent, then such supply will be taken into account when calculating the relative shares of Haveli and Panjnad.

IV. *Bahawalpur on the Gharra reach—*

It appears clear that the supplies available to Bahawalpur on the basis of the existing agreement are unduly large and it is proposed to re-allot the waters available in the Gharra reach. The new capacities might be fixed on a basis of the areas, as accepted during the meetings of this Committee.

V. *Kharif period—*

It appears to be the general view ofthe Committee that the kharif period in the West Punjab and Sind is approximately fifteen days later than in the rest of the Punjab. It is proposed that for all purposes the kharif period should be fixed from the 15th April to the 31st October, and that changes in authirised shares should take place in these dates.

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6. The Committee as a whole resembled on the morning of the 8th March.

The INDEPENDENT MEMBERS then took each proposal in turn and enquired if agreement had been reached by the INTERESTED PARTIES and if so, to state the terms of that agreement.

There agreement had not been reached, the precise points still at issue, were recorded and the general opinion of the Committee was taken thereon. In consequence there is now no major point, upon which the Committee felt unable to frame a definite recommendation.

7. Dealing with each proposal in order, the following are the unanimous recommendations of the Commttee:—

Recommendations

Proposal I—

The Committee generally accepted the proposal that the irrigation of Khairpur State should be brought on the same basis as that of the perennial channels of British Sind.

Assuming that the culturable commanded area is 640,000 acres including 40,000 acres of reserved forest as stated by Mr. Sladen (Khairpur State) and including the areas water-logged at the moment, as culturable, then on the basis of 4·2 cusecs at canal head per thousand acres of culturable commanded area, permissible head capacity would be 2,688 cusecs.

Mr. Sladen dissented. (See *paras.* 9 *to* 11.)

8. An unsurveyed area of the State, which lies on the Eastern Nara Canals, has already been allotted a capacity of 400 cusecs on a non-perennial basis. Converting this to a perennial basis, the perennial capacity would be 267 cusecs.

In both the above calculations, no consideration has been given to rice areas. The change in the above figures to arrive at the final authorized capacity will be small and does not affect the conclusion.

9. Mr. Sladen's objection is summarized as follows:—

He was satisfied from what he had heard, that the most efficient method of using perennial water was to utilize the supply at the time when the crops normally required it, viz., at sowing and maturing times. On this account, he demanded that the 2,688 cusecs quoted above should be mean discharge and not maximum permissible.

10. Chairman remarked that Mr. Sladen's objections had been noted. He would point out that it was not proposed to reduce the total authorized withdrawals at Sukkur during kharif. On the other hand, the total authorized withdrawals at Sukkur were to be increased during part of the rabi season by the

amount required for the Khairpur State channels, if placed upon the perennial basis. He explained the view of the INDEPENDENT MEMBERS that the internal distribution at Sukkur was a domestic affair, between British Sind and Khairpur State. With this the Committee agreed.

11. It may be added that before the proceedings concluded, Mr. Trench and Mr. Sladen submitted a statement to the Committee accepted by both parties, which would form the basis of the mean monthly draw-offs to be permitted to Khairpur State month by month. This statement will be found annexed to this report as Table I.

Proposal II—

12. The Committee divided consideration of this proposal into two parts

(*a*) *Rabi—*

The Committee find from the record placed at their disposal, that it was only in exceptional years that the total withdrawals of all projects on the Indus viz. Sukkur project, Khairpur State, Thal project and the Paharpur extension, exceed the supplies available. Any deficiency of supply would be so small, that it would not cause any difficulty. On the Indus the Thal project would share any possible shortage with the Sukkur barrage canals on the basis of the authorized capacity for rabi on those canals. This would occur on rare occasions, for a few days only.

13. (*b*) *Kharif—*

The Committee found that the total additional demands, in excess of present withdrawals, amounted to between 11,000 and 12,000 cusecs. From this excess must be deducted the amounts used at present in the inundation canals on the Chenab. See Table II annexed to this report.

14. The amounts shown in this table would be of importance during September, to the inundation canals in Sind, so far as they affect the level of the river water rather than the actual supplies.

For the inundation canals in lower Sind, an additional credit should be given for any reduction in the kharif discharge withdrawn by the Khairpur canal, consequent upon the conversion to perennial.

15. The Government of Bombay had already agreed to the Haveli project with a total kharif capacity of 7,500 cusecs. The total additional demands above that figure, now required for all projects contemplated including revisions amount to approximately 3,900 cusecs. From this should be deducted the actual withdrawals of those inundation canals, which would be replaced by the Haveli project and have a capacity of 9,636 cusecs.

16. The above calculations assume that the projected canals together with the Panjnad canal will run full maximum authorized capacity, throughout the entire kharif season. In practice, this does not occur on any canal, so that the above are the most adverse conditions that can possibly result.

Furthermore, a withdrawal in the upper reaches of the river is not completely reproduced in the lower reaches. This fact also has been neglected.

17. The Committee further recommends that apart from any other changes; the total maximum withdrawals at Sukkur should be increased by 6,500 cusecs in the month of October, to meet the deficit caused by the failure to include the requirements for kharif crops in that month on the Eastern Nara, the North Western and Dadu Canals.

Proposal III—

18. Although the agreement reached between the INTERESTED PARTIES treated POINTS III, IV and part of V together, the decisions reached are recorded in this report, separately, for the sake of clarity.

Therefore, the first point for consideration is the Clause 4 D. 2 of the Agreement between Punjab, Bahawalpur and Bikaner dated 4th September 1920.

In this connection, the Committee unanimously recommends that the restrcitions laid upon the Bahawalpur canals drawing supplies from the Chenab, by that clause, shall be removed.

19. Subject to this, and also subject to the acceptance by the Government concerned with supplies from the Gharra reach, of the remaining recommendations *in toto*, the Committee unanimously recommends the adoption of the perennial and maximum head capacities below:—

Canal	Perennial (Rabi) Capacity	Non-perennial Capacity	Total (Kharif) Capacity
Haveli	2,750	5,000	7,750
Panjnad	1,500	6,500	8,000
Totals ..	4,250	11,500	15,750

20. At this point Mr. Nicholson (Punjab) raised the question of defining the non-perennial share capacity for the Panjnad Canal, on the grounds that it was a transfer from the Sutlej Valley Project Canals.

Sir Bernard Darley (Bahawalpur) objected, and held that if such capacity were defined for the Panjnad, it should be defined similarly for the Haveli.

The discussion is recorded in the minutes of the meetings of the Committee and the two gentlemen finally agreed to accept the recommendation of the INDEPENDENT MEMBERS on this minor point.

21. The INDEPENDENT MEMBERS have given this point their careful consideration and find themselves unable to agree with Mr. Nicholson.

They recommend that the non-perennial share capacity should *not* be defined in the final agreement which must be entered into between the Parties. Their reasons are as under—

(*a*) The waters of the Gharra reach are to be reserved for the Canals off-taking therefrom.

The restriction on the withdrawal at Panjnad in relation to Sutlej supplies in this reach, is to be removed. This is the only connection between the Panjnad canal and canals taking off the Gharra reach. The final separation of the Panjnad from other Sutlej Valley Project canals removes any necessity there might have been to treat all these canals on similar lines.

(*b*) In practice, the INDEPENDENT MEMBERS, fail to see any advantage in defining the non-perennial share capacity for the Panjnad Canal.

However cogent the reasons for defining non-perennial share capacity for the Sutlej Valley Project canals originally were, these reasons cannot apply to either Haveli or the Panjnad canals on the Chenab.

For the above reasons they advise against the adoption of Mr. Nicholson's suggestion.

22. Certain difficulties were discovered in defining the method of distribution. Additional information in connection with discharges at the two sites and in particular regarding regeneration, was not available immediately. Mr. Nicholson kindly agreed to arrange for the supply of the necessary hydrographs. Furthermore, both Sir Bernard Darley and Mr. Nicholson agreed to accept the recommendation of the INDEPENDENT MEMBERS on this minor point.

Proposal IV—

23. As mentioned in paragraphs 18 and 19, the agreement reached in this connection is bound up with that in POINT III and part of V and acceptance is required of these POINTS together.

Dealing first with the perennial canals, the Committee unanimously recommends a redistribution of capacities on the Gharra reach as under- :—

Perennial	Capacity	Per cent (rounded)
Punjab	3,940	30%
Bahawalpur	6,340	49%
Bikaner	2,720	21%

24. The Committee further recommends unanimously a distribution of kharif, non-perennial and total capacities as under:—

SUTLEJ GHARRA REACH

Partner	Perennial Capacity		Non-Perennial Share Capacity		Total		Non-Perennial Additional Capacity	Total Maximum Capacity
	Cusecs	Per cent rounded	Cusecs	Per cent rounded	Cusecs	Per cent rounded	Cusecs	Cusecs
Punjab ..	3,940	30%	11,523	72%	15,463	53%	5,761	21,224
Bahawalpur ..	6,340	49%	4,467	28%	10,807	37%	2,233	13,040
Bikaner ..	2,720	21%	*Nil*	..	2,720	10%	..	2,720
Total ..	13,000	..	15,990	..	28,990	..	7,994	36,984

Proposal V—

25. The Committee find that the proposal to alter the dates of opening and closing of the non-perennial channels disclosed varying requirements. The recommendations recorded below, however, are the result of agreement and the Committee recommends their adoption *in toto*.

Proceeding up the rivers as hitherto.

(*a*) On the Indus, below Mithankot: Sind will retain the existing practice, as laid down in the Sukkur Project Report of 1919.

26. In the following paragraphs, the recommendations now recorded, vary in certain respects from the figures generally accepted at the Delhi meetings of the Committee 1st—8th March 1935.

The modifications now introduced, affect only the partners Punjab, Bahawalpur and Bikaner and have been formally accepted by their representatives at a subsequent meeting in Lahore dated the 28th March 1935. The INDEPENDENT MEMBERS therefore do not feel called upon to comment thereon, in any way and recommend their acceptance *in toto*.

27. (*b*) On the Indus above Mithankot and on the Panjnad and Haveli canals, the Kharif season shall be from 15th April till 15th October, but should water be available after the demands of the perennial canals have been met, the non-perennial canals may remain open till the 31st of October.

Provided that: (*i*) if supplies are surplus at Sukkur a non-perennial canal may open after 1st April.

(*ii*) Should supplies from the Western rivers be "switched" to the Sutlej, at some future date, no claim on such "switched" supplies shall be made on behalf of the non-perennial canals taking off at Trimmu (Haveli) and Panjnad.

(*c*) On the Sutlej Gharra reach for the Sutlej Valley canals.

In early Kharif the perennial canals of the 3 partners shall have preference to the extent of 26% of their revised capacities, i.e. :—

		26%
Punjab	3,940	1,024
Bahawalpur	6,340	1,648
Bikaner	2,720	707
	13,000	3,379

Until the river rises to give this discharge, 3,379 at canal heads, the rabi percentages shall apply. When the discharge available is above this, the excess shall be allotted to non-perennial canals in the following proportion:—

	Per cent
Punjab	72
Bahawalpur	28

until the non-perennial canals draw 26% of 15,990, i.e., 4,157.

Above this combined discharge 3,379+4,157=7,536 at canal heads the partners will share as follows:—

	Per cent
Punjab	53
Bahawalpur	37
Bikaner	10

and these kharif percentages will apply, whatever the discharge, from July to 15th October.

Bikaner Canal discahrge will be gauged immediately downstream of the unlined portion, mile 6 approximately.

Summary

28. Summarizing the above in the form of replies to the terms of reference, the Committee is unanimously of the opinion that:—

I. Additional supplies of water are required for:—

(*a*) Khairpur State on the scale laid down in detail in paragraphs 7 to 11 above.

(*b*) Bahawalpur State on the scale laid down in paragraph 19 above.

(*c*) Haveli Project on the scale laid down in paragrapah 19 above.

II. Such supplies are generally available in the river Indus and its tributaries. They can be distributed without detriment to the rights, existing or prospective, of the Interested Parties, provided that each Party makes mutual concessions detailed in the analysis in paragraphs 10, 12 to 17, 23 to 25, and 27 above.

29. The Committee emphasizes that this INTERIM REPORT deals only with matters of immediate importance to the INTERESTED PARTIES.

There are a number of additional points—important, though not urgent—arising from the enquiry to which the Committee proposes to invite the attention of the Government of India in the final REPORT.

We have the honour to be,

SIR,

Your most obedient servants,

F. ANDERSON,

Chairman.

F. A. BETTERTON,

Independent Member,

Committee on Distribution of Waters of Indus.

TABLE I.

Statement showing monthly mean allotments for Khairpur Feeders.

Month	Monthly Mean cusecs
April	1,000
May	2,250
June	3,000
July	4,000
August	4,000
September	4,000
October	2,675
November	2,675
December	2,625
January	2,000
February	2,000
March	2,000

The rabi mean supply, based on Rohri canal rabi capacity factor, for Khairpur Feeders should be 2,429. Against this the State asks for 2,329 cusecs.

W. L. C. TRENCH

J. M. SLADEN.

8*th March* 1935.

TABLE II.

Total withdrawals of the Chenab Inundation and Sidhnai Canals to be absorbed in the Haveli Project.

Month	1922-23	1923-24	1924-25	1925-26	1926-27	1927-28	1928-29	1929-30	1930-31	1931-32	1932-33	1933-34	1934-35
1	2	3	4	5	6	7	8	9	10	11	12	13	14
April—													
1—15 ..	80	1,652	1,203	134	887	177	413	75	1,151	644	101	1,592	128
16—30 ..	613	2,047	1,172	120	438	151	3,661	907	3,212	318	170	1,130	161
Mean ..	347	1,850	1,188	127	663	164	2,037	491	2,181	481	135	1,361	145
May ..	1,626	4,106	1,116	628	3,115	647	5,956	1,331	5,450	2,411	126	2,354	136
June ..	4,694	4,439	2,442	3,850	4,867	2,155	6,966	4,826	6,499	3,487	2,238	7,456	2,487
July ..	6,194	6,196	7,108	7,457	6,229	5,819	7,340	5,914	6,768	6,616	4,763	8,171	6,845
August ..	6,126	6,050	6,101	5,421	6,627	6,765	7,333	6,275	5,558	5,944	7,303	7,913	6,497
September ..	4,230	3,237	4,158	2,872	4,791	2,766	4,925	4,462	3,356	3,891	2,612	5,185	3,077
October—													
1—15 ..	2,163	1,200	2,286	1,466	2,180	1,030	1,035	1,802	1,339	2,096	915	2,844	756
16—31 ..	1,194	774	1,433	937	1,727	616	515	1,194	558	1,727	440	2,289	343
Mean ..	1,679	987	1,869	1,202	1,954	823	775	1,498	948	1,911	678	2,566	549

H. W. NICHOLSON

PART VI.

APPENDICES.

APPENDIX I (A).

Note, dated the 10th December 1920, by Sir Thomas Ward, Kt., C.I.E., M.V.O., Inspector-General of Irrigation in India, on the urgency of the accurate gauging of the Indus river and its tributaries.

1. The Government of India have recently had under their consideration two irrigation projects of the first magnitude, for the Sukkur Barrage and Canals in Sind, and for the Sutlej Valley Canals in the Punjab. As the former project will draw its supplies from the Indus and the latter from a tribuatary of the same river, it was necessary to examine the question of the effect of the withdrawals proposed in the Punjab upon the supplies available at Sukkur before the Government of India could recommend to the Secretary of State that both schemes should be taken in hand simultaneously.

2. *Prima facie*, it is logical to assume that the abstraction of water from the tributaries of the Indus must necessarily diminish the volume passing Sukkur, but it is quite possible that this diminution is to some extent compensated for by seepage back into the river, during the rabi season, of a portion of the enormous withdrawals made by the Punjab during the kharif. Unfortunately the data available are too meagre to permit of a definite conclusion being arrived at on the subject. Such records of discharges as exit have, however, been carefully examined and analysed, and, on the information before them the Government of India are satisfied that the Sutlej Valley Project can be put in hand without prejudicing the supplies necessary to secure the area of irrigation contemplated on the Sukkur Canals.

3. More than this it is impossible to assert, and the question of the collection of reliable data for the disposal of the problem has become one of the first urgency. It will obviously be necessary, once construction commences on the Sukkur scheme for any future projects put forward by the Punjab to be very carefully examined in relation to the possible effects of further withdrawals from the tributaries of the Indus upon the rights to irrigation from the Sukkur Canals upon which the Government of Bombay are now entering. I have no hesitation in saying that the data for such an examination do not at present exist, and that, unless steps are immediately taken to collect and collate them, endless difficulty is likely to ensue. Almost all the controversies which have up to date taken place in India in respect of questions of water-rights have been directly attributable to the fact that adequate figures were not forthcoming and that consequently recourse had to be had to indirect deductions and presumptions; the only method of averting such controversies is to have at hand reliable information on the factors in the case.

4. The problem which has to be solved in this instance is the determination of the natural supplies in the Indus and of the diminution or increase which takes place in these supplies consequent on the withdrawal of water for irrigation in the Punjab and the seepage of a portion of such withdrawals back into the rivers. This can only be done by careful gauging of the streams concerned; and it is this gauging which I would urge should at once be taken in hand in a systematic and scientific manner.

5. A certain amount of gauging* is at present undertaken both at the headworks of the various canals in the Punjab and at various intermediate discharge sites, but examination of the results has shown that the records are not systematically kept and are not reliable in all cases. What is required is that a list of gauging sites should be drawn up, and that continuous observations should be made at them over a protracted period. In the table accompanying I have listed the sites which, if adopted, appear to me likely to give the material required.

6. This list is less formidable than might appear at first sight since gaugings, in some cases continuous, in others periodical, are already made at 16 out of the 23 sites proposed. At such stations all that will be necessary will be to arrange for continuous gaugings being made and to ensure that as accurate results as possible are obtained from them.

7. In addition to the gauging of the rivers, accurate measurements of the withdrawals by all canals, both in British and Bahawalpur territory, will require to be made.

8. In my opinion the best results will be achieved by the Bombay and Punjab Governments each appointing a special executive officer to deal with the work. In the Punjab the officer selected would be directly responsible for the gaugings at the seven new stations proposed, and would receive those from the other stations from their respective Executive Engineers. He would have no responsibility as to the latter but would visit the gauging sites from time to time and, as an expert, make suggestions so as to ensure the utmost accuracy possible being attained. He would also check, by means of reliable current meter observations, the results obtained at such stations with the object of determining the co-efficient, if any, to be applied to them. It will be for the Government of Bombay to decide whether the Bombay officer should be in direct charge of the gauging parties at Mithankot, Sukkur and Kotri, the responsibility for which rests, at present, with the Indus River Commission.

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*This information would be considerably more useful if discharge diagrams were substituted for the rise and fall diagrams now published.

APPENDIX I (A)—*concld.*

9. But the main work of these officers would be the tabulation, co-ordination and scrutiny of the results obtained. For this purpose they would be required to meet at frequent intervals, probably every month, to discuss results. I would further propose that they should be required to report to a Committee, which should meet every year, consisting of the Chief Engineer, Bombay, the Chief Engineer in Sind, the two Punjab Chief Engineers and the Inspector-General of Irrigation as Chairman, with power to add to their numbers. This Committee would review the report of the two executive officers and this review, together with the report and tables and diagrams of the observations made, would be printed and submitted annually to the Government of India.

10. I have referred above only to the question of the distribution of water as between the Punjab and Sind, but the same investigation should give valuable results as to apportionment between the various projects in the former province and between Upper and Lower Sind in the latter. I do not propose, in this note, to deal with this aspect of the question nor need I refer to the valuable information likely to be obtained by a careful investigation of the subsoil conditions underlying the Punjab doabs. It will, however, be obvious that the Committee suggested above will be in a position to give material assistance to Government in respect of any case in which these points are under discussion.

11. There are two points to which I would specially invite attention. The first is the extreme importance of the work to all the parties concerned, to the Government of the Punjab because all future schemes in that province will have to be examined with an eye to the rights of Sind to irrigation, to the Government of Bombay because projects for extensions in Sind will similarly have to be analysed with reference to the prescriptive rights which would thereby be acquired by them as against the Punjab, to the possible prejudice of extensions in that province and to the Government of India as arbiter in inter-provincial differences. This importance should be clearly kept in mind when officers are being appointed to the work, such officers being selected for their special abilities as men likely to take a keen and scientific interest in their duties, and should also be impressed upon all those Executive Engineers who will be responsible for individual gauging stations, upon the results obtained at which the special officers must largely depend for their data.

12. The second point is the desirability of continuous daily observations of discharges. From personal experience in Seistan and Siam I am convinced that in no other way can reliable results be obtained and no trouble is too great when compared with the advantages gained from complete continuity of observations. I would strongly advocate the observation of daily discharges (not merely gauge readings) at all the stations selected, current meter observations being made at the more important ones, frequent discharges should also be taken to check the volume of the withdrawals, the canal-head discharge curves being recalibrated where necessary. Only in this way will finality be reached.

13. I am aware that considerable trouble and expense will be involved by these suggestions but both trouble and money will have been expended to the best possible advantage if the fruitless discussions, which are otherwise bound to arise between Sind and the Punjab, are averted and the consequent delays in the development of irrigation obviated.

True Copy.
W. R. CHAMBERS,
Superintendent, Government of India
Public Works Department.

APPENDIX I (B)

List of sites referred to in paragraph 5 of note, dated 10th December 1920, by Sir, T. R. J. Ward, Inspector-General of Irrigation.

Serial No.	River	Site	Officer responsiable
1	Jhelum	Mangla	Executive Engineer, Mangla.
2	Do.	Rasul	Ditto Rasul.
3	Jhelum	Above junction with Chenab ..	Special Executive Engineer.
	Chenab	Above junction with Jhelum ..	
	Do.	Haveli	
4	Do.	Marala	Executive Engineer, Marala.
5	Do.	Khanki	Ditto Khanki.
6	Ravi	Madhopur	Ditto Madhopur.
7	Do.	Balloki	Ditto Balloki.
8	Do.	Sidhnai	Ditto Sidhnai.
9	Chenab	Sher Shah	Ditto Multan.
10	Beas	Pang	Special Executive Engineer.
11	Beas	Above junction with Sutlej ..	Ditto.
	Sutlej	Gidar Pindi bridge	
	D	Western Bein	
	Do.	Eastern Bein	
12	Do.	Bhakra	Executive Engineer, Rupar.
13	Do.	Rupar	Ditto.
14	Do.	Gandasinghwala	Executive Engineer, Upper Sutlej.
15	Do.	Salmanke	Special Executive Engineer.
16	Do.	Jamlera	Ditto.
17	Do.	Adamwahan	Executive Engineer, Lower Sutlej.
18	Chenab	Panjnad Weir*	Special Executive Engineer.
19	Indus	Kalabagh	Ditto.
20	Do.	Ghazi Ghat (Dera Ghazi Khan) ..	Executive Engineer, Dera Ghazi Khan.
21	Do.	Mithankot	Indus River Commission.
22	Do.	Sukku	Ditto.
23	Do.	Kotri	Ditto.

*The conditions at this site are very exceptional, lying as it does immediately below the confluence of two large rivers, and it is very important that continuous detailed discharges should be made there by a competent observer as physical problems of considerable difficulty may be apprehended in the designing and siting of the proposed weir.

APPENDIX II. (A)

THE ORIGINAL ISSUES.

1. Should the non-perennial irrigated areas receive perennial water?

2. The representatives of the different parties will please give the required information in the form attached.*

NOTE.—The representatives of the Interested Parties should be in a position to justify their project intensities as they will be examined on these.

(For definition of "intensity", please see item No. 39 of Central Board of Irrigation, Publication No. 5.)

3. *Duties*—The representatives of the Interested Parties should be in a position to state their duties as these will be analysed in respect of quality of land, rainfall method of cropping and sub-soil water-table.

(For definition of "duty", please see item No. 56 of Central Board of Irrigation, Publication No. 5.)

4. At this stage the members of the Committee will be called upon to express their views as to whether the available discharges should be divided on a basis of gross area or culturable irrigable area.

5. What are the available river supplies at all the strategic points on the Indus and its tributaries between October and June?

Regeneration will be examined at this stage.

6. The available supplies in early Kharif are generally inadequate for perennial and non-perennial canals. The Committee will therefore consider the advisability of fixing the percentage of withdrawals of each party for perennial and non-perennial canals or for both.

7. The Committee will discuss the question of inundation canals at this stage in respect of the minimum levels required.

8. With reference to the Haveli project, what are the maximum and mean supplies required in (*a*) kharif and (*b*) rabi, and are these supplies available without affecting the efficiency of the existing canal sytem?

9. With reference to the Thal project what are the maximum and mean supplies required in (*a*) kharif and (*b*) rabi, and are these supplies available without affecting the efficiency of the existing canal systems?

10. The Committee may be asked to express their view as to the advisability of an independent water control officer.

F. ANDERSON,
Chairman.

*Not printed.

APPENDIX II (B).

THE FINAL FORM OF THE ISSUES.

1. *A principle*—Should non-perennial irrigated areas receive perennial water?

2. *Project areas*—The representatives of the Interested Parties will please give the required information in the form attached.*

NOTE—The representatives of the Interested Parties should be in a position to justify their project intensities as they will be examined on these.

(For definition of "intensity" please see item No. 39 of Central Board of Irrigation, Publication No. 5.)

3. *Duties*—The representatives of the Interested Parties should be in a position to state their duties as these will be analysed in respect of quality of land, rainfall, method of cropping and subsoil water-table.

(For definition of "duty", please see item No. 56 of Central Board of Irrigation, Publication No. 5.)

4. *A principle*—At this stage the members of the Committee will be called upon to express their views as to whether the available discharges should be divided on a basis of gross area or culturable irrigable area.

5. Records—What are the available river supplies at all the strategic points on the Indus and its tributaries between September and June?

The Committee will also discuss the question of inundation canals in respect of the minimum levels required.

Regeneration also will be examined at this stage.

6. *A principle*—Should existing canals take precedence over future projects in considering the division of surplus water found available?

7. *Records*—The available river supplies for certain existing canals, both perennial and non-perennial, are said to be inadequate at certain seasons. The Committee will examine this question together with that of the dates of opening and closing of non-perennial channels.

8. With reference to the Haveli project, what are maximum and mean supplies required in (*a*) kharif and (*b*) rabi and are these supplies available without affecting the efficiency of the existing canal systems?

9. With reference to the Thal Project, what are the maximum and mean supplies required in (*a*) kharif and (*b*) rabi, and are these supplies available without affecting the efficiency of the existing canal systems?

10. *Control*—The Committee may be asked to express their view as to the advisability of an independent "water control officer".

F. ANDERSON,
Chairman

*Not printed.

APPENDIX III

Circular, dated 5th March 1935, from Independent Members to Interested Parties presenting POINTS FOR DISCUSSION.

The Independent Members of the Committee on the Distribution of the waters of the Indus and its Tributaries offer the following suggestions as its bases for discussion by the representatives of the Interested Parties.

From the hydrographs and other records examined they are of opinion that the water supplies at the critical points are sufficient to justify them in putting forward the suggestions below as a reasonable basis for solution of the problem.

In doing so the Independent Members have confined themselves strictly to principle leaving details to be worked out after the other Members have recorded their views on them.

I. *Khairpur*—The allotment of water for the irrigation of Khairpur State to be on precisely the same footing as that of British Sind having due regard to the principles which exclude areas from irrigation due to high water-table or similar causes.

II. *Sind*—Sind to share the waters of the Indus with the Thal Project when constructed—

(*a*) In this connection the Indepedent Members are of opinion that the water supplies already guaranteed to Sind are unduly high, and will urge the necessity on several grounds of restricting water supplies to the minimum required for efficient irrigation. Nevertheless it is not proposed to reduce the project intensity or the maximum authorised discharges.

(*b*) The change in the authorized share of Khairpur will result in a reduction of the water allotted to it in kharif together with an allotment of rabi water. The amount of the allotment of rabi water will be added to the total authorized withdrawals at Sukkur.

(*c*) Thal and Sukkur will share shortage in proportion to the head capacity or authorized full supply discharge.

III. *Bahawalpur at Panjnad*—The Independent Members are fully alive to the reasons which led to the restrictions on the withdrawals from the Chenab of the Bahawalpur canlas at Panjnad. The settlement proposed in its entirety will remove the necessity for these restrictions. It is proposed, therefore, that the Bahawalpur canals at Panjnad and the Haveli Project should share the available water strictly on a basis of their capacities or authorized full supply discharges. Hereafter the Bahawalpur canals at Panjnad will have no *claim* whatsoever on Sutlej water. Nevertheless, should surplus water pass below Islam, during a period when Haveli and Panjnad are below indent, then such supply will be taken into account when calculating relative shares of Haveli and Panjnad.

IV. *Bahawalpur on the Gharra reach*—It appears clear that the supplies available to Bahawal pur on the basis of the existing agreement are unduly large and it is proposed to re-allot the waters available in the Gharra reach. The new capacities might be fixed on a basis of the areas, as accepted during the meetings of this Committee.

V. *Kharif Period*—It appears to be the general view of the Committee that the kharif period in the West Punjab and Sind is approximately fifteen days later than in the rest of the Punjab. It is proposed that for all purposes the kharif period should be fixed from the 1st of April to the 31st of October, and that changes in authorized shares should take place on these dates.

F. ANDERSON
F. A. BETTERTON

APPENDIX IV

Statement showing discharges of Panjnad River during early and late kharif period during the past 4 years.

[To be substituted for Annexure G appended to the Bahawalpur BRIEF.]

Period	1931	1932	1933	1934
April 1—10..	16,208	12,551	15,084	3,340
„ 11—20..	22,976	14,393	19,422	5,611
„ 21—30..	31,460	19,156	25,511	13,915
May 1—10..	24,09	19,075	25,398	19,238
„ 11—20..	44,552	18,702	37,377	14,570
„ 21—31..	41,863	21,727	40,476	12,647
June 1—10..	41,498	35,067	59,436	24,134
Sept. 21—30..	51,665	23,448	109,44	24,516
Oct. 1—10..	24,701	12,758	61,651	16,624
„ 11—20..	17,329	5,770	29,429	9,027
„ 21—31..	12,969	3,896	19,022	6,309

J. P. GUNN

APPENDIX V.

DEFINITIONS in respect to areas employed by the Interested Parties in their Brief indicating the basis of allocation of water.

A—SIND.

Gross Irrigable Area—The gross area less such area within the irrigation limit as may be excluded from irrigation by the project system or channel for any such reasons as high spring level or unsuitability of soil for canal irrigation.

Culturable Irrigable Area—The gross area irrigable by lift or flow less the area not available for cultivation, *e.g.*, village areas, roads, unculturable lands.

NOTE—Large areas of unirrigable lands are excluded from the gross irrigable area. Small isolated patches are excluded under the heading culturable irrigable area as unculturable lands.

W. L. C. TRENCH

B.—PUNJAB.

SUTLEJ VALLEY PROJECT.

Gross Commanded Area—In the case of the Sutlej Valley Project this is the total area within the irrigation limits. For the canals as constructed the limit of irrigation along the river is however somewhat different to that on which the areas were determined for the purposes of the 1920 Agreement.

Culturable Commanded Area—In the case of this project the culturable area commanded has been determined from actual rectangulation and level surveys. Any area which is irrigated by lift although not commanded by flow, is included as culturable commanded area.

COLONY CANALS.

Gross Commanded Area—In the case of the colony canals the gross commanded area shown in the published statistics is the summation of the areas of all the villages and colony in chaks in which irrigation takes place. There are a certain number of other villages and chaks of crown waste in which no irrigation has so far taken place. These areas are not included. The total of such areas is not however so great as to materially affect the total area.

Culturable Commanded Area—The culturable commanded area on the colony canals however is the total allotted area in which irrigation has taken place. Culturable commanded area which has not been so far allotted is not included under this head. As in the case of the Sutlej Valley Project, land actually uncommanded by flow but which is irrigated by lift is included in the culturable commanded area. It is on the culturable commanded area as recorded above that the water allowance for irrigation purposes is determined. In some cases of old villages on the Lower Chenab Canal an arbitrary culturable commanded area has been shown which has no connection with the actual, due to the fact that the supplies previously granted were not fully utilized.

SIRHIND CANAL.

Gross Commanded Area—In the case of Sirhind Canal it is the summation of the areas of villages in which irrigation takes place. The villagers concentrate their irrigation in a portion of the village as the effect of irrigation on the land renders it less suitable for barani crops.

Culturable Commanded Area—The culturable commanded area on the Sirhind Canal is the summation of the areas of the fields in each village which actually come under irrigation. This concentration of irrigation in a portion of the village leads to greater efficiency as the watercourses are shorter and do not extend over the whole village. The result however, is that considerable areas which are culturable and potentially commanded are not included.

H. W. NICHOLSON.

C. BAHAWALPUR.

Gross Commanded Area—That portion of the gross irrigable area which is commanded by flow irrigation.

Culturable Commanded Area—That portion of the culturable irrigable area which is commanded by flow irrigation.

B. DARLEY.

D.—BIKANER.

Gross Area—On the Bikaner Canal the gross area includes all land within the irrigation boundaries of distributaries. Large blocks of land between distributary irrigation boundaries to which it is not proposed to give irrigation at present are *not* included in the gross area.

Culturable Commanded Area—The culturable commanded area is the gross area within irrigation boundaries of distributaries less all land not easily commanded by flow, less unculturable land excluded by reason of the fact that it is occupied by village sites, roads, railways, canals and sandhills.

T. A. W. FOY

SUBJECT INDEX

161 IB—100—9-10-50—SGPP Lahore

IMMEDIATE
SECRET

Government of India
Ministry of External Affairs

EXPRESS LETTER

From: Foreign, New Delhi.

To: Foreign, Karachi.

No. D.7454-Pak.III/51.

Dated the 24th October, 1951.

Reference your telegram No. 4250 of October 12 regarding shortages of supply in Upper Bari Doab canal. This canal was run on full supply up to 28th July. On 29th July, floods in the river Ravi necessitated closure of the canal for two days and caused certain changes in the course of the river. The Bela which covered the junction of the Lower Training Works and the Link Crate Bar was washed away resulting in a gap at the junction. This diverted the course of the river, making it difficult to feed the pocket. Owing to this, the canal remained below indent for about 10 days during August. Supplies were further interrupted by floods in the river on 1st, 7th, 11th, 22nd and 23rd August, 1951. Owing to these frequent floods, all efforts to put in a bund to divert the supplies back to the river pocket were unsuccessful.

2. Efforts to put in the bund continued and the work was carried on night and day. But on 10th September when a gap of about 100 feet was still left, a further flood washed away a portion of the bund. The bund was completed on the 17th September which raised the supplies in the canal from 3,000 to 6,000 cusecs. Towards the end of September, the river discharge dropped down to about 5500 cusecs, out of this there was a leakage of about 200 cusecs through the Diversion Bund which was unavoidable.

3. During the period of shortage, rotational running of branches was resorted to according to usual practice and the shortage was shared proportionately by Punjab(India) and Punjab(Pakistan).

4. It will be clear from above that the short supplies were due to reasons beyond the control of the Punjab(India) Government and that as shortages were shared proportionately, there is no question of making up to Punjab(Pakistan) for any previous short supply.

Sd/-. Y.K. Puri.

Deputy Secretary.

Copy of a telegram dated 22.9.51 from Irrigation, Simla, to Irrigation, Lahore.

.....

Diversion Bund completed at Madhopur and supply at Head raised 6000 cusecs against 6900 stop Further efforts to raise to indent are in hand stop Supdt. Engineer Bari Doab directed to deliver due share Pakistan channels.

Secret.
4250

Telegram O.T.P.No.4250, dated the 11th October, 1951.

From: Foreign, Karachi.

To: Foreign, New Delhi.

.....

IMMEDIATE.

Punjab Government have reported that the Upper Bari Doab Canal has been running extremely short from August, 51 and that when the Chief Engineer Punjab(I) was approached by Chief Engineer Punjab(P) he attributed the shortage to a change in the course of the river at Madhopur Headworks. He promised, however, to get repairs done expeditiously and stated that orders had been issued for sharing of shortage. Despite this channels of Upper Bari Doab Canal lying in Pakistan have throughout the current kharif been running deficient. Shortage in August was 33 % and in September 54%. Such shortages as exist should be shared equitably. Continued failure of Punjab(I) to supply our due share of waters is creating a very difficult situation. We would strongly urge that Punjab(I) may be instructed to raise Punjab(P) channels to their share immediately and make up the previous short supply.

.....

Existing uses in India on Indus Basin

The Sutlej River

India draws supply upto 9,040 cusecs in Kharif and 8,438 in Rabi at Ruper in Sirhand Canal. The balance supply goes down to Ghara reach of Sutlej.

2. The Ghara Reach of Sutlej (The Sutlej Valley Canals taking off from Ferozepore, Suleimanki and Pallah or Islam Headworks).

India draws supply at Ferozepore Headworks in the Eastern and Bikaner Canals as detailed below:-

Rabi
(16th October to 31st March)

1. India draws 21% of the supply upto 13,000 cusecs of the supply available for the canals (Anderson Committee Report - Part I, Para 31 to 33).

2. If the discharge during winter freshet exceeds 13,000 cusecs, India is to get 11.5% of the excess (Orders of C.E., I.B. Punjab (Undivided) vide No. 6378 West, dated April 7th, 1938).

Early Kharif
(Anderson Committee Report, Part I, para 31 to 33).

a) As long as the river at Ferozepore is below 3,380 cusecs India's share is 21%.

b) When the supply is from 3,380 to 7,537 cusecs, India's share is 0.115 Q + 320.4 where Q is the discharge.

c) When the river rises above 7,537 cusecs or Ist of July whichever is earlier to 15th October, India's share is 16%.

The balance supply goes to Panjnad Headworks in Pakistan.

3. The Ravi River

The Upper Bari Doab Canal at Madhopur draws supply upto 5,770 cusecs in Rabi and 6,900 cusecs in Kharif and India passes on 46.8% in Rabi and 49.3% in Kharif to Pakistan at the borde.

The balance supply goes to Balloki Headworks in Pakistan.

Ghara Reach of the Sutlej River.

Sutlej Valley Canals.

Name of Canal.	Head-works.	Pro-vince.	Country.	Capacities Authorised full supply as per Anderson Committee. P	N.P.	Distribution of River Supplies. Rabi	Kharif Early Kharif Discharge upto 3380 Cs.	Discharge 3380 to 7537 Cs.	Discharge above 7537 Cs. or from July whichever is earlier.
1	2	3	4	5	6	7	8	9	10
Eastern	Ferozepur	Punjab(I)	India.	-	2756 (3320-564 for Bahawalpur State)	21%	21%	21% of 3380 plus 2756 / 17243 of 72% =11.5%	2756/21183 x 52. . .6 plus 10 Total 16
Bikaner	"	Bikaner State.	India.	2720	-				
Dipalpur	"	Punjab(P)	Pakistan.	-	6950	30%			
Pakpattan	Sule-manki.	"	"	3940	2654				
Mailsi	Islam or Pallah.	"	"	-	4883				
Eastern Sadiqia	Sulei-manki	Bahawalpur State.	"						
Fordwah.	"	"	"						
Bahawal Canal.	Islam.	"	"						
Bahawalpur share from Eastern Canal.	Ferozepur	"	"	6340	6700	49%	79%	79%	79% of 3380 plus (72.0-11.5) plus 28% .....88.5% of Excess. plus 46 38 84%

1. Figures taken from Anderson Committee Report as amplified in C.E.Punjab letter No.1038-9.S.W./231/27 dated 7.6.1943.
2. The total of non-perennial capacities for Punjab in the above columns works out to 17243 cusecs against 17284 in para 32 of Anderson Committee Report,Part I (Table I,Column 4 + Column 8). The difference of 41 cusecs was left over to cover possible discrepancies discovered later.

Recommendations of Anderson Committee Report were approved by Govt. of India letter No.1-R.18 dated New Delhi, the 30th March,1937.

As per Anderson Committee Report Para 31 Part I.

As per Anderson Committee Report, Part I,Para 31 in Column 7 the % taken for Punjab is 52 against 53 given in Anderson Committee Report. This 1% surrender to Bahawalpur of the total utilized supply in Kharif is due to the construction of Montgomery-Pakpattan Link (C.E.,I.B.undivided Punjab No. 1038-9 S.W.331/27 dated 7th June 1943).

No. 6378 West.

From

J.D.H. Bedford, Esquire,
Chief Engineer, Irrigation Works, Punjab.

To

(1) The Chief Engineer,
Bikaner Government.

(2) The Chief Engineer,
Bahawalpur Government.

Dated Lahore, the 7th April 1938.

Regulation of supplies during a closure of the Weir in winter.

- - - -

Sir,

I have the honour to state that when a closure occurs at any one of the three Sutlej Valley Project Weirs in the winter, one or more perennial canals are thrown out of action viz:-

(a) At Ferozepore Weir - the Gang (Bikaner) Canal.

(b) At Suleimanke Weir - the Sadiqia (Bahawalpur) and Pakpattan (British) Canals.

(c) At Islam Weir - the Bahawal (Bahawalpur) Canal.

It seems therefore that the river water available when one Weir is closed, may be more than the Full Supply discharge of the perennial canals that can take it.

I would, therefore, suggest that the credit to be accumulated by the perennial canals that are closed, should be limited to their share of the river supply upto the authorised capacities of the remaining perennial canals that can be opened. Any surplus water above the capacities of the open perennial canals should be given to the non-perennial canals in accordance with the ordinary rule.

The favour of your opinion on the above suggestion is solicited.

I have the honour to be,
Sir,
Your most obedient servant,

Sd. T.W.R. Easton
Executive Engineer,
for Chief Engineer, Irrigation Works, Punjab.

Enclosure:-
1 spare copy of this letter.

No....

MAP of BAHAWALPUR STATE

Scale 1 inch = 8 miles.

Miles 10 5 0 10 20 30 Miles.

70°

29°

N

DERA GHAZI KHAN DIST.

Indus R.

MUZAFFA

Mari Minchin R.H.

Samak. R.H.

Chachran. R.S.

PANJNAD MAIN LINE

SHIDANI DY.

KHAN BELA DY.

Jampur

REHMAN DY.

SANGLA DY.

MAHAN DY.

Khan Bela R.H.

BR

Allahabad R.H.

Chaudri. R.S.

Kalla

Toliwari R.S.

Chanigoth

Zahir Pir. R.S.

Shekhan. R.H.

RAJ DY.

NAWAHROT

MINCHIN DY

Palu Shah R.H.

DALLAS BR.

MAKHAN. DY

RUKKAN DY

Mianwali R.H.

QADIR DY.

MAU MAKHDUM DY

HAJI DY

DINA DY.

Vijja Abdasion R.S.

Kotla Pathan. R.S.

Gaini Ikhtior Khan

Nawankot. R.H.

GALA KALLAM

ARIF DY

Firaza. R.S.

Khanpur. R.S.

Jetha Bhutta. R.S.

Qasimwala. R.H.

Bhung. R.H.

Degi R.H.

Sharin. R.H.

SHARIN DY

BHONA DY

FAZAL BR. DY.

Shahbazpur R.H.

LAMMA DY.

DEGI DY

ADAMWAL MR

GREY

Chak Abbas. R.H.

RAHIM YARI KHAN

Sohja. R.S.

Tarinda. R.S.

Kot Samaba. R.S.

Bagho Bahar. R.H.

Bhutta Sheikh R.H.

SHERGARH. M.

PATTAN DAHARAN M.

ADAM SAHABA DY

Adam Sahaba. R.S.

Rahim Yar Khan. R.S.

SADIQ

Sanjapur R.H.

Kot Sabzal R.H.

WALHAR MR

Walhar R.S.

Machhi Goth. R.S.

Sadiqabad. R.S.

SINAWAR MR

TALA DY

Wah Foqiran R.H.

TARINDA DY

ABIHATAT DY

GULLAN DY

Tillo Goth. R.H.

Ratl. R.S.

Dhandi. R.S.

IR MR NOT BUILT

2-R NOT BUILT

PARTIALLY BUILT

Kot Dhani. R.H.

ABBASIA CANAL

PANJNAD CANAL

DISTRICT

SUKKUR

CANAL NOT BUILT

KANDER DY

RAHIMYARKHAN DISTRICT

BAHAWALPUR DISTRICT

28°

71°

Inches 1 2 3 4 5 6 7 8

Centimetres 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19

KODAK Color Control Patches © The Tiffen Company, 2000

Kodak LICENSED PRODUCT

Blue Cyan Green Yellow Red Magenta White 3/Color Black

71°

72°

R. Chenab

Maksuda R.S

Raja Ram R.S.

Kutabpur R.S.

Gilawala R.S.

Dunyapur R.S.

Kuthala. R.S.

Miranpur R.S.

Nur Shah

MULTAN

Rukanpur R.S.

Shammah. R.S.

Shah Nal R.S.

Kotla Ali R.S

Mailsi.R.S.

Ashraf Shah.R.S.

Arewahan.R.S.

Lodhran R.S.

Jamraniwah R.S.

Kahrur Pakka R.S.

N.W.RAILWAY

Empress Bridge

Samasatta R.S.

Left Bank of Sutlej R.

PANJNAD HEADWORKS

Panjnad.R.H

5 AHMADPUR BRANCH

HAQQANI MR.

Khairpur Dho

Shakrani.Lk.

RASUL MR.

Kotla Musa Khan

Naushera

ABBASIA CANAL

ULTAN WAH DY

Kotla Sultan

BAGHDAD DY

Bahawalpur R.S.

Bahawalpur E.R.S.

Jhangiwali R.H

Dera Bakha R.S.

Lal Suhara.R.S.

CITY

AHMADPUR

BRANCH

DY OF BAHAWAL CANAL

Baghdad.R.S.

Kalanchiwala.R.S.

Musafir Khana

SARDARWAH DY

Muharikpur.R.S.

QUTABWAH DY.

KHANWAH DY.

Mangreja.R.H.

Kadirpur R.H

Rangpur R.H

Kulab.R.S.

Dera Nawab R.H.

Bhurwala.R.H.

Mamunian.R.S.

4

DESERT BRANCH

DERA NAWAB DY

DERAWAR BR

CANAL

DYHRI DY

Wadhan.R.H.

Yozman.R.S.

Kudwala.R.H.

MITHRA DY

DERAWAR BR.

Mithra.R.H.

Dairwala.R.H.

Derawar Fort

Samarah.R.S.

Yozmain.R.S.

Mansurah R.S.

Fort Marot R.S.

Rasafah.R.S.

Marot

Dingarh

Jamgarh

Mirgarh

BAHAWALNAGAR DIST

BAHAWALPUR DISTRICT

CHOLISTAN

PURBIKA

72°

QAIM CANAL

SADIQWAH. MR.

QAIMWAH DY.

Qaimpur R.H

BAGHALI DY

Khairpur R.H.

ASRANI MR.

Gath Shah Mohd R.S.

Asrani R.S.

Tamewali R.S.

Golpur.R.S.

Sheikhwahan.R.S.

Qaimpur.R.S.

LL.MR.I

Maksuda R.S
72°
Kutabpur R.S.
apur R.S.
Kuthala. R.S.
Basamsai. R.S.
Machianwala. R.S.
Burewala. R.S.
Gaggo. R.S.
Fatna. R.S.
Arifwala. R.S.
73°
MULTAN
DISTRICT
Nur Shah. R.S.
Shammah. R.S.
MONTGOMERY DISTR
ISLAM HEADWORKS
Mailsi. R.S.
Ashraf Shah. R.S.
Arewahan. R.S.
Kahrur Pakka R.S.
Left Bank of Sutlej R.
CANAL
AHMADWAH
FARRAKWAH. DY.
QAIMWAH DY.
QAIM
SADIQWAH. MR.
BAGHALI DY
Qaimpur R.H
Khairpur R.H.
Lat Suhara. R.S.
ASRANI MR.
Gath Shah Mohd R.S.
Asrani R.S.
Tamewali. R.S.
Golpur. R.S.
Sheikhwahan. R.S.
Qaimpur. R.S.
LL. MR.
BAHAWAL CANAL
Nurkot. R.H.
Sala Nola. R.S.
AZIM DY
Shahr Farid
SHAHR FARID DY
Chak Abdullah. R.S.
FORDWAH
BRANCH
DAULAT DY
FORDWAH MAMR. DY.
SIKANDAR. DY.
ROJHANWALI DY
Girdhari R.S.
Akoka. R.H.
Jhulan. R.H
Bahawal Nagar. R.S.
Mitti Roya R.S.
Madrash. R.S.
Takht Mahal. R.S.
CHAK ABDULLA
Nitalka. R.H
GAJJIANI. DY.
JALWALA
YARWAH. DY.
Jalwala. R.H.
Dhop Sangteka R.S.
MR
Hasilpur. R.S.
Bokhshankhan. R.S.
Chistian. R.S.
CHISTIAN. MR.
FATTEH DY.
Sand Tibba
Lakhiwala
ARAIN. MR.
Chandna. R.H.
MALIKWAH BRANCH
Sawaiwala. R.S.
BAHADURWAN. MR.
SIRAJWAH DY
Kurianwala. I.H
SUNDA DY
BAKHUSHAH DY
GIRDARIWALA
BAHAWALNAGAR DIST
BERWALA
Chingadinga. R.H.
MURAD DISTY
Lodhranwala R.H.
Daharanwala R.H.
QAZIWALA
Dunga Bunga. R.S.
DUNGA BUNGA DY
Qaziwala. R.H.
KHATAN
JHANGI MR
Khatan R.S.
Harunabad NA.
Gulab Ali. R.H.
GULABALI DY
BAGSAR DY BRANCH
BAKRANA DY
PAHAUR DY
Fagirwali. R.S
KALIANWALA
Mansurah R.S.
Fort Marot R.S.
Rasafah. R.S.
Qureish. R.S
Marot
Jamgarh
Mirgarh
Khichiwala. R.S.
SADIQIA CANAL
HAKRA DY
RIGHT OLD
Ft. Abbas R.S.
HAKRA
LEFT DY
2L DY
3L DY
4L D
Hakra R.
B I K A N E R
73°

REFERENCES

- Perennial Area
- Non-perennial Area
- Area to be abandoned finally
- " " " " temporarily
- New perennial Area
- Non-perennial to be added to perennial

ANNEXURE A.

TEHSILS

Minchinabad	1
Bahawalnagar	2
Khairpur	3
Bahawalpur	4
Ahmadpur East	5
Allahabad	6
Khanpur	7
Rahimyar-Khan	8
Ahmadpur Lamma	9

REFERENCES

- Perennial Area
- Non-perennial Area
- Area to be abandoned finally
- " " " temporarily
- New perennial Area
- Non-perennial to be added to perennial

REFERENCES

- River
- Channels
- Railway Line
- Irrigation Boundary. Div. Boundary
- State Boundary
- District
- Tehsil
- Rest House ● R.H.
- Roads, Metalled
- " Unmetalled
- Main Roads proposed
- Inspection Hut I.H.
- Bund