REPORT

OF THE

INDUS COMMISSION

(Volume I)

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REPORT OF THE INDUS COMMISSION

PART I

GENERAL

Complaint of Sind and Projects complained of—This is a complaint by the Government of Sind under section 130 of the Government of India Act, 1935. The complaint relates to certain irrigation projects constructed, or being constructed, or contemplated by the Government of the Punjab on the Indus and its tributaries. These projects, as set out in paragraphs 3, 4 and 28 of Sind's printed Complaint, Part I, are :—

(1) The Haveli Project—already in operation ;

(2) The Thal Project—under construction ;

(3) The Bhakra Dam Project—in contemplation ;

(4) 24 storage reservoirs with an assumed capacity of 500,000 acre-feet (1 acre-foot=43,560 cubic feet) each, on the affluents of the Indus, Jhelum, Chenab, Ravi, Beas and Sutlej rivers, and one of them, the Woolar Lake Scheme, on the Jhelum itself—said to be in contemplation ; and

(5) Feeders to transfer water (subject to certain conditions) from the Ravi to the Beas and from the Chenab to the Beas with a total assumed withdrawal of 23,000 cusecs (1 cusec =1 cubic foot per second or about 2 acre-feet per day) at its highest—said to be in contemplation.

2. **Projects requiring investigation.**—These are the projects as set out in Sind's complaint, but it is clear from the Punjab's printed Defence, Vol. I, that, as to items (4) and (5) above, what the Punjab has done or proposes to do is rather different and a good deal less. So far as subsidiary storages are concerned—Item (4) above—we have been assured that the Punjab has no intention, within the next 40 years, of doing more than what is set out in paragraph 32 of its Defence, Vol. I, namely :—

(*a*) 7 storages on the affluents of the Beas, with a total capacity of 2·065 million acre-feet, or preferably (if this is permissible), a single storage on the Beas itself with a live capacity of 2 million acre-feet (*vide* proceedings of the 26th September 1941 ; 8th October 1941 ; and 11th October 1941) ; and

(*b*) 4 storages on the affluents of the Ravi and the Chenab and the Woolar Lake Storage on the Jhelum with a total effective capacity of 1·428 million acre-feet (disregarding the Deg Storage because, it is said, the Deg water spills across the country and very little of it reaches the main river).

Thus the total of the subsidiary storages contemplated by the Punjab does not exceed 3½ million acre-feet against 12 million acre-feet assumed by Sind. This is apart from the main storage contemplated at the Bhakra Dam on the Sutlej mentioned in item (3).

Similarly, as regards feeders, the only Punjab projects now relevant are those set out in paragraphs 35 and 36 of the Punjab Defence, Vol. I, namely :—

(*a*) a link of 700 cusecs capacity from the Lower Bari Doab Canal on the Ravi to the Pakpattan Canal on the Sutlej (already constructed) ; and

(*b*) a link of 5,000 cusecs capacity from Balloki on the Ravi to Suleimanke on the Sutlej (in contemplation).

Thus the maximum capacity of the feeders constructed and contemplated by the Punjab is 5,700 cusecs as against a maximum withdrawal of 23,000 cusecs assumed by Sind. Whatever reason Sind may have had for assuming these large figures, whether as regards storages or feeders, it seems clear to us, having regard to the language of section 130 of the Government of India Act, 1935, that in these proceedings we need consider only the projects which the Punjab has already executed or now proposes to execute and that we must leave out of account anything which the Punjab does not propose to execute within the next 40 years. (See paragraph 40 of the Punjab Defence, Vol. I.)

3. **Nature of complaint.** (*a*) **Regarding inundation canals.**— Broadly speaking, Sind's first complaint is that the effects of the Bhakra Dam Project and the other projects contemplated by the Punjab, when superimposed upon the full effects of the Thal and Haveli Projects and of certain older projects already executed, will be to cause " such lowering of water levels both in Upper and Lower Sind during the months of May to October inclusive as will seriously affect the efficient working of Sind's inundation canals." (Para 4, Sind Complaint, Part I.)

4. It may be explained that an inundation canal is a canal dependent on the natural level of the river for its supplies. An inundation canal will therefore only run when the water in the river rises to a level which permits of the canal being fed ; and any abstraction of water from the river at a point above the canal

intake may, by lowering the level at the intake, affect the working of the canal. We say " may affect " and not " must affect ", because there are often countervailing factors which neutralize the effects of the upstream withdrawals.

5. The following general description of the inundation canals in Sind is taken from the latest Administration Report of the Province (for the year 1939-40) :

" The Province of Sind is situated beyond the influence of the South-West and the North-East monsoons, and in consequence its rainfall is normally scanty and unreliable. Unlike the greater part of India, therefore, the area of cultivation in Sind that depends solely or mainly upon rainfall is insignificant. The river Indus, however, brings down abundant supplies of water, the minimum discharge at Sukkur during the last 10 years being 16,800 cusecs while the maximum has been as high as 702,000 cusecs and the average 148,000 cusecs. From where it enters the Province of Sind, the river is generally in deltaic formation, flowing along an elevated ridge formed by its own alluvial deposits. The indigenous system of irrigation by inundation canals took advantage of this physical peculiarity. The device was primitive. A channel was cut from the river approximately at right angles to its course, and after running a short distance the canal deviated to an alignment parallel to the river and commanded the low-lying lands falling away from the marginal ridge. These old irrigation works have been improved and extended, scientific methods have been introduced into the design and control of these canals, and they have been provided with head and cross regulators. There are, however, inherent defects in this method of irrigation. The cultivation dependent on these inundation canals is principally Kharif (summer), and even this is subject to uncertainty of supply owing to fluctuations in the river levels. The low water supplies available during the winter season could be tapped only to a small extent and therefore the water largely ran to waste in the sea. As a result of the vagaries of a constantly changing river, the inundation canals frequently suffer from deficiency of supply during critical irrigation periods. The above inherent defects in irrigation have been remedied in Central Sind with effect from the year 1932 by the construction of the Lloyd Barrage at Sukkur and the opening of the perennial canals taking off above it. It is only in parts of Upper and Lower Sind, which are outside the sphere of influence of the Barrage, that only a ' Kharif ' water supply continues to be available from the inundation canals. ' Besi-Rabi ' crops (Rabi or winter crops grown on a copious watering given prior to sowing and before the inundation canals cease to flow), however, are grown to a considerable extent in these areas,

especially if the 'Abkalani' (inundation season) happens to be a long and high one." (Administration Report of the Irrigation and Civil Works, Sind, for the year 1939-40, Part I, page 3, paragraph 1.)

6. The irrigation canals in Sind are either (*a*) inundation canals dependent on the natural level in the river, or (*b*) canals of the Lloyd Barrage system fed from the artificially raised water of the Barrage. In 1939-40, nearly $1\frac{1}{2}$ million acres were irrigated by inundation canals (with a total length of 3,252 miles including distributaries) and $3\frac{1}{4}$ million acres by the Barrage canals (with a total mileage of 9,618) so that the former are still of considerable importance. In this Report we shall often have occasion to distinguish between the inundation canals of Upper Sind—that is, those which take off the Indus above Sukkur—and those of Lower Sind, which take off below Sukkur. One of the reasons for this distinction is that the withdrawal of water from the Indus for the Sukkur Barrage canals may be a factor to be taken into account in considering the working of the inundation canals of Lower Sind, but not of Upper Sind.

7.(*b*) **Regarding Sukkur Barrage Canals**—Sind's second complaint in substance, is that the Thal and Haveli Projects when taken in conjunction with certain connected orders passed by the Government of India in their letter I. R.-18, dated March 30, 1937, will create a serious shortage of water at Sukkur in the Rabi or "winter" season (October to March inclusive) and will interfere with the proper working of the Sukkur Barrage Project in Sind. (Paras. 11 and 12, Sind Complaint, Part II.)

8. Orders of the Government of India of March 30, 1937.—A brief explanation of the genesis of the orders passed by the Government of India on March 30, 1937, is necessary at this stage. These orders were passed, as is clear from their date, shortly before the new Government of India Act came into operation. Under the old Constitution, water-supplies, irrigation and canals, and water storage were a provincial "*reserved* subject" (included in item 7 of Part II of Schedule I to the Devolution Rules under the old Act), so that every local Government was under the superintendence, direction, and control of the Government of India in these matters. The distribution of the waters of the Indus system had been a source of controversy between various Provinces and Indian States at least since 1919, and in 1935 some of the matters in controversy were referred by the Government of India to a Committee of 8 experts, 6 of whom were nominated by the interested units (namely, Bombay including Sind, the Punjab, the North-West Frontier Province, Bahawalpur, Bikaner and Khairpur) and the remaining 2, including

the Chairman, were independent members nominated by the Government of India. This Committee will be referred to in the sequel as the Anderson Committee, after its Chairman. The Committee's terms of reference were :—

"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."

In addition, the Committee discussed certain matters which, though outside the terms of reference, seemed to them to be important enough to deserve placing on record. The Committee submitted a unanimous report on September 16, 1935, to which were annexed the opinions of the independent members on certain points regarding which the Committee were unable to be unanimous. The Government of India then consulted the various units concerned and passed final orders on March 30, 1937. The letter explaining and detailing these orders is reproduced in Appendix I to this Report. The several local Governments and Durbars generally accepted the recommendations of the Committee and the Government of India's orders generally followed them.

9. Reliefs claimed by Sind.—The main reliefs, which Sind asks for in this complaint are, in effect, (1) that the Punjab should not be allowed to proceed with the Bhakra Dam Project and the other projects contemplated except under proper safeguards, and (2) that the orders of the Government of India of March 30, 1937, should be modified in certain respects. These and certain other minor reliefs claimed by Sind will appear more fully from Sind's printed Complaint.

10. Brief history of Projects referred to in Sind's Complaint.—A short description of each of the projects which have been referred to in Sind's Complaint may be of assistance at this stage.

PUNJAB PROJECTS :—

(1) *The Haveli Project.*—This has been in operation since the spring of 1939. The supplies for the project in its present form appear to have been approved by the Government of India in 1937, subject to the several orders annexed to their letter of March 30, 1937. It irrigates certain areas which were formerly fed from the Sidhnai

headworks on the Ravi or by inundation canals from the Chenab, besides an additional area of a little over 600,000 acres of new land previously unirrigated. The system provides 2 canals taking off the Chenab at Trimmu, below the point where the river is joined by the Jhelum. The perennial canal of the system—*i.e.*, that designed to irrigate throughout the year—has a capacity of 2,750 cusecs and the non-perennial canal—*i.e.*, that designed to irrigate only for a part of the year (April to October inclusive)—a capacity of 5,000 cusecs. The total draw-off by the Haveli canals working to full capacity is thus 7,750 cusecs from April to October inclusive and 2,750 cusecs in the other months. The perennial canal does not, however, work to full capacity from November to February inclusive, being then subject to capacity factors of less than unity.

(2) *The Thal Project.*—This is now under construction. The scheme was first submitted to the Government of India in 1919 but underwent considerable modification from time to time; the supplies necessary for the project in its present form appear to have been approved by the Government of India along with those for the Haveli Project in 1937, subject to the relevant orders annexed to their letter of March 30, 1937. It is intended to irrigate certain areas between the Indus and the Jhelum and the Chenab. The Thal system provides for a single canal taking off the Indus at Kalabagh, the full capacity of the canal (perennial) being 6,000 cusecs. But from November to March inclusive, it is subject to capacity factors of less than unity and is therefore not allowed to work to full capacity.

(3) *The Bhakra Dam Project.*—This is in contemplation, but has not yet been commenced. The project is mainly intended to irrigate the famine tracts of Hissar in the Punjab and the adjoining areas in the Bikaner State. The scheme, as described in paragraphs 15-17 of the Report of the Indus Discharge Committee, 1929, provided for a dam on the Sutlej, with a storage capacity of 4·75 million acre-feet (taken as equivalent to 79,166 cusec-months). This scheme was examined by Mr. Nicholson representing the Punjab and Mr. Trench representing Bombay with a view to ascertaining its effects on the inundation canals of Upper Sind—*i.e.*, between Mithankot and Sukkur on the Indus. They reported on December 15, 1930, that in their opinion these canals would not suffer any reduction of supply as the result of the Bhakra Dam. Mr. Trench further stated, and Mr. Nicholson agreed, that conditions for the inundation canals below Sukkur also would not probably deteriorate as the result of the dam in question. In 1934, the Government of Bombay accepted these findings and accordingly informed the Government of the Punjab that they had no objection to the construction of the dam,

but emphasized that this approval applied expressly to the scheme as outlined in the report of the project and "did not in any way indicate approval to the withdrawal of further supplies from the other Punjab rivers tributary to the Indus or from the Indus itself". (Letter No. 2337/27-I, dated March 27, 1934, from the Government of Bombay to the Government of the Punjab, reproduced at pages 145 and 146 of the Punjab's Correspondence Volume.) The Anderson Committee did not examine the Bhakra Dam Scheme, as it had been dealt with separately; but they recorded the fact that the other storage works which they were recommending were "in addition to the Bhakra Dam Scheme, to which no objection has been raised by any interested party". (Paragraph 48 of the Anderson Committee's Report, Vol. I.) The Government of Bombay accepted the Committee's recommendations not only as to the additional storages but also as to the Paharpur, Thal, Panjnad, and Haveli canals, without withdrawing its consent given in 1934 to the Bhakra Dam Scheme. (Letter No. 5997/27-I, dated March 19, 1936, from the Government of Bombay to the Government of India.) The inference might therefore be drawn that in 1936, for whatever reasons, Bombay accepted the Anderson Committee's recommendations in addition to the Bhakra Dam Scheme.

It must, however, be mentioned that the Bhakra Dam Scheme now contemplated by the Punjab differs in certain respects from the original scheme examined by Messrs. Nicholson and Trench and accepted by the Bombay Government. In one respect the scheme is less burdensome to Sind than the original, for in the present scheme the live capacity of the reservoir is 4 million acre-feet instead of 4·75 million acre-feet as originally contemplated. But in another respect the present scheme may prove more burdensome, for by giving priority to the Sutlej Valley canals, it postpones the filling of the reservoir. In the original scheme, as interpreted by Messrs. Nicholson and Trench, the reservoir drew water from the river almost entirely in the months of June, July and August, when the river is high; but in the new scheme, owing to the priority given to the requirements of the Sutlej Valley Project, the reservoir will have to draw water later in the season, when the river is already falling and when the Sind inundation canals can ill afford a further drop in the level. Whether on balance the new scheme is less onerous to Sind than the old is a matter requiring detailed investigation, but it is clear that the two schemes are not the same.

We must also mention (a) that the cumulative effect of the Bhakra Scheme and the other projects with which this complaint is concerned upon the inundation canals of Sind has never yet been investigated, whether by the Nicholson-Trench Committee or the

Anderson Committee, or any other tribunal, and (*b*) that the full details of the design of the Bhakra Scheme now contemplated by the Punjab are not yet settled (*vide* paragraph 26 of the Punjab Defence).

As the Anderson Committee were not meant to deal with the Bhakra Scheme, there is no reference to that scheme in the Government of India's orders of March 30, 1937.

(4) *Subsidiary Storage Projects.*—These are in contemplation, but have not yet been commenced (*vide* paragraph 2 of this Report). The Anderson Committee recommended that small storage schemes of a capacity not exceeding half-a-million acre-feet on the affluents of the Indus, Jhelum, Chenab, Ravi, Beas, and Sutlej rivers for storing water during July and August might be undertaken by any Province or State without the formal sanction of any other authority ; but that any scheme of higher capacity must have the prior approval of all interested parties. The Committee also recommended the Woolar Lake Storage Scheme on the Jhelum on the ground of its small capacity (334,000 acre-feet). All these recommendations were accepted by the Government of India in their orders of March 30, 1937. It is under these orders that the Punjab contemplate executing the several storage schemes already mentioned. One point calls for notice in this connection. The schemes include 7 storages on the affluents of the Beas with a total capacity of 2·064 million acre-feet, none having a capacity of more than half-a-million acre-feet. All these storages are directly covered by the orders of the Government of India ; but the Punjab would prefer to substitute for them a single storage of 2 million acre-feet on the main river Beas. It may be contended that this substitution would, under those orders, require the prior approval of all interested parties, so that, unless the orders are now modified, the substitution cannot be made without the consent of Sind, amongst other units.

(5) *Feeder Projects.*—One of these, namely, the Pakpattan Link Project (700 cusecs in capacity) has already been constructed ; the other, the Balloki-Suleimanke Link Project (5,000 cusecs in capacity) has not yet been commenced (*vide* paragraph 2 of this Report). Both are designed to transfer water from the Ravi to the Sutlej and are said by the Punjab to be covered by the orders of the Government of India confirming the Anderson Committee's recommendation 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". (Paragraph 55, page 25, Anderson Committee's Report, Vol. I.) In April, May and June, however, the supplies for the Balloki-Suleimanke Link are to be eked out

by water from the Chenab led through the Upper Chenab Canal. To this extent, the project is subject to the condition imposed by one of the Government of India's orders of March 30, 1937 (Serial No. 20), namely, that the transfer of water from the Chenab to the Sutlej must be such as would not affect the Sind inundation canals.

(6) *The Sutlej Valley Project.*—This project comprises a number of canals, the earliest of which (Pakpattan Canal) was opened in 1926. The project was first submitted by the Punjab Government to the Government of India in 1920 and was sanctioned by the Secretary of State in December 1921. The canals are mainly on what is known as the Gharra Reach of the Sutlej, that is to say, the reach of the river between its confluence with the Beas (Harike) and its confluence with the Chenab (Panjnad). The authorized full supply of the Gharra Reach canals, under the Government of India's orders of March 30, 1937, is 36,984 cusecs, including perennial and non-perennial.

SIND PROJECT :—

The Sukkur Barrage on the Indus.—This well-known project has been in operation since 1932. It was submitted by the Government of Bombay to the Government of India in 1920 and was sanctioned by the Secretary of State in April 1923.

N.-W. F. P. PROJECT :—

The Paharpur Canal taking off from the Indus at Paharpur was sanctioned by the Secretary of State in 1905 and opened in 1906-07.

11. Date of complaint and appointment of Commission.—Sind's complaint originated in a letter to the Governor-General, dated October 14, 1939. In its first form it was confined to the apprehended effects of the Punjab projects on the inundation canals of Sind (sometimes referred to as " The Kharif Case "); it was subsequently supplemented so as to include the effects on the canals of the Sukkur Barrage (sometimes referred to as " The Rabi Case "). The complaint in its final form was submitted to the Governor-General on June 7, 1941. (See Appendix V, page 87, Punjab Defence, Vol. II.)

On September 11, 1941 [Notification No. 129/41-GG(A)], the Governor-General appointed us to investigate and report on the matters to which the complaint relates. The Notification of appointment is reproduced in Appendix II to this Report.

12. Procedure.—We held our first session at Simla on September 22, 1941. The session lasted until October 11, 1941. There

were at the outset some preliminary discussions as to the status of certain Indian States that wished to intervene, notably Bahawalpur and Khairpur. We held that although under section 130 of the Government of India Act, 1935, it was not open to an unfederated State—and no State is yet a federated State—to make a complaint regarding interference with water supplies, nevertheless, there was nothing to prevent us from giving every interested State the fullest opportunity of being heard so far as we considered necessary for the purpose of investigating the matters referred to in Sind's complaint. Both Bahawalpur and Khairpur have availed themselves of this opportunity. There were, however, certain matters in which these two States were interested, but which were not relevant to the investigation of Sind's complaint; these matters we have, of course, had to exclude from our consideration.

13. In answer to Sind's complaint, rejoinders were put in before us not only by the Punjab, but also by the North-West Frontier Province, Bahawalpur, Khairpur, Bikaner, and Jind.

14. **General principles suggested for consideration by parties.**— With a view to saving time, we propounded on the first day of the session certain general principles for distribution of the water of inter-Provincial rivers, which seemed to us to emerge from a study of the practice in other countries and which we desired the parties to comment upon in due course. The statement which we made is quoted below :—

" Subject to correction in the light of what you may have to say, the following principles seem to emerge from the authorities :—

(1) The most satisfactory settlement of disputes of this kind is by agreement, the parties adopting the same technical solution of each problem, as if they were a single community undivided by political or administrative frontiers. (Madrid Rules of 1911 and Geneva Convention, 1923, Articles 4 and 5.)

(2) If once there is such an agreement, that in itself furnishes the ' law ' [governing the rights of the several parties until a new agreement is concluded. (Judgment of the Permanent Court of International Justice, 1937, in the Meuse Dispute between Holland and Belgium.)

(3) If there is no such agreement, the rights of the several Provinces and States must be determined by applying the rule of ' equitable apportionment ', each unit getting a fair share of the water of the common river (American decisions).

(4) In the general interests of the entire community inhabiting dry, arid territories, priority may usually have to be given to an earlier irrigation project over a later one : ' priority of appropriation gives superiority of right ' (Wyoming *v.* Colorado, 259 U. S. 419, 459, 470).

(5) For purposes of priority, the date of a project is not the date when survey is first commenced, but the date when the project reaches finality and there is ' a fixed and definite purpose to take it up and carry it through, (Wyoming *v.* Colorado, 259 U. S. 419, 494, 495 ; Connecticut *v.* Massachusetts, 282 U. S. 660, 667, 673).

(6) As between projects of different kinds for the use of water, a suitable order of precedence might be (*i*) use for domestic and sanitary purposes ; (*ii*) use for navigation, and (*iii*) use for power and irrigation (Journal of the Society of Comparative Legislation, New Series, Volume XVI, No. 35, pages 6, 7)."

We may observe in passing that the ranking of different uses in a particular order of precedence depends on the circumstances of the river concerned. And even as regards the same river, different authorities may take different views. Thus, as regards the Colorado, Article IV of the Colorado River Compact specifically declared navigation to be subservient to domestic, agricultural, and power purposes ; but the Boulder Canyon Project Act put navigation before the others. In India, the Northern India Canal and Drainage Act, 1873, as well as the Bombay Irrigation Act, 1879, recognizes that in certain cases irrigation may be more important than navigation, since each of them provides that no compensation is to be awarded for any damage caused to navigation by any project notified under the Act.

Framing of issues.—Counsel for Sind then opened the Sind case. As the Punjab urged that certain legal issues should be disposed of first, we framed the necessary preliminary issues and decided them, after which we framed the additional issues arising out of Sind's Kharif and Rabi complaints. The proceedings were then adjourned to January 1942 in order to enable the parties to prepare their material. We were assured that no earlier date would be practicable. We utilized the interval in touring and informal meetings. We were on tour during a considerable portion of November 1941, visiting Kalabagh (the site of the Thal headworks), Trimmu, Muddoki, Harike, Rupar, Bikaner, Suleimanke, Islam, Panjnad, Sukkur and Khairpur. We also held an informal session at Lahore on the 8th—10th of December. There were in addition informal meetings between the Technical Members of the

Commission and the technical representatives of the Punjab and Sind from time to time. We believe that we have been able in this way to obviate the need for any oral evidence, which is a fruitful source of delay in cases of this kind.

15. We held our second session in New Delhi from January 19, 1942, to February 2, 1942. During this session we completed the hearing of the issues arising out of Sind's Rabi case. We had then to adjourn to April 15, 1942, as the parties informed us that they could not possibly be ready earlier with the large mass of material required for the Kharif case. Merely to study the material which they have presented has occupied us several weeks since the close of the session on May 20. We can well imagine that its collection must have involved immense labour and we cannot refrain from expressing our appreciation of the tireless industry displayed by both the principal parties. To mention only one instance, Sind had originally to compile several books of figures (one for each year since 1932), each containing over 20,000 entries, purporting to show the effects of " loss and lag ". Some of the figures were of observed discharges ; others were the result of calculation. The Punjab had to check the correctness of each of the entries and each of the calculations. Thereafter, Sind had to re-compile at least six of these books on a new basis, which had then to be similarly checked. This is only one of many instances of the vast labour which both sides have bestowed on the preparation of the case. Although it may be that the value of some of the material, from the point of view of assisting us to a conclusion, is not commensurate with the labour spent upon it, we can well understand the anxiety of the parties to put before us everything which they considered relevant. Cases of this nature, involving, as they do, questions of vital importance to the future development of an entire State or Province, are necessarily fought with great tenacity on each side and often occupy several years in the ordinary courts of law. The case which is regarded as the pioneer in this field in the United States of America, *Kansas* v. *Colorado*, was brought in the Supreme Court in 1901 and was not finally decided till 1907. Even more famous was the case, *Wyoming* v. *Colorado*, which went on in the Supreme Court from 1911 to 1922. It arose out of a proposed diversion in Colorado of the waters of the Laramie river, a small stream with an average annual flow, at the inter-State line, of about 200,000 acre-feet. This works out to less than 300 cusecs (the average flow in the Indus at Sukkur is of the order of 150,000 cusecs); but although the stream is small, large questions of law were involved. The suit was brought in 1911 ; the evidence was taken in 1913 and 1914 ; the case was argued three times and was not finally decided till 1922.

A comparatively recent case in the same country, *Washington* v *Oregon*, went on from 1931 to 1936.

16. Preliminary Issues.—As already mentioned, we had to decide during our first session certain preliminary issues. These were :—

1(*a*). What is the law governing the rights of the several Provinces and States concerned in the present dispute with respect to the waters of the Indus and its tributaries ?

(*b*). How far do the orders of the Government of India, annexed to and explained in their letter of March 30, 1937, themselves constitute the law by which the rights in question are to be determined ?

(*c*). Is Sind entitled to object to the Punjab Government proceeding with the Bhakra Dam Project (*i*) as described in paragraphs 22 and 23 of Sind's Complaint, or (*ii*) as described in the Nicholson-Trench Committee's Report ?

Decision on Preliminary Issues.—After hearing all the interested units, we expressed briefly our views on these issues in the following terms :—

" *Issue 1* (*a*).—All parties have accepted the general principles which we tentatively formulated on the first day after examining the practice in other parts of the world. It follows from them that the rights of the several units concerned in this dispute must be determined by applying neither the doctrine of sovereignty, nor the doctrine of riparian rights, but the rule of ' equitable apportionment ', each unit being entitled to a fair share of the waters of the Indus and its tributaries.

" *Issue 1* (*b*).—The orders of the Government of India, dated March 30, 1937, proceeding, as they did for the most part, on the consent of the units concerned, must be regarded as having secured the most equitable apportionment then possible. If owing to material errors in the original data, or a material change in river conditions, or other sufficient cause, those orders are now found to be inequitable, and if a more equitable arrangement can be discovered in present circumstances, with due regard to the interests of all the units concerned, the original orders may properly be modified. This implies of course that a modification of the orders in

one particular may necessitate consequential modifications in other particulars by way of redressing the balance between the several units.

" *Issue 1* (*c*) (*i*).—The Bhakra Dam Scheme which is mentioned in the Sind Complaint and which it is the present intention of the Punjab to carry out being in some respects different from the Bhakra Dam Scheme which was before the Bombay Government, it is conceded by the Punjab that Sind is not precluded merely by reason of any statement of the Bombay Government from objecting to the present scheme.

" There is the further fact that the combined effects of the Haveli Project, the Thal Project, the Sutlej Valley Project, the various storage and feeder projects, and the Bhakra Dam Scheme upon the inundation canals in Sind have never yet been investigated by any independent tribunal. We are, therefore, of opinion that if it is proved that the present Bhakra Dam Scheme superimposed upon the other projects will materially injure the working of the inundation canals in Sind, Sind is entitled to object to the Punjab proceeding with the present Bhakra Dam Scheme except under proper safeguards.

" (*ii*).—As regards the original Bhakra Dam Scheme of 1919 (referred to in the Nicholson-Trench Committee's Report), we do not think it necessary to express any view, because that scheme is not, to use the language of section 130 of the Government of India Act, 1935, ' executive action proposed to be taken ' by the Punjab at present ."

17. Discussion of rights in flowing water.—As this is the first case that has arisen under section 130 of the Government of India Act, 1935, we should like to elaborate our views on the first of the above issues, as to the law to be applied in the adjudication of disputes of this character. The rights of *A* as against *B* in respect of the flowing water of a river differ according to circumstances. Three main classes of cases may be distinguished :—

(1) where *A* and *B* are both riparian owners, that is to say, owners of land abutting on the river ;

(2) where *A* is the Government of a Province and *B* is an inhabitant of that Province using the water of the river ;

(3) where *A* is the Government of one Province and *B* the Government or inhabitant of another, through both of which Provinces the river flows.

In the present dispute we are really concerned with the third class ; but it might be of assistance to deal with the first two before coming to the third.

18. Law in India as between individual riparian owners substantially the same as in England.—In the first category of cases, the law in India would appear to be the same as the common law in England as laid down in the leading cases :—

Embrey *v.* Owen (1851) 6 Ex. 353.

Swindon Waterworks Co. *v.* Wilts and Berks Canal Navigation Co. (1875) L. R. H. L. 697.

McCartney *v.* Londonderry and Lough Swilly Ry. Co. (1904) A. C. 301.

That law may be briefly summarized thus : A riparian owner or occupier has an unrestricted right to take and use the water of a stream for ordinary domestic purposes (such as drinking and washing) and for the wants of his cattle. If his use is confined to such purposes, he may exhaust the water altogether without being liable to be sued by a lower riparian owner. Then again, he may use the water for what are sometimes called " extraordinary purposes ", provided that the use is connected with the riparian land and that he returns the water substantially undiminished in volume and unaltered in character : *e.g.*, for irrigation of his own land, but not to sell to others. In speaking of the returning of the water, we have in mind cases where the whole stream is diverted. When only a part of the stream is taken for purposes of irrigation, the only limitation is that the amount taken shall not be so much as to hurt the right of the lower owner to have the stream passed on to him practically undiminished. [Secretary of State v. Subbarayudu, (1931) 59 I.A. 56.]

19. These are " natural rights " : they are incident to the property in the land through which the river passes. If a riparian owner claims a greater right than those naturally incident in this manner to his ownership, he must prove that he has acquired it as an easement.

20. Such is the English law on the subject ; but it has been recognized in Stollmeyer *v.* Trinidad Petroleum Co. (1918) A. C. 485, that in applying it to other countries where physical conditions are very different, regard must be had to those conditions in moulding the remedy to be granted to a riparian owner. Conditions in India, at least in certain parts, being different from those in England, we might have expected that a different law would develop in this country, as it has developed in parts of America and Australia ; but so far there does not appear to have been any such development.

Illustrations (*h*) and (*j*) to section 7 of the Indian Easements Act, 1882, which extends *proprio vigore* to Madras, the Central Provinces and Coorg, and has been extended to Bombay (including Sind) and the United Provinces, reproduce substantially the English Law. Illustration (*h*) speaks of "the right of every owner of land that the water of every natural stream which passes by, through, or over his land in a defined natural channel shall be allowed by other persons to flow within such owner's limits without interruption and without material alteration in quantity, direction, force or temperature". Illustration (*j*) speaks of "the right of every owner of land abutting on a natural stream, lake, or pond to use and consume its water for drinking, household purposes and watering his cattle and sheep; and the right of every such owner to use and consume the water for irrigating such land and for the purposes of any manufactory situate thereon: Provided that he does not thereby cause material injury to other like owners." In Debi Pershad Singh *v.* Joynath Singh (L. R. 24 I. A. 160), a case from what is now Bihar, the Privy Council applied the English common law (1897).

21. In Bel Bhadar Pershad Singh *v.* Sheik Barkat Ali (1906-07) 11 C. W. N. 85, the question whether the American doctrine of appropriation is applicable in Bengal was considered. It was held to be inapplicable even in a part of the country where the soil was dry, rocky and parched, and where, in consequence, irrigation was a prime need. This doctrine of appropriation has been described as follows in a leading American case, Wyoming *v.* Colorado (1922) 259 U. S. 419:—

"The (English) common law rule respecting riparian rights in flowing water never obtained in either state. It always was deemed inapplicable to their situation and climatic conditions. The earliest settlers gave effect to a different rule whereby the waters of the streams were regarded as open to appropriation for irrigation, mining and other beneficial purposes. The diversion from the stream and the application of the water to a beneficial purpose constituted an appropriation, and the appropriator was treated as acquiring a continuing right to divert and use the water to the extent of his appropriation, but not beyond what was reasonably required and actually used. This was deemed a property right and dealt with and respected accordingly. As between different appropriations from the same stream, the one first in time was deemed superior in right, and a completed appropriation was regarded as effective from the time the purpose to make it was definitely formed and actual work thereon was begun, provided the work was carried to completion with reasonable diligence."

As already stated, the Calcutta High Court refused to apply this doctrine in Bel Bhadar Pershad Singh's case, one of the

Judges observing: "But whatever may be the law or future developments of the law in other countries than this, I can only say that no such rule has yet been laid down in this country."

22. It would therefore seem that the law in India regarding the rights of riparian owners relative to each other in respect of the waters of rivers and natural streams is substantially the same as the law in England summarized above.

23. Law in India as between the Government of a Province and an inhabitant of that Province. (a) Where there is no statute.—We now come to the next category of cases, where the question is between the Government of a Province and an inhabitant of that Province. That the rights of the Government in this matter may be different from those of a private individual is recognized in section 2 (*a*) of the Indian Easements Act, 1882 which provides: "Nothing herein contained shall be deemed to affect any law not hereby expressly repealed; or to derogate from (*a*) any right of the Crown to regulate the collection, retention, and distribution of the water of rivers and streams flowing in natural channels, etc., etc." It follows that the law as between riparian owners set out in the illustrations to section 7 of the Act does not necessarily apply as between a private riparian owner and the Provincial Government. As to what actually are the rights of the Provincial Government, we have to consider two possibilities: (1) there may be a statute on the subject, *e.g.*, in certain parts of Northern India, the Northern India Canal and Drainage Act, 1873 (Central Act VIII of 1873); (2) there may be no such statute. If there is a statute, the position is, of course, regulated by the statute itself. If there is no statute, the position would seem to be regulated by the custom of the locality in question. In Fischer *v.* the Secretary of State for India, I. L. R. 32 Madras 141 (the decision in which was cited with apparent approval by the Privy Council in Prasad Row *v.* the Secretary of State for India, I. L. R. 40 Madras 886), it was held that, at least in the Madras Presidency, the Government had power by the customary law of India to regulate, in the public interests, the collection, retention, and distribution of waters of rivers and streams flowing in natural channels, provided that it did not thereby inflict sensible injury on riparian owners and diminish the supply they had hitherto utilized. The rights of the Government are thus wider than those of an ordinary upper riparian owner *e.g.*, the Government can take water for purposes other than those of the riparian lands, provided, of course, the supply hitherto utilized by the riparian owners is not sensibly reduced.

24. (*b*) In the Punjab and certain other Provinces of Northern India.—In the Punjab, the United Provinces, the Central Provinces

and the North-West Frontier Province, the rights of the Provincial Government are regulated (save in respect of certain minor canals in the Punjab and in the North-West Frontier Province) by the Northern India Canal and Drainage Act, 1873 (Central Act VIII of 1873). We may summarize briefly some of its provisions. The preamble declares that the Government is entitled to use and control for public purposes the water of all rivers and streams flowing in natural channels. Section 5 provides that whenever it appears expedient to the Provincial Government that the water of any river or natural stream should be applied or used for the purpose of any existing or projected canal (which term includes a reservoir) the Government may, by notification in the Gazette, declare that the water will be so applied or used after a specified date not being earlier than three months from the date of the notification. Under section 7, the Collector has thereupon to give public notice of the intended application or use of the water, inviting claims for compensation. Section 8 lays down that compensation may be awarded only in respect of certain specified matters. For example, under clauses (*a*) to (*d*) no compensation is to be awarded for damage caused by stoppage or diminution of percolation, or floods, or by deterioration of soil, or by stoppage of navigation, or by displacement of labour. But under clause (*e*) compensation may be awarded for stoppage or diminution of supply of water through any natural channel to any defined artificial channel in use at the date of the notification. The section also lays down how the amount of the compensation is to be determined : it is to be determined from the diminution in the market value of the property, or, where that is not ascertainable, it is to be reckoned at twelve times the amount of the diminution of the annual nett profits of the property. Section 9 provides that no claim for compensation can ordinarily be made after the expiration of one year from the date of the damage. Section 10 provides, in effect, that the tribunal for assessing compensation shall be the same as under the Land Acquisition Act.

25. There was some discussion before us as to the precise meaning of the term " floods " in section 8 of this Act. It is interesting to recall that there was a similar discussion at the time of the passing of the Bill in 1873 and indeed a clarifying amendment was attempted. An extract from the proceedings of the Council of that date is instructive for more reasons than one :—

> " The Hon'ble Mr. Bayley moved that for section 8, clause (*a*) the following be substituted :
>
> " ' (*a*) stoppage or diminution of percolation, or of floods, *except so far as such stoppage or diminution is provided for by clause* (*e*) *of this section.*'

" He said the amendment, although apparently a mere verbal one, was of a really practical character, intended to make more clear the intention of the Bill, and of some importance as making misconception impossible on a somewhat serious point. As the section 8 to which his amendment referred now stood, clause (*a*) declared that no compensation should be given for the stoppage or diminution of percolation or floods; but by the subsequent clause (*e*), compensation was declared claimable for injury done to irrigation channels. In the Punjab there were several classes of irrigation channels, and one very large class were termed 'inundation canals'. They were canals, the headworks of which were cut in the river bank above the cold weather level of the river. These canals were supplied only when the river swelled, either by the melting of the snow in the hot weather, or during the rains. As to the question of the supply of water to these canals during the rains, no works likely to be undertaken could possibly diminish the supply; but in regard to the supply of those canals which depended upon the rise of water in the river from the melting of the snow, the case was different. In some works which had been lately executed, the hot weather supply to such canals was entirely cut off, and it was quite possible that that might be the case in other instances. These canals were more important than other irrigation channels, because they supplied water in that part of the year when it was most valuable. It appeared to Mr. Bayley that the intention of the Bill was that the owners of these canals should not be excluded from compensation in cases where their supply was destroyed or diminished, and he understood the honourable mover to be of opinion that no misconception could arise because these channels were filled, not by floods, but by the normal rise of the river; but, as the Bill stood, it might be held that these canals were supplied by flood, for it was impossible to define exactly what was the normal rise of a river, and what was a flood, or to distinguish between what was an exceptional, and what a natural, rise of the river. In these cases the river had a broad, low-lying bed between high banks. In no case, he believed, did the rivers ever overtop the high banks, but covered more or less the broad bed between these banks, and within these limits the waters rose much more in some years than in others. It was to prevent all misconception, and any untoward decision declaring

against claims for compensation for the stoppage of these irrigation canals, which would have the effect of destroying very large works and very wide results of private enterprise, that he proposed the amendment. He understood that the Hon'ble Member in charge of the Bill, although not convinced that the amendment was necessary in order to make the meaning quite clear, was willing that it should be adopted.

"The Hon'ble Mr. Egerton (the Member in charge of the Bill) said, if this were understood, and allowed to pass, as a mere verbal amendment, and if it were taken as merely rendering more plain the meaning of section 8 that compensation for loss or diminution of water-supply to inundation channels was not excluded by the use of the word 'flood' in clause (*a*), he should have no objection to the use of such words as would make that meaning clearer. But he did not assent to the amendment, because he thought it unnecessary, and because he thought that, according to the Bill as it stood, the meaning was sufficiently clear. The use of the word 'flood', in clause (*a*), did not, to his understanding, exclude the question of loss or diminution of water-supply to any natural or artificial channel under clause (*e*), because an inundation canal was supplied, not by floods, which he took to mean a general uncontrolled rise of a river in which the water overflowed its banks, but by the normal rise or fall of the river, which took place with regularity and was under control, by being passed into the channels of inundation canals through which the water was generally supplied for irrigation. If every rise of the river was to be considered a flood, then he thought the proper meaning was not assigned to the word. He did not think any Collector or Divisional Canal Officer authorized to grant compensation under this Act, would have any doubt as to what person should be compensated under clause (*e*); and as he thought the meaning was not doubtful, he must oppose the amendment."

Ultimately, the amendment was withdrawn. The discussion shows, incidentally, that the framers of the Act were of the view that damage done to owners of land on inundation canals—and not merely to riparian owners on the main river—by any new project must be compensated for and that section 8 (*e*) of the Act made sufficient provision for the purpose. We mention this point, because in

the present case we are concerned with a similar claim, although in respect of the inundation canals of a different Province.

26. (*c*) **In Sind.**—In Sind, the position is regulated by the Bombay Irrigation Act, 1879 (Bombay Act VII of 1879), as amended by Sind Acts VI and XI of 1939 and XV of 1940. Generally speaking, the Act is on the same lines as the Northern India Canal and Drainage Act already mentioned.

We need not discuss the legal position in other Provinces.

27. Law in India as between the Government of one Province and the Government or inhabitants of another.—We now come to the third category of cases, where the question is between the Government of one Province and the Government or inhabitants of another. This is really the question with which we are immediately concerned in the present dispute. Under the Government of India Act, 1935, water, that is to say, water supplies, irrigation and canals, drainage and embankments, water storage and water power, is a subject falling in the Provincial Legislative List (Entry 19 of List II in the Seventh Schedule to the Act). If there were no limiting provisions in the Act, each Province would, by virtue of this entry and section 49 (2), be entitled to do what it liked with all water supplies within its own boundaries. There are, however, sections 130 to 132 of the Act which impose certain restrictions on the Provinces in this matter. If any action taken or proposed to be taken by one Province affects or is likely to affect prejudicially the interests of another Province or of any of its inhabitants, the Government of the latter Province may complain to the Governor-General under section 130. Thereupon, after appointing a Commission of investigation, the Governor-General (or, in certain circumstances, His Majesty in Council) may make such orders as he may deem proper in the matter ; and under section 131 (6) of the Act, the orders so made are binding on the Province affected thereby. The Act therefore recognizes the principle that no Province can be given an entirely free hand in respect of a common source of water such as an inter-Provincial river. This is in accordance with the trend of international law as well as of the law administered in all Federations with respect to the rights of different States in an inter-State river. The literature on this subject (save as to problems of navigation) is as yet scanty, but most of the material available until 1931 has been brought together in Prof. H. A. Smith's " Economic Uses of International Rivers " (1931), from which we have borrowed largely. An examination of the treaties between independent States from 1785 onwards shows that, taken as a whole, these treaties proceed upon the principle that works executed in the territory of one State require the consent of another, if they injuriously affect the interests of the

latter. One of these treaties may be noticed in some detail: the Convention relating to the development of hydraulic power affecting more than one State concluded at Geneva on December 9, 1923, between the British Empire, France, Belgium, Italy and various other countries. Although the Convention relates in terms to the development of hydraulic power, it is obvious that the same principle should apply to any other form of exploitation, such as irrigation. Article 4 of the Convention provides that "if a Contracting State desires to carry out operations for the development of hydraulic power which might cause prejudice to any other Contracting State, the States concerned shall enter into negotiations with a view to the conclusion of agreements which will allow such operations to be executed". Article 5 provides that the technical solutions to be adopted in the agreements shall be based exclusively upon considerations which might legitimately be taken into account in analogous cases of development in a single State, "without reference to any political frontier". If we may regard this Convention as typical, it would seem to be an international recognition of the general principle that inter-State rivers are for the general benefit of all the States through which they flow irrespective of political frontiers.

28. We may also refer here to certain rules enunciated by the Institut de Droit international at its Madrid Session of 1911. Only one of them is directly relevant:

> "Lorsqu'un cours d'eau traverse successivement les territoires de deux ou plusieurs États..... il ne peut être prélevé par les établissements (spécialment les usines pour l'exploitation des forces hydraulique) une quantité d'eau telle que la constitution, autrement dit le caractère utilisable ou le caractère essential du cours d'eau à son arrivée sur le territoire d'aval, se trouve gravement modifié". (Annuaire de l'Institut de Droit international, t. 24, p. 365, quoted at pp. 444, 445 of the 1937 Report of the Permanent Court of International Justice, Series C, Fascicule No. 81, The Diversion of Water from the Meuse.)

In other words, the upper State cannot take such a quantity of water from a common river as will seriously impair its utility in the territory of the lower State.

When we turn from international law to the decisions of Federal tribunals in disputes between member States, we find the same tendency. We shall discuss some of the more important of these decisions in due course.

29. No Province free to act regardless of injury to other Provinces.—It is clear then that under the scheme of the Government of India Act, 1935—which, as shown above, follows in this respect recent tendencies in other parts of the world—a Province cannot claim to do whatever it likes with the water of a river regardless of the injury which it might inflict on other Provinces or States lower down.

30. Limits of permissible action.—What then can it legitimately claim to do ? And when can we say that it oversteps the limits of permissible action ?. Until we have found some law or principle which would furnish an answer to these questions, we cannot determine the extent, if any, to which any proposed action " prejudicially affects " the interests of a neighbouring Province or State ; nor can we recommend to what extent that action should be permitted or restrained.

31. (*a*) When there is an agreement, that itself determines the limits.—When there is an agreement between the Provinces or States concerned, the problem is comparatively simple, because the agreement itself might well be regarded as determining their respective rights. There is, we believe, a growing practice of entering into such agreements, as being the most satisfactory solution of the problem. We have already seen that the Geneva Convention of 1923 enjoins such agreements.

32. Typical agreements.—We reproduce in Appendix III the substance of three agreements and one statute relating to the apportionment of common waters, which might be of interest and assistance in connection with the present controversy. The agreements are—

(1) between Mexico and the United States, signed in 1906, regarding the distribution of the waters of the Rio Grande River after the completion of a storage dam by the United States in New Mexico ;

(2) between Madras and Mysore, signed in 1924, regarding the distribution of the waters of the Cauvery river after the construction of the Krishnarajasagara Dam by Mysore ; and

(3) between Great Britain and Egypt, signed in 1929, regarding the distribution of the waters of the Nile in connection with the storage dam which had been constructed at Sennar in the Sudan.

The statute is that known as the Boulder Canyon Project Act (sometimes referred to as the " Swing-Johnson Act "), passed by

the Congress of the United States of America in 1928, relating to the apportionment of the waters of the Colorado river. The problems of the Colorado resemble in many respects those of the Indus river system and a short history of this statute may not, therefore, be out of place.

33. The Colorado River Compact and the Boulder Canyon Project Act, 1928.—The Colorado river rises in the State of Colorado and after a course of about 1,700 miles through various other States falls into the Gulf of California. The river and its tributaries drain an area of about 250,000 square miles in seven States—Colorado, Nevada, Utah, Wyoming, New Mexico, Arizona and California. The average annual flow of the river system is about 18,000,000 acre-feet or 25,000 cusecs. These figures are small compared with the corresponding figures for the Indus system, whose average annual inflow is of the order of 200,000 cusecs. In fact, the total discharge in the Colorado is less than one-fourth of the water that is wasted to the sea in the Indus basin. As early as 1907 President Theodore Roosevelt urged a broad and comprehensive plan of development for the Colorado river. "The plan in general", he pointed out, "is to enter upon a broad and comprehensive scheme of development for all the irrigable land upon the Colorado river with needed storage at the head-waters, so that none of the waters of this great river which can be put to beneficial uses will be allowed to go waste". There were other factors at work inducing co-operation for the development of the river: an increasing demand for electric light and power, the movement for public ownership of natural resources, the desire to prevent tedious litigation over questions of water rights and the necessity for flood control. (*See* "The Colorado River Compact" by R. L. Olson, 1926, pp. 1—14.) All these causes led to the appointment in 1921 of a Colorado River Commission to consider the problem. The deliberations of this Commission resulted in a document signed on November 24, 1922, known as the "Colorado River Compact". It divided the whole river basin into an upper and a lower section, the point of division being Lee Ferry. The Upper Basin comprised mainly the States of Colorado, New Mexico, Utah, and Wyoming, and the Lower Basin the States of Arizona, California, and Nevada. Most of the available water was apportioned between the two Basins, due provision being made at the same time for the satisfaction of the rights of Mexico. It was always understood that the apportionment would fail in years of low flow, unless storage was provided ("Mr. Hoover, Chairman of the Commission: I think it is obvious that the whole possibility of division rests on the promise of storage, otherwise, it is quite impossible"—Minutes of the Thirteenth Meeting, quoted in

Appendix II, page 305 of "The Colorado River Compact" cited above) but the Compact was studiously silent on the point, apparently because the signatory States wished to keep open the question as to who was to finance or construct the storage dam. We shall see that ultimately the Central Government came to the rescue and undertook the project. One of the articles of the Compact provided that it was to become binding and obligatory when approved by the legislatures of each of the signatory States and by the Congress of the United States. Six of the seven State legislatures ratified the agreement, but Arizona refused to ratify, while California and Utah subsequently cancelled their ratification. Several years of controversy followed and ultimately on December 21, 1928, the United States Congress passed the "Boulder Canyon Project Act" which approved the Colorado River Compact of November 22, 1922, subject to certain limitations and conditions, and at the same time waived the necessity for ratification by each of the signatory States. Instead, the Act provided that the approval was to become effective upon the ratification of the Compact, as so modified, by California and at least five of the six other States. The legislatures of all these States except Arizona ratified the modified Compact and the Act accordingly came into effect by a Proclamation of June 25, 1929.

34. As a point of some interest, it may be mentioned that the Boulder Canyon Dam built by the United States under the Act has a storage capacity of about 30,000,000 acre-feet and a height of 727 feet, being the highest dam in the world.

35. Unsuccessful challenge to the Boulder Canyon Project Act.—In the case Arizona *v.* California [1931] (283 U. S. 423), Arizona challenged the validity of the aforesaid Act. The plaintiff State alleged that although the improvement of navigation was amongst the recited purposes of the Act, the recital was a mere subterfuge designed to give Congress the appearance of jurisdiction and that in fact the diversion, sale and delivery of water from the river as authorized in the Act would not improve, but would destroy, its navigable capacity. The Court, however, held that as the improvement of navigation was one of the declared purposes of the Act and as the river was navigable and the means provided by the Act were not unrelated to the control of navigation, the grant of authority to build the dam and reservoir was a valid exercise of the constitutional power of the Centre to improve navigation. It may be mentioned that the Act authorized the United States Secretary of the Interior to construct the dam and the connected works. It also created a Fund known as the Colorado River Dam Fund : all revenues received in carrying out the provisions of the Act were paid into, and all necessary expenditure was made out of, this Fund, the

United States Treasury being authorized to make advances to the Fund up to a sum of 165,000,000 dollars. The dam and the reservoir were to be used for river regulation, improvement of navigation and flood control; for irrigation and domestic uses; and for power. The title to the dam, reservoir, plant, etc., was for ever to remain in the United States and the United States Government was to control, manage and operate the same. Thus the ownership, construction, maintenance, and operation of the dam and the connected works were all centralized. Another feature of the Act was that it did not itself attempt to fix the allotment of water for each of the seven States concerned. The Compact had made an apportionment as between the Upper Basin and the Lower Basin, and this was generally approved by the Act; any further apportionment amongst the individual States of each Basin was apparently left to the States themselves to work out. It may be mentioned that the original purpose of the Colorado River Commission was to apportion the water amongst the individual States; but this was not found possible and the next best course, basin-wise apportionment, was adopted. It is unnecessary to enter into other details, either of the Compact or of the Act. We should like to point out, however, that the Compact would have been abortive for lack of absolute unanimity amongst the States concerned, if the Centre had not intervened by imposing the statutory solution.

36. Agreement between units concerned would be the best solution in the present case.—An agreement between the various units concerned in the present dispute providing for an apportionment of the waters of the Indus and its tributaries would, undoubtedly, be the most satisfactory solution: it would not only put an end to the controversy that has arisen, but might also prevent future controversies. In the absence of such an agreement, it is a question for consideration whether an apportionment cannot be imposed upon the parties by orders under section 131 of the Government of India Act, 1935, in much the same way as the United States Congress imposed an apportionment by statute after the failure of the Colorado River Compact for lack of ratification.

37. A final apportionment of the Indus system, to be practicable, would probably require the construction of two new barrages in Sind, and would raise questions of finance which might prove insoluble without the intervention of the Central Government. The Central Government were not represented before us during the present investigation, and we are therefore not in possession of their views in the matter. We shall content ourselves with setting out the main facts of the situation as they have been put before us.

38. Case for final apportionment of Indus system.—The most important factor calling for notice is the large quantity of water that is at present running waste to the sea. The following figures, abstracted from the Punjab Defence, Vol. I, are instructive. During the period 1932-33 to 1940-41, the average quantity of water in the Indus basin utilized by the Punjab and by Sind (including, in each case, the adjoining Indian States) and the average quantity wasted to the sea in each month were :—

Month.	Utilizations.			Mean monthly discharge in cusecs wasted to the sea.
	Mean monthly discharge in cusecs utilized by the Punjab.	Mean monthly discharge in cusecs utilized by Sind.	Total utilized.	
1	2	3	4	5
April	38,340	15,730	54,070	49,419
May	62,906	27,792	90,698	86,551
June	89,786	59,810	149,596	185,465
July	94,607	85,917	180,524	265,317
August	95,114	103,507	198,621	357,942
September	90,297	59,058	149,355	187,725
Mean Kharif ..	78,509	58,636	137,145	188,737
October	55,385	30,882	86,267	46,634
November	32,030	22,956	54,986	21,899
December	24,936	11,872	36,808	19,938
January	23,987	19,065	43,052	13,842
February	28,174	20,607	48,781	9,920
March	36,427	15,584	52,281	22,255
Mean Rabi ..	33,490	20,206	53,696	22,414

The above table shows the enormous volumes that are at present being wasted to the sea, particularly during the Kharif season, April to September—nearly four times the total flow of the Colorado system. (The wastage in Kharif works out to about 69

million acre-feet; the annual flow of the Colorado system is about 18 million acre-feet).

39. Solution by final apportionment would necessitate financial assistance to Sind.—The new Punjab schemes, if permitted, will take only a fraction of this large waste. The most important of the new schemes is the Bhakra Dam Project which contemplates the irrigation of a gross area of about 46 lakhs of acres, lying mainly in the district of Hissar and in the State of Bikaner, with a canal of 10,500 cusecs. To enable these schemes to be executed without any risk to Sind, Sind's inundation canals would have to be converted into weir-controlled systems. The two new barrages contemplated by Sind for this purpose will, however, not only assure adequate supplies to existing cultivation, but are also expected (in Sind's forecast) ultimately to bring under cultivation about 19 lakhs of acres of new land. It is clear from these figures that, while there is a vast volume of water running waste to the sea, there are at the same time large areas both in the Punjab and Sind which need water. Speaking in 1873 on the Northern India Irrigation Bill, the Lieutenant Governor of Bengal described the Punjab as a land where water was worth its weight in gold. The description would probably be equally true of Sind. In an American case of 1931, Justice Holmes said : "A river is more than an amenity, it is a treasure." These observations have added force today, when it is considered so essential to increase the production of food crops in the country in every possible way. A national asset of such value ought not to be wasted, unless its exploitation proves to be prohibitively expensive. On this last point, we have to speak with some diffidence. From the figures put before us by Sind, we gather that the two new barrages (which between them are estimated to cost about Rs. 16 crores, including the cost of Feeders and of developing irrigation) will not be productive in the sense of yielding enough to pay 6% on the sum at charge. But if the Province is able to borrow money at a lower rate of interest, *e.g.*, at $3\frac{1}{2}\%$, and also gets a contribution from the Punjab by way of compensation for damage, it is possible that they may more than pay their way. These, however, are financial details, for a full examination of which we have had neither the time nor the material. For example, the Punjab representatives have criticised Sind's estimates of cost as unduly high and of revenue as unduly low. It is clearly impossible for us in these proceedings to examine barrage sites, or designs, or rates, or to go into the question of Sind's revenue or taxation policy, and to pronounce an opinion on these estimates. The most that we can venture to say is that a solution by final apportionment of the river system will, even on the most conservative estimates of the cost of the requisite barrages,

necessitate some kind of assistance or accommodation to Sind. While urging the parties to seek such a solution by negotiation with all the authorities concerned, and while promising them such assistance as we could give in the matter of drafting details, we have, for obvious reasons, hesitated to formulate a scheme ourselves.

40. Punjab's reasonable contribution assessed at 15% of cost of new barrages.—If we were asked, on the materials before us, to assess the contribution which the Punjab might reasonably be asked to make as the price of such a settlement, we would indicate one possible line of approach to the problem thus :

Sind's proposed barrage projects (including Feeders and measures for developing irrigation) will have two effects :

(*a*) they will give a satisfactory supply of water to areas which are already occupied and which we shall call A ;

(*b*) they will give a satisfactory supply of water to new areas which are ultimately expected to be occupied, and which we shall call B.

Clearly, the Punjab cannot be asked to bear any share of the cost necessary to irrigate the unoccupied areas (B), since there is no question of any damage to them ; and even of the cost necessary to give a satisfactory supply to the occupied areas (A), she can be expected only to bear a certain portion, as we shall show presently. The first part of the problem is to ascertain the share of the cost of the barrages which is properly debitable to the improvement of the occupied areas (A) ; the second part of the problem is to ascertain what portion of that share is properly to be debited to the Punjab.

From Sind's note on remedial measures (sheets 169, 181 of Sind's Kharif Case, Volume I) it would appear that A=1,609,000+ 1,080,000 or 2,689,000 acres, and $A+B$ (net C. C. A.) = 1,966,000+ 2,249,000 or 4,215,000 acres. Now, it is true that the unoccupied areas, once they are fit for occupation, stand to gain more from the barrages than the occupied areas, acre per acre. But, on the other hand, we have to remember that the new areas are not expected to be fit for occupation all at once ; in the case of the Gudu barrage, the sales of these areas to intending occupiers are spread over a period of twenty years, and in the case of the Hajipur barrage, over a period of forty years, after construction. We may not be far wrong, if we treat these two factors as neutralising each other, and distribute the cost between the occupied and unoccupied areas according to acreage. It follows that if the total cost of the barrage projects be x, the share of the cost necessary to give a satisfactory supply to $A = \frac{A}{A+B}\, x = \frac{2689}{4215} x$.

41. We must bear in mind that even at present, that is, even without the additional projects contemplated by the Punjab, the *A* areas do not receive satisfactory inundation supplies. Their existing supplies have in fact fallen below what Sind would call "demand level". What is the demand level for the more important inundation canals of Sind appears from the Demand Statement at page 267 of the Punjab Defence, Vol. III-A, which purports to have been taken from Sind's "Demand Graphs" (Sind Document No. 5). The method of plotting the Demand Graphs has been described in paragraphs 7·3·1 to 7·3·9 on sheets 54, 55 of Sind's Kharif Case, Vol. I, and according to Sind they represent the requirements of the canals on a very conservative estimate. On this assumption, the difference between the actual average supply drawn and the demand level may be said to represent the deficiency of the inundation canals due to causes already in existence. Let us call this existing difference *E*. The additional withdrawals contemplated by the Punjab are expected to cause a further deficiency represented by the difference between the actual average supply hitherto drawn and the reduced supply which will be available after the additional withdrawals. Let us call this further drop *F*. Since existing factors have caused a deficiency in supplies measured by *E* and the additional withdrawals are expected to cause a further deficiency measured by *F*, the total cost of remedying the deficiencies due to both sets of causes and giving a satisfactory supply to *A* must be shared between the two in the proportion of *E* to *F*. This total remedial cost being, as already explained, $\frac{A}{A+B}\,x$, it follows that the Punjab's additional withdrawals must bear a share of the cost equal to $\frac{F}{E+F} \cdot \frac{A}{A+B}\,x$.

42. We have worked out the value of the fraction $\frac{F}{E+F}$ for each of the months, June, July, August and September, adopting for *F* the mean of the "Set A" and "Set C" drops. For the purposes of this calculation we have taken the figures given in Statements 3, 4, 5 and 7 at pages 267, 268, 269 and 271 of Punjab Defence, Vol. III-A. There has been no criticism of these figures by Sind, although there has been criticism of certain other figures connected with Punjab Document P-43. We find that the value of the fraction for June is 24%, for July 17%, for August 18%, and for September 17%. We must take the highest of these figures, for if, say, 24% of the crop cannot be sown owing to lack of water in June, the fact that more water would have been available later is no mitigation of the injury. Taking, then, the highest of these figures as a rough index of the reduction in the crop out-turn due to the Punjab withdrawals,

the Punjab's contribution works out to 24% of $\frac{A}{A+B}\ x$, or (since $\frac{A}{A+B} = \frac{2689}{4215}$) about 15% of the total cost of the two new barrages including Feeders and measures for developing irrigation.

43. It will be seen from Vol. II of this Report that we estimate the cost of the barrages including the Feeders, but excluding the cost of developing irrigation, at Rs. 12 crores ; adding Rs. 2 crores for the cost of developing irrigation, the total comes to Rs. 14 crores, so that the Punjab's contribution should, on this basis, be about Rs. 2 crores. This figure agrees with the figure which has been arrived at by another line of approach in Vol. II of this Report. We should like to emphasize that these estimates are merely the best that we can make on the materials produced before us ; if the parties can arrive at a more satisfactory estimate, so much the better. (See pages 115—118 of Vol. II of the Report).

44. (a) **Existence of treaty or agreement simplifies ascertainment of rights.**—A recent case before the Permanent Court of International Justice (decided by the Court on June 28, 1937) turned on the interpretation of a treaty of 1863 between the Netherlands and Belgium for the apportionment of the waters of the Meuse. [Permanent Court of International Justice, Series A/B, Judgments, Orders and Advisory Opinions, Fascicule No. 70, " The Diversion of Water from the Meuse."] The existence of the treaty simplified the Court's task ; all that the Court had to do was to find whether certain works executed or to be executed by the parties were or were not in violation of the treaty, and any discussion of the general principles of international law governing the utilization of international rivers by riparian States became unnecessary. In fact, the Court refused to travel beyond the treaty, although aware that the treaty, concluded nearly seventy years previously, was, owing to various changes of circumstance that had taken place since, no longer an adequate protection for the mutual interests of the parties. [*Loc. cit.* pp. 16, 53, 79, 80.] One of the Judges observed on this point : " As long as the Treaty remains in force, it must be observed as it stands." [*Loc. cit.* p. 43. See also the argument of Counsel for Belgium (M. de Ruelle) in Series C, Fascicule 81, p. 409.]

45. (b) **Manner of ascertaining rights when there is no agreement in existence.**—It would thus appear that where there is a treaty or agreement between the parties, that in itself furnishes the best means of ascertaining their mutual rights. Where, however, there is no agreement or treaty, how are their rights or legitimate interests to be ascertained ?

46. Writing in March 1926, the Nile Commission, in adjudicating upon a dispute between Egypt and the Sudan, said : " Precedents in the matter of water allocation are rare and practice varied ; and the Commission is aware of no generally adopted code or standard practice upon which the settlement of a question of inter-communal water allocation might be based." [Para. 21 of the Nile Commission's Report incorporated in Cmd. 3348, Treaty Series No. 17 (1929).]

47. In 1930 Prof. H. A. Smith, commenting on cases of the type of Connecticut *v.* Massachusetts (282 U.S. 660) remarked, " These cases involving the economic use of international rivers are rapidly increasing in number and importance, and in future they seem likely to arouse more discussion than the questions of navigation rights which have hitherto furnished the main juristic interest of these waterways. The general principle of free navigation has now been so widely established that little remains to be done except to adjust its application to particular cases. But the group of problems connected with diversion is now introducing us to a chapter of International Law which is still in the making." [British Year Book of International Law, 1930, p. 196.]

48. American precedents.—These problems appear to have arisen in recent years in the United States of America more than anywhere else and we may therefore turn to the decisions of the Supreme Court of that country for guidance. The following cases are particularly instructive :—

Kansas *v.* Colorado [1907] (206 U. S. 46).

Wyoming *v.* Colorado [1922] (259 U.S. 419).

Connecticut *v.* Massachusetts [1931] (282 U.S. 660).

New Jersey *v.* New York [1931] (283 U.S. 336).

Arizona *v.* California [1931] (283 U.S. 423).

Washington *v.* Oregon [1936] (297 U.S. 517).

Arizona *v.* California [1936] (298 U.S. 558).

Wyoming *v.* Colorado [1936] (298 U.S. 573).

Hinderlider *v.* La Plata River & Cherry Creek Ditch Company [1938] (304 U.S. 92).

49. Before going into the details of these cases we may mention that, broadly speaking, three different views on the subject of the rights of States in respect of an inter-State river have been advanced from time to time. The first proceeds on what is called the doctrine of sovereignty. According to this view every Province or State has, in virtue of its sovereignty or quasi-sovereignty, the right to

do what it likes with the waters within its territorial jurisdiction regardless of any injury that might result to a neighbouring unit. Pushed to its logical conclusion, this means that a Province in which the head-waters of a great river are situated can abstract any quantity of water and make a desert of the Provinces or States lower down. We have already pointed out that this view is against the trend of international law and that in any event, so far as India is concerned, it would conflict with the manifest intention of section 130 and the succeeding sections of the Government of India Act, 1935.

50. A second view that has sometimes been urged is that the rights of riparian Provinces or States should be determined by the common law principle which applies to individual riparian owners in England. This principle, as already mentioned, is that every riparian proprietor is entitled to the water of the stream in its natural flow, without sensible diminution and without sensible alteration in its character or quality. Pushed to its logical conclusion, this principle would enable a Province or State at the mouth of a big river to insist that no Province or State higher up shall make any sensible diminution in the water which comes down the river: there may be desert areas in the upper Province needing irrigation and there may be vast quantities of water running waste to the sea past the lower Province; nevertheless, on this common law principle, a lower Province can insist that the water shall flow down the river without sensible diminution, even if this means that the upper desert areas shall for ever remain desert.

51. A third principle that has been advocated is that of " equitable apportionment ", that is to say, that every riparian State is entitled to a fair share of the waters of an inter-State river. What is a fair share must depend on the circumstances of each case ; but the river is for the common benefit of the whole community through whose territories it flows, even though those territories may be divided by political frontiers.

52. Rule of " equitable apportionment " consistently applied in America.—In all the American cases that we have mentioned, the Court has consistently applied the third of these principles, that is to say, the principle of " equitable apportionment ".

53. Detailed discussion of relevant American cases.—We shall now describe in some detail the facts and decisions in each of these cases.

(1) *Kansas v. Colorado* [*1907*] (*206 U.S. 46*).

54. This case arose out of the use of the waters of the Arkansas river. The Arkansas rises in the Rocky Mountains in Colorado,

flows south-east for 280 miles in Colorado, then flows east and south-east for 300 miles through Kansas, then through Oklahoma Indian Territory and Arkansas into the Mississippi. The average annual flow of the river at the Colorado-Kansas State line is about 200,000 acre-feet, or a little under 300 cusecs. (Transactions of the American Society of Civil Engineers, Vol. 90, 1927, page 1039.) Colorado, the upper State, began to appropriate the waters of the river between Cañon City and the Kansas border for irrigating barren, arid land in Colorado. At the time of the suit, the area irrigated from the Arkansas River and tributaries was: in Colorado 300,000 acres; in Kansas 22,000 acres (*loc. cit.* page 1041). The suit was brought by Kansas in 1901, and was decided in 1907. The substance of the complaint was that Colorado was using up the water of the river for a huge irrigation scheme and that she intended to exhaust the flow of the river. The complaining State, Kansas, recognized the English common law rule of riparian rights within her own borders and contended that the same rule should be applied between herself and another State. On this basis, Colorado would hardly have been able to appropriate any water for irrigation. Colorado contended, on the other hand, that by virtue of her sovereignty, she was entitled to consume all the waters within her boundaries. Neither of these extreme contentions was accepted. The Court held that the States had equal rights and that " equality of right and equity " forbade interference with the existing withdrawals (as distinct from any proposed future withdrawals) of water in Colorado. The Court observed that although these existing withdrawals had caused perceptible injury to portions of the Arkansas Valley in Kansas, yet, to the great body of the Valley, they had worked little, if any, detriment. On the other hand, they had resulted in the reclamation of large areas in Colorado, transforming thousands of acres into fertile fields. The complaint was accordingly dismissed without prejudice to the right of the plaintiff to institute new proceedings, if the depletion of the waters by Colorado continued to increase " to the extent of destroying the equitable apportionment of benefits between the two States resulting from the flow of the river." The principle of " equitable apportionment " was thus laid down. Each party was ordered to pay its own costs.

(2) *Wyoming v. Colorado [1922] (259 U.S. 419).*

55(1) This is regarded by some authorities as probably the most important irrigation case decided by the U. S. Supreme Court and it therefore merits a detailed description. The State of Wyoming brought the suit against the State of Colorado and two Colorado Corporations to prevent a proposed diversion of the waters of the Laramie river, an inter-State stream. Wyoming, the plaintiff in

the suit, is the lower riparian State and Colorado the upper The suit was brought in 1911 ; the evidence was taken in 1913 and 1914. The case was argued three times and was finally decided in 1922. This is an indication of the complexity of the issues involved in disputes of this kind.

(2) A detail of procedure which may be of some interest is that as the United States appeared to have a possible interest in some of the questions raised in the case, notice was given to the Attorney-General, and a representative of the United States participated in the subsequent hearings. In the proceedings before us also, notice was informally given to the Government of India, but no representative attended.

(3) The Laramie is a non-navigable river rising in Colorado. It flows for 27 miles through Colorado, then crosses into Wyoming, flows for 150 miles through Wyoming and then joins the North Platte river. Both Colorado and Wyoming are in the arid region where flowing waters had long been commonly diverted from their natural channels for purposes of irrigation.

(4) The cause of action was that the two defendant Corporations were, with the permission of Colorado State, proceeding to divert a considerable portion of the waters of the river into another valley so situated that none of the water could return to the Laramie.

(5) Wyoming sought to prevent the diversion on two grounds : (*a*) that the waters of the inter-State stream could not rightfully be diverted to another valley from which it could never return ; and (*b*) that the proposed diversion would not leave in the stream sufficient water to satisfy certain prior and superior appropriations to which Wyoming and her citizens were entitled. Colorado and her co-defendants sought to defend the proposed diversion on three grounds : (*a*) that Colorado had the right to dispose, as she might choose, of all the waters in the portion of the river within her borders, regardless of any injury to Wyoming and her citizens (the doctrine of " sovereignty " again) ; (*b*) that Colorado was entitled to an equitable division of the waters of the river, and that the proposed diversion together with all the subsisting appropriations did not exceed her fair share ; and (*c*) that even after the proposed diversion there would be sufficient water in the river to satisfy all prior Wyoming appropriations.

(6) The Court had no difficulty in rejecting the first of Colorado's contentions and in reaffirming the rule of equitable apportionment laid down in Kansas *v.* Colorado. But whereas in that case the Court was content with deciding negatively that Colorado's

existing appropriations did not justify any interference, here it had to decide affirmatively to what extent Colorado's proposed diversions should be restrained. For this purpose, a general phrase like " equitable apportionment " afforded little guidance ; something more definite was required. This the Court found in the law which each of the two States applied within her own borders, namely, the doctrine of appropriation which we have already described (see paragraph 21 of this Report). The Court observed that this doctrine " prompted by necessity and formulated by custom, received early legislative recognition in both territories and was enforced in their Courts". The cardinal rule of the doctrine is that priority of appropriation gives superiority of right. Each of the States applied this rule as between individuals in her own territory and considered it to be just and reasonable in the natural conditions of that region. Upon these considerations the Court held that " equitable apportionment " of the inter-State river as between the two States would best be secured by applying the same rule. It is hardly necessary to point out that this rule, like the rule of equitable apportionment, destroyed the first of Colorado's defences (based on the doctrine of sovereignty) which asserted in effect that she could withdraw as much water as she wished, regardless of Wyoming's priorities. Wyoming's first contention, namely, that the proposed diversion was to another valley from which she could receive no benefit, was also pronounced untenable, because in neither State did the right of appropriation depend on the place of use being within the same valley. The practice of diverting water to another valley was common in both States and had been recognized by their Courts.

(7) The grounds upon which the Court applied the doctrine of appropriation for purposes of equitable apportionment in this case are particularly instructive. Each State had adopted the doctrine for her own internal purposes and the Court considered it eminently just and equitable to act upon the same doctrine as between the two States. When we come to discuss one of the later cases, Connecticut *v.* Massachussets [1931] (282 U. S. 660), we shall find that each of these two States recognized the common law rule that a riparian owner has the right to the natural flow of the stream without sensible diminution ; nevertheless, the Court refused to apply that rule to the decision of the dispute between the two States. The reason is obvious : the paramount rule in every inter-State case of this kind is that of equitable apportionment. The common law rule of riparian rights is completely destructive of equitable apportionment, for, under that rule, the upper owner can hardly take any share—far less his fair share—of the water of the river for purposes of irrigation. Therefore, that rule cannot be applied to an inter-

State dispute even where it is recognised by both the States in their own internal disputes. The doctrine of appropriation, on the other hand, is consistent with equitable apportionment, provided that the prior appropriator is not allowed to exceed reasonable requirements. This condition is in fact part of the doctrine as enunciated by the Court in Wyoming *v.* Colorado [1922] (259 U. S. 419, 459) and again in Arizona *v.* California [1936] (298 U. S. 558, 566). Moreover, this doctrine is dictated by considerations of public interest : in arid territories where irrigation is a prime need, there would be no incentive for any individual or State to spend money upon an irrigation project, unless there was some assurance that it would not be ruined by subsequent diversions higher up the river. Where, therefore, both the States in an inter-State dispute recognize the doctrine of appropriation within their own borders, the most equitable course is to apply that same doctrine to the determination of the dispute.

(8) A point of some importance as to the date from which priority is to be reckoned was also decided in this case. It appears that Colorado's proposed diversion from the Laramie was first conceived as a possibility in 1897. There was a survey in 1902 and there were other surveys in subsequent years. But the question whether and how the proposed appropriation could be made remained an open one until the contract between the Irrigation Company and the Irrigation District was made in 1909. In these circumstances, the Court held that the appropriation should, for purposes of priority, be regarded as dating from 1909. " Up to that time the whole subject was at large ; there was no fixed or definite plan. It was all in an inceptive and formative stage—investigations being almost constantly in progress to determine its feasibility and whether changes and alternatives should be adopted rather than the primary conception. It had not reached a point where there was a fixed and definite purpose to take it up and carry it through. An appropriation does not take priority by relation as of a time anterior to the existence of such a purpose."

(9) Certain other details may be of some interest. Colorado led evidence to show the average yearly flow in the river during a long period, as if that constituted a proper measure of the available supply. The Court considered that this was not a proper measure, because of the great variation in the flow. " To be available in a practical sense, the supply must be fairly continuous and dependable. .....Crops cannot be grown on expectations of average flows which do not come, nor on recollections of unusual flows which have passed down the stream in prior years. Only when the water is actually applied does the soil respond." The Court also rejected

the lowest natural flow during a given period as a true measure of the available supply. "According to the general consensus of opinion among practical irrigators and experienced irrigation engineers the lowest natural flow of the years is not the test." "In practice," the Court went on to observe, "they proceed on the view that within certain limits a fairly constant and dependable flow materially in excess of the lowest can be obtained by means of reservoirs." To this Wyoming objected that such a view would in effect put upon her the burden of providing storage facilities. Nevertheless, the Court considered that for the purpose of computing the supply available it was reasonable to proceed on that view. It appears to have adopted neither the average over a long period nor the minimum, but the lowest average of any two successive years, excluding the years of exceptionally low flow. Apparently, the Court worked upon the assumption that it is possible to store water in one year for use in the next, but not for longer periods.

(10) The judgment also contains some interesting observations about losses through evaporation, etc. "In diverting and applying water in irrigation there is a material loss through evaporation, seepage, and otherwise, which is unavoidable. The amount varies according to the conditions, chiefly according to the distance the water is carried through canals and ditches and the length of time it is held in storage. Where the places of use are in the same watershed and relatively near the stream, as is true of the lands on the Laramie plains served by the greater part of the Wyoming appropriations, a substantial amount of water goes back into the stream from irrigated areas and becomes available for further use lower down the stream. This is called return water. The amount varies considerably and there are no definite data on the subject." (*Loc. cit.* p. 483.)

(11) Ultimately the Court held that 170,000 acre-feet per year was the probable available supply, taking into account the practicable storage facilities and use of return water. This was the estimated supply at Woods, after the recognized Colorado appropriations were satisfied. Adding to this a contribution from the Little Laramie of 93,000 acre-feet and a further contribution of 25,000 acre-feet from certain smaller tributaries, the Court arrived at a figure of 288,000 acre-feet as available for Wyoming's prior appropriations and Colorado's proposed appropriations. The date of the proposed Colorado diversions for purposes of priority being taken as 1909, the Court calculated Wyoming appropriations prior to that date as being 272,500 acre-feet. This left 15,500 acre-feet for Colorado. A decree was accordingly made restraining the defendants from

taking more than 15,500 acre-feet. As regards costs, Wyoming was made liable for 1/3, Colorado for 1/3 and the two defendant Corporations jointly for 1/3.

(12) A curious result of the decree was that although it purported to recognize Wyoming's prior appropriations, actually, in a year of low flow, it was Wyoming that suffered. For, while Colorado, being the upper State, could draw her full quota of 15,500 acre-feet allowed by the decree of 1922, the water that remained was not sufficient even for the pre-1909 appropriations of Wyoming. This actually happened in 1922 itself, so that Wyoming's legal victory proved in practice to be an empty one. A Governor of Wyoming was of opinion that the State would have done better to seek an agreement with Colorado instead of engaging in legal combat. (See the Transactions of the American Society of Civil Engineers, Vol. 90, 1927, pp. 1052, 1053.) A solution by agreement is best in the end for all concerned.

(3) *Wyoming v. Colorado [1936] (298 U. S. 573).*

56. (1) A sequel to the last case occurred in 1936, when Wyoming sued Colorado again to enforce the previous decree on the ground that Colorado and her water claimants had been taking more water than was allowed by the decree and thereby working material injury to Wyoming and her water claimants. Wyoming succeeded in obtaining an injunction ; she was also given leave to apply in due course for an order respecting the measurement and recording of diversions in the event of the two States being unable to agree ; the Court retained jurisdiction for the purposes of such an application ; and the costs were taxed one-half to each of the two States. The decisions of interest in the latter case are mainly two : the Court held (1) that as the former suit was one between two States, each acting as a quasi-sovereign and representative of the interests and rights of her people in a controversy with the other, the water claimants in Colorado and those in Wyoming were bound by that decree as much as the States themselves [it should be remembered that the earlier decree established " the right of the State of Colorado or of anyone recognized by her as duly entitled thereto " to divert and take within that State certain supplies of water]; (2) that a State may, consistently with a decree in an inter-State suit determining rights in an inter-State stream, whereby the validity of various appropriations in specified amounts is established, permit diversion under any of the recognized appropriations in excess of the accredited quantity of such an appropriation so long as the total diversions under all do not exceed the aggregate of the quantities accredited to them severally. Briefly, a State may take more water

in one place and less in another, so long as its total allotment is not exceeded.

(2) The first of these points is essentially covered, so far as India is concerned, by sections 130 and 133 of the Government of India Act, 1935. A complaint under section 130 lies whenever the interests of a Province or of any of its inhabitants have been or are likely to be affected prejudicially by action taken or proposed to be taken in another Province with respect to a common source of water; and the effect of section 133 is that none of the inhabitants affected can bring any independent suit or action in such a case. Any relief to the individuals concerned can only come from the orders passed under section 131 of the Act. As far as can be judged from the language of section 131, there is nothing to prevent the Governor-General or His Majesty in Council, as the case may be, from granting relief to any individuals affected. The complaint under section 130 must always be by a Province (or a Federated State); but the relief need not be confined to the Province as a whole. Indeed, there may be cases in which the only injury done or likely to be done by a project executed or contemplated in another Province is to certain individual owners of a limited area in the complaining Province. In such circumstances, we see no reason for holding (as Sind invited us to hold) that no relief can be given to those individuals, or that any compensation intended for them must be awarded to the complaining Province. Section 131 (5) provides that the Governor-General (or His Majesty in Council) shall give such decision and make such order in the matter of the complaint " as he may deem proper ": the discretion so vested in the Governor-General (or His Majesty in Council) seems to us to be absolute.

(3) Another point of interest in the *Wyoming v. Colorado* case of 1936 is the complaint made by Wyoming of lack of co-operation from Colorado. We have had similar apprehensions expressed in the present case and the observations of the Supreme Court on this part of Wyoming's complaint may be worth reproducing. " In the bill it is complained that Colorado, although requested so to do, has refused to permit Wyoming to instal measuring devices at the places of diversion for the purpose of ascertaining the amount of water being diverted in Colorado from the river and its tributaries, and there is a prayer for a decretal order permitting such installation. The evidence bearing on this matter can hardly be regarded as establishing the propriety of such an order, and yet it tends to show a need for improving the means and methods of measuring the diversions, for keeping accurate and complete records thereof, and for according to the representatives of Wyoming full access to both the measuring devices and the records. Recognizing this need,

Colorado in her brief assures us that through her officers she will accord to Wyoming's officers free access to the measuring devices and to the registering charts, records, and other available data, will co-operate freely with them in devising an appropriate plan for measuring the diversions, and will give full consideration to such suggestions as they may make respecting the improvement of the measuring equipment. In this situation the order which is asked would be inappropriate. While the problem of measuring and recording the diversions is a difficult one, we entertain hope that the two States will by co-operative efforts accomplish a satisfactory solution of it. But we think Wyoming should have leave to apply to us for an appropriate order in the matter if the two States are unable to agree and it is found that there is real need for invoking action by us." (*Loc. cit.* p. 586.)

(4) *Connecticut v. Massachusetts* [*1931*] (*282 U. S. 660*).

57. (1) This suit was brought by the State of Connecticut against Massachusetts to restrain the latter from diverting waters from the watershed of the Connecticut river in order to provide water for Boston and the neighbouring cities and towns.

(2) Massachusetts had by legislation authorized the diversion into the Wachusetts reservoir of the waters of the Ware and the Swift, tributaries of the Chicopee, itself a tributary of the Connecticut. Connecticut's complaint was that this would seriously reduce the flow in the Connecticut river and would, amongst other things, cause damage to agricultural lands that were subject to yearly inundation in that State.

(3) Each of these two States recognized within her own borders the common law doctrine that riparian owners have the right to the undiminished flow of the stream free from any contamination or burden. Connecticut, therefore, contended that the Court, following the law enforced by each of the States, should grant an injunction restraining any diversion by Massachusetts. On this point, however, the Court held that the proper law to apply to inter-State disputes was, as decided in Kansas *v.* Colorado, that of equitable apportionment. While the municipal law relating to like questions between individuals in each State is to be taken into account, it is not to be deemed to have controlling weight between States. In each inter-State dispute of this character, it is for the Court, upon a consideration of the pertinent laws of the contending States and of other relevant facts, to determine what is an equitable apportionment.

(4) On the facts of the case, the Court pointed out that the diversions contemplated by Massachusetts were already subject to

certain limitations imposed by the United States War Department. The nature of these limitations may be briefly indicated. The diversions from the Ware were not to exceed 85,000,000 gallons (U. S. A. measure) per day between October 15 and June 15; and except during that period no water was to be taken at all. As regards the diversions from the Swift also, certain conditions had been laid down: in particular, it had been laid down that during periods of low water certain specified volumes of water would have to be released from the impounding dam so as, in effect, to ensure a minimum gauge height at Hartford in the interests of navigation. Because of these limitations, which Massachusetts undertook to respect, the Court found that the diversions would not reduce the height of floods in the Connecticut by more than one to six inches. This would result in some damage to small pieces of hay land; but the damage was not proved to be either large or even capable of being computed.

(5) The Court enunciated the rule that it would not exert its extraordinary powers to control the conduct of one State at the suit of another, unless the threatened invasion of rights was of serious magnitude and established by clear and convincing evidence. The burden on Connecticut to sustain the allegations on which it sought to prevent Massachusetts from making the proposed diversions was much greater than that generally required in a like suit between private parties. Connecticut had not discharged that burden in the present case. Drinking and other domestic purposes are the highest uses of water and the proposed diversions by Massachusetts were intended to supply Boston and other populous areas with water for these purposes.

(6) In the result, the complaint was dismissed without prejudice to the right of Connecticut to bring a fresh suit against Massachusetts whenever it should appear that the latter was taking more water than was authorized by its legislation as limited by the War Department. Each party was ordered to pay its own costs.

(7) The rule that the threatened invasion of rights must be of serious magnitude before the Supreme Court will control the conduct of one State at the suit of another doubtless rests on the fact that the American States were originally independent sovereign units. Recourse to the Supreme Court thus represents a substitute for war, the ultimate remedy in the case of disputes between independent States. As independent States do not resort to war except when the threatened invasion of rights is serious, analogy would dictate that the Supreme Court should not interfere except in such cases. Whether a similar principle ought to be

applied to disputes between Provinces in India may well be doubted. The only limitation imposed on the Governor-General's powers by section 131 of the Government of India Act, 1935, is that the issues involved should in his opinion be " of sufficient importance ".

(5) *New Jersey v. New York* [*1931*] (*283 U. S. 336*).

58. (1) This was a suit by the State of New Jersey to restrain by injunction the State of New York and the City of New York from diverting any water from certain tributaries of the Delaware to the watershed of the Hudson in order to increase the water supply of the City of New York. Pennsylvania was allowed to intervene in the proceedings to protect its interests against anything that might be done to prejudice its future needs.

(2) On the law to be applied to the case, the Court observed : " A river is more than an amenity, it is a treasure. It offers a necessity of life that must be rationed among those who have power over it. New York has the physical power to cut off all the water within its jurisdiction. But clearly the exercise of such a power to the destruction of the interest of lower States could not be tolerated. And on the other hand, equally little could New Jersey be permitted to require New York to give up its power altogether in order that the river might come down to it undiminished. Both States have real and substantial interests in the River that must be reconciled as best as they may be. The different traditions and practices in different parts of the country may lead to varying results but the effort always is to secure an equitable apportionment without quibbling over formulas ".

(3) It would seem that New York proposed to take some 600,000,000 gallons (U. S. A. measure) per day (equivalent to about 930 cusecs) from the tributaries of the Delaware. The Court found, on the report of the Master, that so large a withdrawal would have serious effects in certain respects, *e.g.*, by increasing the salinity of the lower part of the river to the injury of the oyster fisheries. The Court accordingly restricted the withdrawals to 440,000,000 gallons per day and imposed certain other conditions. Amongst them was that water must be released from the impounding reservoirs of New York City in sufficient volume to ensure a certain minimum flow at certain points of the Delaware river. The decree further provided that any of the parties, whether complainant, defendants or intervenor, might apply at any time for any further relief and the Court retained jurisdiction of the suit for this purpose. Subject as aforesaid, the injunction asked for was

refused. The costs were ordered to be paid by the parties in the following proportions :—

State of New Jersey	35 per cent.
State of New York	35 per cent.
City of New York	15 per cent.
Commonwealth of Pennsylvania ..	15 per cent.

(6) *Arizona v. California* [*1931*] (*283 U. S. 423*).

59. (1) We have already referred to this suit (see paragraph 35 *supra*) brought by the State of Arizona against California and other States of the Colorado basin and the U. S. Secretary of the Interior, in order to have the Boulder Canyon Project Act, which had been passed by the Congress of the United States on December 21, 1928, declared unconstitutional and void, and to restrain the defendants permanently from enforcing or carrying out the aforesaid Act or the Colorado River Compact. It will be remembered that the Act authorized the United States Secretary of the Interior, at the expense of the United States, to construct at Black Canyon on the Colorado river a dam, a storage reservoir and other works and provided for their control, management, and operation by the United States. Subject to certain conditions, the Act also approved the Compact, which, amongst other things, made an almost equal apportionment of water between the Upper Basin of the Colorado (including Colorado, New Mexico, Utah and Wyoming) and the Lower Basin (including Arizona, California and Nevada). Arizona was not satisfied with this apportionment.

(2) On the question of the constitutionality of the Act, the Court held that it was valid as an exercise of the constitutional power of the Congress to improve navigation. The Court considered it unnecessary to consider whether the validity of the Act could not be rested on other grounds also, *e.g.*, on the ground that it provided for the irrigation of public lands of the United States.

(3) Certain other claims made by Arizona were also rejected, and, in the result, the suit was dismissed without prejudice to any fresh application for relief in case the water stored in the Boulder Canyon Reservoir was used in such a way as to interfere with the enjoyment by Arizona of any rights already perfected or with the right of Arizona to make additional legal appropriations. At the time when the suit was filed, the construction of the dam and reservoir was apparently just being commenced.

(7) *Arizona v. California* [*1936*] (*298 U. S. 558*).

60. (1) In 1936, after the construction of the Boulder Dam had been completed, Arizona brought another suit against California

and the other five States of the Colorado Basin. To understand the object of this suit, it is necessary to remember that the Boulder Canyon Project Act specifically declared that nothing therein " shall be construed as interfering with such rights as the States now have either to the waters within their borders or to adopt such policies and enact such laws as they may deem necessary with respect to the appropriation, control, and use of water within their borders, except as modified " by inter-State agreement. As Arizona had made no such agreement, the Act left her legal rights with respect to appropriations from the river within her borders unimpaired. More than half of the Colorado—688 miles out of a total length of 1,293 miles—flows in Arizona or upon her boundary. She had also more than 2,000,000 acres of land, not yet irrigated, but susceptible of economic irrigation from the river. Arizona was, therefore, not satisfied with the apportionment made by the Colorado River Compact and approved by the Boulder Canyon Project Act ; she evidently considered it inequitable, having regard to her large riparian rights and needs. Accordingly, relying on the rule of equitable apportionment, Arizona brought this suit, praying that the quantum of her equitable share in the unappropriated water of the river be fixed by the Court, so that she might go forward with certain pending irrigation projects. Certain other reliefs were also asked for, but it is not necessary for our present purposes to mention them. The main relief sought was a judicial apportionment of the unappropriated water of the Colorado. The suit proved abortive, because the plaintiff omitted to implead the United States as a party. The Court observed that the equitable share of Arizona in the unappropriated water impounded above Boulder Dam could not be determined without ascertaining the rights of the United States to dispose of that water in aid and support of its project to control navigation. The petition was, therefore, dismissed. The question whether an equitable division of the unappropriated water of the river could be decreed in a suit to which the United States was also a party was left open.

(2) The point to notice in this decision is that the suit failed, not because the Court considered the rule of equitable apportionment inapplicable, but because no such apportionment could be made in the absence of one of the parties mainly concerned, namely, the United States.

(8) *Washington v. Oregon* [*1936*] (*297 U. S. 517*).

61. (1) This suit was filed by the State of Washington in 1931 against the State of Oregon. Washington alleged that Oregon was wrongfully diverting the waters of the Walla Walla river to the prejudice of the inhabitants of Washington, and prayed for an

adjudication apportioning the interests of the two States in the river and its tributaries, and restraining any use, or diversion of the waters found to be unlawful. Each of the States applied the doctrine of appropriation within her own territories, and the decision of the Court accordingly proceeded, as in Wyoming *v.* Colorado, on the basis of that doctrine.

(2) Upon the facts of the case, the Court found that there was no clear evidence of damage to Washington from the diversions complained of, and, in accordance with the rule that the Supreme Court will not exert its extraordinary powers to control the conduct of one State at the suit of another, unless the threatened invasion of rights is of serious magnitude and established by clear and convincing evidence, the suit was dismissed. The costs and expenses of the suit were divided (equally) between the parties in accordance with the usual practice in such cases, in spite of the fact that the suit had failed for insufficiency of evidence.

(9) *Hinderlider v. La Plata River & Cherry Creek Ditch Company* [*1938*] (*304 U. S. 92*).

62. (1) This suit was not one between States; it originated in 1928 in the district Court of La Plata County and came up on appeal in 1938 before the Supreme Court of the United States. Its interest lies in the Supreme Court's decision that even where two States recognize the doctrine of appropriation and the rule of priority which is part of that doctrine, the appropriations in each State, whatever their priority, must not be greater than the State's equitable share.

(2) The facts of the suit were briefly these. The plaintiff-respondent company, a Colorado Corporation, had, by a decree of 1898, secured the right to an appropriation of about 39 cusecs from the La Plata, an inter-State stream, rising in Colorado and flowing into the San Juan river in New Mexico. In 1925, the U. S. Congress consented to a compact between the two States providing for an equitable apportionment of this stream. As part of the arrangements for securing equitable apportionment, the compact provided that in times of low flow, the State engineers of the two States might distribute the water by rotation to the lands in each State in alternate periods. During one of these periods, when it was New Mexico's turn to take all the water, the Colorado Corporation was naturally unable to take its 39 cusecs and hence brought the suit for a mandatory injunction.

(4) As already stated, the Supreme Court held that as Colorado possessed the right only to an equitable share of the water in

the stream, the decree of 1898 did not award to the Colorado Corporation any right greater than the State's equitable share. Since that share was *nil* during any period when it was New Mexico's turn to take all the water under the scheme of equitable apportionment prescribed by the compact of 1925, the Colorado Corporation was not entitled to take any water during any such period. This, in effect, was the decision. The suit therefore failed.

(5) Incidentally, the Court observed that an equitable apportionment could be made between States by compact (with the consent of Congress), as here, or by judicial determination, as in Wyoming *v.* Colorado (259 U. S. 419).

(6) It appears to follow from the decision in this suit that, although an earlier appropriation by *A* in one State has ordinarily priority over a later appropriation by *B* in another State (as affirmed in Wyoming *v.* Colorado, 259 U. S. 419, 470-471), such will not be the case if and in so far as *A*'s appropriation exceeds his State's equitable share ; in other words, equitable apportionment is the dominant rule and prevails over the rule of priority, if and in so far as the two conflict.

63. We have now completed a review of the most relevant American precedents that we have been able to discover. Two other precedents, one from Switzerland and the other from Germany, have been mentioned in Prof. H. A Smith's " Economic Uses of International Rivers " from which the following summaries are taken.

64. (1) **European precedents also favour rule of " equitable apportionment ". The Zwillikon Dam Case (1878).**—This case began in 1871 as ordinary litigation between private parties, in which at a later stage the cantons concerned, Aargau and Zurich, intervened.

(2) The small stream of the Jonabach divides the cantons of Aargau and Zurich. At the village of Zwillikon, a Zurich firm called Biedermann Brothers built a dam in order to develop power for the use of their factory, and objection to this was taken by certain Aargau mill-owners whose properties lay further down the stream, the substance of their grievance being that the dam deprived them of a sufficient flow of water during normal working hours. Owing to the rate of flow from the dam, it was claimed that the Aargau owners lost four hours of working time each day. There was no question in this case of diversion. In 1872 Zurich passed a law permitting the erection of dams in all cases where they did not involve a loss of water during normal working hours, and providing further that dams might be erected even in such cases, provided that

loss to third parties was prevented by compensating works or that the parties reached an agreement. Under this law Biedermann Brothers obtained a licence for their dam, which was granted on condition that they should deposit a sum of 6,700 francs to the account of the millowners and provide for a sufficient flow of water between 4 a.m. and 8 p.m. The Canton of Aargau now took up the case before the Swiss Federal Tribunal, claiming that the Zurich statute was an infringement of her rights.

(3) The decision, which was rendered in 1878, laid down that Aargau had no proprietary interest in the water, but only a right to a reasonable share of the flow, and that this right was not infringed by the Zurich statute, which made equitable provision for the protection of riparian owners. Aargau herself had the power to remedy any injury that might be caused, since the sum of money deposited would enable the lower millowners to erect a dam which would provide them with the necessary water at all hours. In other words, the sum deposited was treated as the potential equivalent of a second dam which Aargau might construct in her own interests.

(4) The ruling of the Bundesgericht essentially rests upon the principle of the " equitable apportionment of benefits ", which was later adopted by the Supreme Court of the United States.

65. (1) The Donauversinkung Case [1927].—This case relates to the water of the Danube. The head-waters of this river are formed by a number of streams issuing out of the mountains of the Black Forest. As the main stream passes through the States of Baden and Württemberg, it loses by percolation a considerable volume of water during certain periods of the year. This water ultimately emerges above-ground to form the source of the small river, Aach, which flows through Southern Baden into Lake Constance. Thus, although the percolation takes place in two States, the whole of the benefit goes to Baden. Baden appears to have undertaken certain works designed to increase the percolation, while Württemberg, on the other hand, undertook certain works to diminish the percolation, each within her own borders. These measures ultimately became the subject of cross-actions before the German Staatsgerichtshof, each party seeking an injunction to restrain the activities of the other.

(2) The Court laid down that the exercise of sovereign rights by each member of the international community is limited by its duty not to injure the interests of other members, and no State may use the water in such a manner as to cause material injury to another. On the other hand, an attempt must be made to apportion or measure

the respective interests in an equitable manner, balancing the advantages gained by one State against the injury, or possible injury, caused to another. This appears to be substantially identical with the doctrine laid down by the United States Supreme Court in the case of Kansas *v.* Colorado. Baden was enjoined to abstain from artificial works calculated to increase the percolation, and Württemberg from such works as were calculated to reduce it. The Court pointed out that any real settlement of the controversy must rest upon an agreement between the parties.

66. Interesting points of detail to be gathered from American cases.—We have quoted all these precedents at some length, because they not only contain statements of general principle, but also various details which might be of assistance in the present case. The general principles emerging from them have already been summarised by us (para. 14 *supra*) and have indeed been accepted by all parties. We shall now proceed to mention some of the other points which appear to us to be worth noticing :—

(1) For the purpose of securing an inter-State agreement to prevent the waste of a national resource such as a large river, the Central Government, as in the Colorado case, may properly render such financial and other assistance as it constitutionally can. In India, apart from any other provisions, sections 150 and 163 of the Government of India Act, 1935, enable the Centre to assist Provinces on suitable terms.

(2) It is not unusual to impose restrictions upon the withdrawals of an upper riparian State in order to ensure a minimum gauge height or a minimum flow at places lower down the river, the upper State being required to release water for these purposes from its impounding reservoirs [see Connecticut *v.* Massachusetts (282 U. S. 660) and New Jersey *v.* New York (283 U. S. 336.)] Whether this course would be practicable in a given case must depend upon the circumstances of the case ; but there is nothing novel in the idea of regulating the upper State's diversions in this way.

(3) There is a growing tendency for the Court in disposing of an inter-State river dispute, to continue to retain jurisdiction to modify its decree as future circumstances may require [see New Jersey *v.* New York (283 U. S. 336) ; Wyoming *v.* Colorado (298 U. S. 573)]. In other words, it is desirable that the authority making the order should reserve liberty to modify it in certain particulars, if a change of conditions necessitates modification.

In the case before us, section 131 (7) of the Government of India Act, 1935, creates some doubt whether an order made by the Governor-General (or His Majesty in Council) upon the report of a Commission can be varied without the appointment of a new Commission.

But it seems to us that if the original order itself reserves liberty to the Governor-General (or His Majesty in Council) to prescribe certain specified particulars from time to time according to changing conditions, the necessary prescriptions may undoubtedly be made without the appointment of a new Commission. For example, suppose the Governor-General were to make an order in these terms : " For the purpose of ensuring an adequate gauge at Kotri the Governor-General may from time to time prescribe the maximum volume of water that may be taken into storage at the Bhakra Dam ". The prescription of different maximum withdrawals at different times in pursuance of such an order would not be a variation of the order so as to require the appointment of a new Commission each time a new maximum was to be prescribed.

(4) It may sometimes be necessary to grant to the lower State the right of inspection of the upper State's dams, reservoirs, and other works ; of meters and other measuring apparatus ; of the records of inflow, outflow, and diverted flow ; and so on [see New Jersey *v.* New York (283 U. S. 336)]. Jurisdiction to make orders for this purpose is sometimes specifically retained even after the decree [see Wyoming *v.* Colorado (298 U. S. 573)].

(5) In inter-State river disputes, costs are, as a matter of practice, equally divided between the States concerned.

67. Rule of equitable apportionment to be modified in its application to inundation canals in India.—We have seen that equitable apportionment is the dominant rule in the decision of inter-State river disputes and that, in America, even as between States recognising the rule of priority, a prior appropriation has to give way, if it exceeds the equitable share of the State concerned. In the application of these principles to India, certain special circumstances have to be borne in mind. Many of the appropriations in each Province had to receive the sanction of the Government of India or the Secretary of State before they could be made. There can hardly be any question of an appropriation of this kind exceeding the equitable share of the Province ; we must presume that it would not have been sanctioned, if it had been excessive. But the question does arise as regards inundation canals, which received no such sanction (some date from pre-British days) and which must, by their very nature, be an obstacle to equitable apportionment ; for, any abstraction of water higher up the river will ordinarily lower the level of the river below and interfere with their supplies. If their supplies are to be assured, it may happen that no diversion, however equitable and necessary, can be permitted at any higher point.

Not only is there inequity here, but there is also waste; for, inundation canals take only a very small fraction of the water required to maintain the river levels necessary for their working, the rest being wasted to the sea.

68. The argument has been put with great force in paras. 10 and 11 of the Punjab Defence, Vol. I, from which we quote the following extracts:

> " The proportions (of the water of the Indus system) utilized vary from year to year and from month to month but the following figures, which are the averages for August over the years 1932 to 1940, are representative and illuminating. In that month the total inflow at the foot-hills into the Indus system averaged 567,000 cusecs daily. Of this total the Punjab utilized 95,000 cusecs, while Sind withdrew 104,000 cusecs. Of the remainder 10,000 cusecs were lost in transit during the long course of the river from the hills to the sea, while the enormous volume of 358,000 cusecs was wasted to the sea ".

> " Sind contends that the Punjab and its neighbouring States shall not be permitted to utilize any of this 358,000 cusecs, now running wastefully to the sea, in order that she may not be deprived, as she alleges, of some small fraction of the discharges drawn by her inundation canals, which account for 66,000 cusecs out of her total withdrawal of 104,000 cusecs. The average Punjab additional withdrawals in August under all the schemes objected to amount to 76,000* cusecs or, roughly, one-fifth of the water wasted to the sea ".

> " The Punjab contends that in the arid conditions existing in the areas to be benefited by the Schemes under contemplation—areas which are visited at periodic and frequent intervals by all the horrors of famine—Sind has no right to demand that half the available supplies of the Indus shall be wasted to the sea and (that) it is incumbent on Sind to carry out at her own expense the works necessary to prevent such waste. It is the duty of Sind to take all such measures as may be necessary for enabling Sind to utilize the water available to her ".

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* Revised, according to the Punjab's " Set C " calculations, to 55800, see p. 46, Punjab Defence, Vol. III-A.

69. There is, however, another side to the picture. Undoubtedly inundation canals are a wasteful anachronism and the sooner they are replaced by weir-controlled systems, the better. But many miles of such canals are still in existence (Sind has over 3,000 miles including distributaries) and large numbers of people have for generations depended upon them for their livelihood. It may be that they and their Province cannot yet afford to instal a better and, in the beginning, more expensive system of irrigation. In the meantime, are they to be deprived of their living, merely because an upper Province needs the water ? If the upper Province wishes to take the water, let it pay adequate compensation in cash or in kind.

70. Inundation canals always given protection in India.— There is no doubt that this latter view has been uniformly taken in the past in India, whatever may be the rule in other countries. Sind has submitted to us a note setting out in detail a number of precedents from which we select three :—

(1) In 1901, the Punjab submitted the Lower Bari Doab project to the Government of India. It was found that the project was likely to cause some injury to the inundation canals of Bahawalpur State at the beginning and end of the irrigating season. The Government of India accordingly suggested that the Punjab Government should let the Bahawalpur Darbar understand that if it was decided to construct the canal, Government would be both willing and anxious to incur any expenditure which subsequent experience or further enquiry might show to be necessary to safeguard the interests of the State and to award reasonable compensation for any injury that might be unavoidable. Ultimately, the project was not proceeded with.

(2) In 1915, the Punjab submitted their Haveli project to the Government of India. This project was designed to safeguard the supplies in certain Punjab inundation canals which were endangered by the earlier Triple Canals Project. In submitting the Haveli project the Punjab pointed out that the tracts which would benefit were amongst the most backward and insecure in the Province and that their depressed economic condition was in a large measure responsible for the recent epidemic of dacoity and general lawlessness, and the scheme would do much to better their condition and remove the cause of disorder. On general grounds, therefore, there was everything to be said in favour of the proposed project, but the Bahawalpur Government protested against it on the ground that it would affect the Bahawalpur series of Chenab Inundation Canals and so the Government of India did not sanction it. They were

of the opinion that until the Sutlej Valley Project, then in contemplation, was in working order and the benefits anticipated therefrom for the Bahawalpur inundation canals were an accomplished fact, the efficiency of these canals should not be impaired by the withdrawals required for Haveli.

(3) According to the statement of Mr. Nicholson, the Punjab Member of the Anderson Committee, the Punjab Government paid about Rs. 76 lakhs to the Bahawalpur State towards the construction of the Panjnad Weir. That money was given for two reasons: one was that the Provincial Government wished to reserve to themselves the right to take off a canal from the Panjnad into Sind, if considered necessary; the second was that Bahawalpur, for many years, had been claiming that their inundation canals had been very adversely affected by the withdrawals by Government canals from the Punjab rivers above, and that, but for these withdrawals, it would have been unnecessary to build the Panjnad Weir, and therefore the Punjab Government should pay a portion of the cost. There is a similar statement in paragraph 5 of the Punjab Government Brief sent to the Anderson Committee: "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". (Page 34, Anderson Committee's Report, Vol. II.)

71. Nature and limits of protection as reflected in legislation.— So much for the Indian practice in this matter; the law, if we may generalize from the law within each Province, is even more illuminating. So far as the Punjab and certain other Provinces are concerned, we have already seen that the Northern India Canal and Drainage Act, 1873, empowers the Provincial Government, whenever it thinks expedient, to take water from a river for any irrigation project. If the project causes stoppage or diminution of supply to an inundation canal, the Act provides for compensation on a certain specified basis. The position under the Bombay Irrigation Act, 1879, is similar. These provisions clearly show the policy which the Legislatures concerned, the Central Legislature in the one case and the Bombay Legislature in the other, have thought it reasonable to adopt: no inundation canals in the Province are to stand in the way of a new irrigation project which the Provincial Government considers necessary, but compensation is to be given for any damage done to the canals by the project. It is true that these provisions apply only within each Province where either of the Acts cited is in force;

but they clearly proceed on the general principle that no new project, however beneficent in other ways, should be allowed to impair existing inundation canals without payment of compensation. Equally important is the implication that in other respects inundation canals are not to retard the progress of irrigation. We can see no reason why these two propositions, which are embodied in these Acts, should be limited by provincial boundaries. The essential principles need not be different merely because the project is in one Province and the canals in another.

72. Nature of protection recommended by the Nile Commission for basin irrigation in Upper Egypt.—A somewhat similar question arose before the Nile Commission of 1925. The greater part of Upper Egypt is under basin irrigation, largely dependent on natural flood levels in the Nile and only partially protected by barrages. Any abstraction of water in flood time in the Sudan was therefore bound to affect these levels to the detriment of the basin irrigation. To hold that the lands in question have an absolute right to undiminished natural levels would thus have precluded any abstraction of water by the Sudan. The Nile Commission approached the matter as a body of practical engineers and advised that development or conservation works in the upper part of the Nile should not be indefinitely restricted by considerations of the natural levels lower down, but that the Sudan should accept a limited rate of progress so as to give Egypt time to construct certain new barrages which she contemplated. If we may deduce any general principle from this advice, it is that established irrigation rights depending on the natural level of the river should be respected within certain limits, though they should not be allowed to put a veto for all time on the development of the upper areas. This is not essentially different from the policy followed in India.

73. Rights to underground water in India.—Before concluding this part of our Report we should like to say a few words about the right to underground water, as this is relevant to the question of "regeneration" or "return flow". It is often said that a considerable portion of the water taken from a river and used for purposes of irrigation within the watershed goes into the sub-soil and percolates back to the river. But, of course, it cannot do so, if it is intercepted on the way by the owner of the overlying land. It is therefore relevant to consider what his rights are with respect to such water. Underground waters fall into two classes: (1) those flowing in defined subterranean channels and (2) diffused percolating waters. We are here concerned mainly with (2). It is probable that the law in India on the subject, save where there

may be any statutory variation, is the same as the common-law rule in England laid down in the leading cases, *Chasemore v. Richards (1859) 7 H. L. C. 349, and Mayor of Bradford v. Pickles (1895) A. C. 587.* According to these decisions, the owner of land containing underground water, which percolates by undefined channels and flows to the land of a neighbour, has the right to divert or appropriate the percolating water within his own land so as to deprive his neighbour of it. In Chasemore *v.* Richards, the House of Lords had to decide whether the owner of land had a right to sink a well upon his own premises and thereby abstract the subterranean water percolating through his own soil which would otherwise, by gravity, have found its way into springs feeding a certain river, the flow of which the plaintiff in that action had enjoyed for upwards of sixty years. It was held that the land-owner had a right to do what he had done, whatever his purpose might be and although the purpose might be wholly unconnected with the enjoyment of his own estate. In Mayor of Bradford *v.* Pickles, the question was whether Pickles had a right to sink a shaft on his own land, the effect of which was to interfere with the underground water feeding certain springs which the Bradford Corporation had appropriated for the purpose of supplying the town of Bradford with water. It was again held that the defendant was within his rights. Illustration (*g*) to section 7 of the Easements Act, 1882, which is in force in certain parts of India (Madras, Central Provinces, Coorg, Bombay including Sind, and the United Provinces), refers to " the right of every owner of land to collect and dispose within his own limits of all water under the land which does not pass in a defined channel ". It follows that the volume of " return flow " percolating back to a river is liable to be reduced, if, amongst other things, the owners of the intervening lands should exercise their right of abstracting it by sinking wells or otherwise. This introduces another uncertain factor into the problem of " regeneration ".

74. We have now concluded our discussion of general principles. In the next Part of this Report we shall deal with the additional issues arising out of Sind's Kharif Case and in the third Part with Sind's Rabi Case. In the remaining Parts we shall deal with certain other matters that arise out of Sind's Complaint.

PART II.

SIND'S KHARIF CASE.

FINDINGS AND RECOMMENDATIONS.

75. Kharif issues.—The issues arising for decision on this part of Sind's Complaint are :—

(1) Which, if any, of the following schemes contemplated by the Punjab should be permitted and subject to what conditions, if any :—

(*a*) The Bhakra Dam Scheme as detailed in paragraphs 26 and 27 of the Punjab Defence (Vol. I);

(*b*) The Storage Schemes mentioned in paragraph 32 of the Punjab Defence ; and

(*c*) The Balloki-Suleimanke Link Scheme mentioned in paragraph 35 of the Punjab Defence ?

(2) Should the limits for the *Kharif* season fixed in paragraph 34 (*b*) of the Anderson Committee's Report, Vol. I, be allowed for non-perennial canals in Sind and if so, under what conditions ?

76. First Kharif issue—General statement of problem, method, and findings—On the first of these issues the parties have produced a large mass of material, most of it necessarily consisting of figures, in support of their respective contentions. Before proceeding to review this evidence, we should like to state in general terms the nature of the problem to be solved, the method adopted to solve it, and the conclusions reached.

77. The main problem is to predict what will be the cumulative effect, some 10 or 15 years hence (for, all the contemplated Punjab projects can hardly come into operation earlier), of certain withdrawals of water from the Indus and its tributaries at various places in the Punjab on the level of the river at certain places in Sind,

some of which are over 800 miles from the place of withdrawal. The difficulties of the problem are obvious.

78. The method adopted is to work out in the first instance what the cumulative effect would have been in certain past years, namely, 1932, 1933, 1934, 1935, 1936 and 1939, if these same withdrawals had been authorized in those years. The inference is then drawn that the effect is likely to be the same in future years ; this necessarily involves the assumption that the river conditions of the future will be generally similar to those of the past. How far such an assumption will prove correct no one can say with any degree of assurance.

79. Our general conclusion, subject, as all long-term predictions must be, to various assumptions, is that the withdrawals necessary for the Punjab projects mentioned in this issue, when superimposed upon the requirements of other projects already in operation or about to be completed, are likely to cause material injury to Sind's inundation canals, particularly in the month of September.

80. A detailed review of the technical evidence will be found in Vol. II of this Report.

81. First Kharif issue—Recommendations.—We now set out our recommendations on this issue. By way of preface, we should like once again to call attention to the vast quantities of water in the Indus basin that are at present running waste to the sea. In the month of August alone they amount to over 22 million acre-feet, which is more than the entire flow during the whole year in the Colorado basin, for the conservation of which, as we have seen, the United States Government thought it reasonable to finance projects costing about 165 million dollars. While all this water is running to the sea, large tracts of land—some of them in the famine areas of the Punjab—are lying barren and unproductive for lack of water. The Punjab Government propose to utilize a fraction of this immense waste, notably in their Bhakra storage project. Unfortunately, as we have found, they cannot do so without risk of material injury to the Sind inundation canals, particularly in the month of September. In the view of the Sind Government, the only satisfactory way of preventing such injury is by the construction of two new barrages, one in Upper Sind and the other in Lower Sind, whose cost they estimate at about Rs. 16 crores. We agree that this would be the most satisfactory solution, if it is feasible. Another solution which might have to be examined would be a barrage for Lower Sind and pumping schemes for Upper Sind. It is obvious that Sind cannot finance projects of this order without borrowing, even on the assumption that the Punjab would make a contribution of Rs. 2 crores, which we consider to be a not unreasonable sum for her to pay as compensation for the damage she is likely to do.

82. Technical Committee to be set up by the Central Government to advise on feasibility of protective measures.—The Punjab Government have, however, given us assurances* that they will not take up any of their new projects for the next three years. Our first recommendation is therefore that during this period, and as early as can be arranged with Sind, the Central Government should set up a Committee to examine the two barrage projects put forward by Sind as well as any alternatives and the possibility of financing them on suitable terms, in much the same way as the United States financed the Boulder Dam Project on the Colorado. There is thus good precedent for Central assistance ; it is permitted by sections 150 and 163 of the Government of India Act, 1935 ; its justification lies in the desirability of conserving a national asset of great value. In this connection we would refer to the following remarks in para. 5 of letter No. 23-P. W. dated December 16, 1920, from the Government of India to the Secretary of State, forwarding the Sukkur Barrage proposals :

Vide p. 11, Vol. II of this Report.

"In the year 1918 the inundation of the Indus failed to reach a height at which the majority of the existing canals could effectively irrigate the lands commanded * * * The surplus value of the crops that would have been obtained, had the Barrage been in existence, would have been £10,000,000 or more than the total estimated cost of the Barrage itself." 1918 was by no means a solitary year of this kind. If we compare it with the other years of the period 1901—1941, with reference to the height of the river at Kotri during the inundation season we find :—

June .. the gauge at Kotri in 1918 was the second highest of any year between 1901 and 1941.

July .. there were 7 years before 1918 and 5 years after 1918 in which the gauge was lower than in 1918.

August.. there was one year between 1901 and 1941 in which the gauge was lower than in 1918.

September there were 4 years before 1918 and 8 years after 1918 in which the gauge was lower than in 1918.

Thus, except as regards August, there were several years in this 40-year period which were worse than 1918 for *kharif* crops.

83. Composition and functions of Technical Committee—The Committee that we have proposed should be a representative technical Committee including among its members the Chief Engineer in Sind and a Chief Engineer from the Punjab. It is essential for the success of the Committee that the two Provinces should co-operate and that, in particular, Sind should borrow from the Punjab the services of an officer conversant with the design and construction of the Punjab barrages to work under the Chief Engineer in Sind for the purpose of helping in designing the barrages in Sind. The functions of the Committee should be—

(*a*) to advise on the designs of the Sind barrages ;

(*b*) to advise on crop ratios, capacities of feeders, capacity factors, allotments of water in the *Kharif* and *Rabi* seasons after providing for prior claims, protection necessary for *sailab* areas in the Punjab, Bahawalpur, Khairpur and Sind ;

(*c*) to examine the financial forecasts of the two new barrage projects and advise on what terms either or both of them would be feasible.

(*d*) to advise how far any other schemes which can be regarded as adequately protective would be feasible, such as schemes for assisting landowners on inundation canals to instal lift irrigation or schemes for power pumping from the river or the subsoil.

84. Reasons for suggesting Technical Committee.—We have suggested the appointment of a technical Committee, because (1) it is impossible for us in the present proceedings to examine questions of this kind ; (2) in 1935, Mr. Trench, then Chief Engineer in Sind, expressed the opinion that barrages are not an economic proposition (Anderson Committee's Report, Vol. III, page 25) ; (3) it is possible that Mr. Trench's opinion was based on the 6% yield standard and may not hold good if Sind can obtain money on easier terms ; (4) the possibility of new barrages in Sind is worth the most careful examination in order that the resources of a great river may not be needlessly wasted.

85. " Feasibility " is a relative term, depending partly upon how much and at what rates money is available. In advising whether any protective measures (whether barrages or pumping schemes) are feasible, the Committee will need to have full information on this point beforehand ; alternatively, they will have to say that the measures would be feasible if money could be obtained at or below certain rates.

86. Possible terms for Central assistance.—As to the terms on which the Central Government may finance the schemes, we doubt if it is necessary for us to say much in this Report. Here, although the Colorado precedent is not applicable in all its details, a variant of it may be possible. Thus, a loan on easy terms might be made conditional upon the Sind Legislature creating a corporate body—a sort of Barrage Trust—in which the new works shall vest and to whose Fund all revenues derived from the sale of new lands (Crown waste) as well as the annual assessment from all the lands served by the new projects, whether new or old, shall be credited, the Trust to have the power to sell Crown waste lands and to fix and revise the assessment from time to time, and the Central Government's loan to be made to the Trust. If this is considered unsuitable, there may be other variants possible.

87. Decision to be given on the first issue.—If our first recommendation (for the setting up of a Technical Committee) is accepted, the immediate decision to be given on this issue would be to restrain the Punjab Government, in accordance with their assurances, from taking up any of their contemplated projects for the next three years, say, before October 1, 1945. We do not think that the Balloki-Suleimanke Link is likely to cause any appreciable injury to Sind's inundation canals provided that (as the Punjab has assured us) it takes no water after June until the Beas Dam is completed ; the small storages on the affluents of the Chenab, the Ravi and the Beas, are already subject to certain conditions under the orders of the Government of India passed in

1937, namely that the capacity of each must not exceed 500,000 acre-feet and that storage is limited to the months of July and August; similarly, the Woolar Lake Project on the Jhelum is limited to storage in August and September and a capacity of 334,000 acre-feet. It follows that no new conditions need be imposed upon the Punjab Government after the aforesaid date, in respect of any of the contemplated projects except the Bhakra and Beas Dam Projects. The conditions upon which they may be permitted to go forward with these two projects or either of them after that date must depend to some extent upon the conclusion to which the Central Government will come on the question of financing the new barrage projects or other protective measures for Sind. It would, therefore, be premature for us now to indicate what those conditions should be. If, as the result of the Central Government's conclusions, there emerges an agreed scheme of protection—that is to say, a scheme agreed to by the Punjab and Sind and approved by the Governor-General, not only as to the mode of financing but also as to the allotment of water and other necessary details—then the only condition that need be imposed upon the Punjab Government would be that they must pay a contribution to the Government of Sind according to the agreed scheme. Or, if the parties should independently arrive at an agreement and if the Governor-General approves the agreement, he may permit the Punjab Government to proceed with the projects subject to the terms of the agreement.

88. If, however, our first recommendation is not accepted or if there is no agreement between the parties, the Punjab Government may be permitted after the three-year period to proceed (*a*) with the Link and the small storages, subject to the conditions already stated, and (*b*) with the Bhakra and Beas Dam Schemes subject to the provisions of the Northern India Canal and Drainage Act, 1873, with necessary adaptations. None of these projects nor all of them put together can be said to take more than the Punjab's equitable share of the waters of the Indus System in any quantitative sense. The justification for applying the principles of the Act is this: at present, if the Punjab Government executes an irrigation project in the Punjab and thereby causes damage to inundation canals in the Punjab, compensation is payable according to the provisions of the Northern India Canal and Drainage Act, 1873. Similarly, if the Sind Government executes an irrigation project in Sind and thereby causes damage to inundation canals in Sind, compensation is payable according to the provisions of the Bombay Irrigation Act, 1879. There is hardly any difference of principle between the two Acts in this respect. It is therefore reasonable that the same principles should apply where a Punjab irrigation project causes damage to inundation canals

in Sind. This amounts to applying as between the two Provinces essentially the same law that applies at present within each Province —a form of solution which is in the spirit of the Geneva Convention of 1923 and also of the decision in Wyoming *v.* Colorado (259 U.S. 419).

89. We should like to notice at this stage a possible objection to this solution. Prof. H. A. Smith in his " Economic Uses of International Rivers " has suggested certain general principles applicable to these rivers, among which is the following (we quote only the relevant words) : " Where any proposed employment of waters by one State threatens to injure the legitimate and vital interests of another, the latter is justified in offering an absolute opposition to the employment proposed, but any difference as to the existence or non-existence of such a vital interest should be regarded as a justiciable dispute. If the tribunal finds that such a vital interest in fact exists, no economic or other advantage to the former State can justify it in proceeding with the works proposed. If, on the other hand, the tribunal finds that no vital interests are affected, the works should be allowed to proceed upon payment of compensation and upon such terms as the tribunal may consider just." (Pp. 151, 152 *loc. cit.*). It may, accordingly, be contended in the present case that if the Bhakra or Beas Dam Project is likely to cause vital injury to Sind, the projects should be prohibited rather than that they should be permitted subject to the payment of compensation. It will, however, be seen from the adapted form of the Act of 1873 which we have proposed for the requirements of the present case (*vide* paragraph 9 of the Order proposed in paragraph 90 of this Report) that it contains a provision reserving power to the Governor-General so to regulate the supplies that may be taken for these projects as to prevent any great damage to the inundation canals in Sind. The idea of regulation was put by us to the parties as early as October 2, 1941. The Punjab seemed to think it quite feasible, if some general guidance on the subject was given, and Sind also undertook to consider any constructive suggestions. We believe that regulation within certain limits will be feasible and we have made certain suggestions for this purpose in Appendix IV.

90. To cover all possibilities, the decision to be given now on this part of Sind's Complaint may take the form indicated below.

DECISION TO BE GIVEN NOW ON ISSUE NO. 1 OF SIND'S KHARIF CASE.

In accordance with the assurances given by them, the Punjab Government should be prohibited from commencing any of the projects mentioned in the first *Kharif* issue before October 1, 1945,

or such later date as the Governor-General may fix in consultation with the Government of the Punjab. This date, whether October 1, 1945, or the later date that may be fixed by the Governor-General, is hereinafter referred to as " the prescribed date ". The Punjab Government may carry on any preliminary negotiations necessary for any of the projects even before the prescribed date. After that date they may commence and proceed with—

(*i*) the Balloki-Suleimanke Link project, subject to the condition that it shall not take any water after June until the Beas Dam is completed ;

(*ii*) any of the storage projects on the affluents of the Chenab, the Ravi, and the Beas, and the Woolar Lake project on the Jhelum, subject to the conditions prescribed in the orders annexed to the Government of India's letter of March 30, 1937.

The execution of the Bhakra Dam Project on the Sutlej and/or the Beas Dam Project on the main Beas after the prescribed date should be subject—

(*a*) to such terms as may be agreed upon before that date between the Governments of the Punjab and Sind, with or without other parties, but with the approval of the Governor-General in his discretion (since other parties may be concerned), or, in default of such agreement—

(*b*) to such of the provisions of the Northern India Canal and Drainage Act, 1873, as the Governor-General, in his discretion, may, with any adaptations, modifications or additions which appear to him to be necessary or expedient, direct to be applied to the case by an Order made before the prescribed date.

91. Order to be made in pursuance of decision.—On this plan the Order contemplated in (*b*) above need not be made immediately ; it may be made at any time before the prescribed date, and will be operative only in default of an approved agreement between the parties. The Order will have to be drafted with the fulness and precision of a statute, because it will operate as a kind of inter-provincial law which, by virtue of section 131 (6) of the Government of India Act, 1935, will over-ride any repugnant provincial legislation. It is not necessary, even if it were possible, for us in this Report to give a final draft of the Order that we propose ; but we indicate below its general outlines :—

DRAFT OF ORDER PROPOSED TO BE MADE BEFORE THE PRESCRIBED DATE.

" In pursuance of the decision given on _____ (here insert date of decision) under section 131 (5) of the Government of India Act, 1935, in the

matter of a complaint by the Government of Sind against the Government of the Punjab under section 130 of the Act, the Governor-General is hereby pleased to direct that the provisions of the Northern India Canal and Drainage Act, 1873, set out, with the adaptations, modifications and additions which appear to him to be necessary or expedient, in the following Order, shall apply to the execution by the Government of the Punjab of any of the projects mentioned in the Schedule to the Order (hereinafter referred to as the 'scheduled projects'):—

"1. Whenever it appears expedient to the Government of the Punjab that the water of any river should be applied or used by the Government for the purpose of any of the scheduled projects, that Government shall give notice to the Government of Sind that the water will be so applied or used after a date, to be named in the notice, not being earlier than one year from the date of the notice.

(*Explanatory Note.*—This is an adaptation of section 5 of the Northern India Canal and Drainage Act, 1873, which will hereinafter be referred to as the Act of 1873. The main change in the adaptation is the substitution of a period of one year for the period of three months mentioned in the section. Having regard to the fact that the inundation canals of another Province are concerned, it seems to us that at least a year's notice is required.)

"2. As soon as practicable after the receipt of such notice, the Government of Sind shall cause public notice to be given at convenient places in Sind, stating that the Government of the Punjab intends to apply or use the said water as aforesaid, and that claims for compensation in respect of the matters mentioned in paragraph 3 of this Order may be made before the Collector to be ultimately submitted, if the Governor-General so directs, to the Committee mentioned in paragraph 5.

(*Explanatory Note.*—This is an adaptation of section 7 of the Act of 1873. It directs the Sind Government to take certain action after receipt of notice from the Punjab Government, the object being to apprise Sind landowners of the impending project and of the provision for compensation. The claims for compensation may be made at any time within 2 years after the relevant project comes into operation and will be adjudicated upon thereafter. See paragraphs 4 and 5 of the Order.)

"3. (1) No compensation shall be awarded for any damage caused by—

(*a*) stoppage or diminution of percolation, or of abnormal floods, as distinct from the normal annual rise of the river in the inundation season ;

(*b*) deterioration of climate or soil ;

(*c*) stoppage of navigation, or of the means of drifting timber or watering cattle ;

(*d*) displacement of labour.

But compensation shall be awarded in respect of the following matters :—

(*e*) stoppage or diminution of supply of water through any natural channel to any defined artificial channel (such as an inundation canal) whether above or under ground, in use at the date of the said notice ;

(*f*) stoppage or diminution of supply of water to any work erected for purposes of profit on any channel, whether artificial or natural, in use at the date of the said notice ;

(*g*) stoppage or diminution of supply of water through any natural channel which has been used for purposes of irrigation within the five years next before the date of the said notice ;

(*h*) damage done in respect of any right to a water-course or the use of any water to which any person is entitled under the Indian Limitation Act, 1908 ;

(*i*) any other substantial damage, not falling under any of the above clauses (*a*), (*b*), (*c*), or (*d*), which is capable of being ascertained and estimated at the time of awarding such compensation.

In determining the amount of such compensation, regard shall be had to the diminution in the market-value, at the time of awarding compensation, of the property in respect of which compensation is claimed ; and where such market-value is not ascertainable, the amount shall be reckoned at twelve times the amount of the diminution of the annual nett profits of such property.

" (2) Compensation shall be awarded under the foregoing provisions to the Government of Sind for any loss of revenue resulting from any of the causes mentioned in clauses (*e*), (*f*), (*g*), (*h*) or (*i*) above, the amount of such compensation being reckoned at fifteen times the annual loss of revenue.

Claims for such compensation shall be presented in the first instance to the Governor-General. The Government of Sind shall also prepare and submit to the Governor-General a statement showing the total of the claims presented to the Collectors in the several districts under paragraph 2.

(*Explanatory Note.*—This is an adaptation of section 8 of the Act of 1873. Incidentally, clause (*a*) has here been restricted to abnormal floods and inundation canals have been expressly included in clause (*e*). As already stated, this was always the intention of the framers of the Act. Compensation for loss of revenue to the Sind Government has been specifically mentioned in the adapted provision. No similar provision exists in the Act for the obvious reason that the Act is limited to cases where the irrigation project and the inundation canals are in the same Province. Sind has asked that compensation to the Sind Government under this clause should be reckoned at twenty times the annual loss of revenue. We have tentatively provided for fifteen times the annual revenue as a compromise between twelve and twenty.)

" 4. No claim for compensation for any such stoppage, diminution, or damage shall be made after the expiration of two years from the coming into operation of the project giving rise to the claim.

(*Explanatory Note.*—This is an adaptation of section 9 of the Act of 1873. We have substituted " two years " for " one year," as one year is too short a period for the effects of a project undertaken at a distant site in another Province to make themselves felt, particularly if the year happens to be one of high flow.)

" 5. (1) The Governor-General may appoint a Committee of such persons as he thinks fit (not being a Court) to enquire into any such claim and to determine the amount of compensation, if any, which should be awarded to the claimant.

" (2) If the Committee and the claimant agree as to the amount of compensation to be awarded, the Committee shall make an award accordingly.

" (3) Where the claimant has claimed a specific amount as compensation, the amount awarded to him shall not exceed the amount so claimed.

" (4) (*i*) Subject to the consent of the Committee, any claimant shall have the right to require the Government of the Punjab to buy his interest at its market-value immediately before the damage occurred in lieu of paying him compensation.

"(*ii*) Subject to the consent of the Committee, the Government of the Punjab shall have the right to buy the interest of any claimant at its market-value immediately before the damage occurred in lieu of paying him compensation.

"(5) In matters of procedure, the Committee shall follow such rules as the Governor-General may prescribe.

(*Explanatory Note.*—This is for the most part an adaptation of section 10 of the Act of 1873, and of the provisions of the Land Acquisition Act incorporated therein. Clause (4) is new, and is intended to prevent under-payments as well as inflated claims for compensation.

It must be noted that the Committee to be appointed under this paragraph will sit some 2 years after the projects in question have actually come into operation. The Committee will therefore be in a much better position to assess the damage actually done and the compensation to be paid on that account than we, who have to predict the probable damage some 10 or 15 years beforehand.

The words "not being a Court" have been inserted to avoid any possible conflict with section 133 of the Government of India Act, 1935, although they may not be strictly necessary.)

"6. If compensation is awarded under paragraph 3 on account of stoppage or diminution of supply of water to any land paying revenue to the Government of Sind, and the amount of the revenue payable on account of such land has been fixed with reference to the water-advantages appertaining thereto, the holder of the said land shall be entitled to an abatement of the amount of revenue payable to such extent as shall be determined by the Collector.

"7. Every inferior holder of any land in respect of which such compensation has been paid shall, if he receives no part of the said compensation, be entitled to an abatement of the rent previously payable by him to the superior holder thereof in proportion to the reduced value of the holding ;

but, if a water-supply which increases the value of the holding is afterwards restored to the said land otherwise than at the cost of the inferior holder, the superior holder shall be entitled to enhance the rent in proportion to such increased value : Provided that the enhanced rent shall not in any case exceed the rent payable by the inferior holder before the abatement, unless the superior holder shall, independently of the provisions of this paragraph, be entitled so to enhance the previous rent.

" 8. All sums of money payable for compensation under this Order shall become due from the Government of the Punjab one year after the claim for such compensation is made in respect of the stoppage, diminution or damage complained of, and simple interest at the rate of six per cent. per annum shall be allowed on any such sum remaining unpaid after the said one year, except where the non-payment of such sum is caused by the wilful neglect or refusal of the claimant to receive the same.

(*Explanatory Note.*—Paragraphs 6, 7 and 8 are adaptations of sections 11, 12 and 13 of the Act of 1873 in the light of the corresponding provisions of the Bombay Irrigation Act, 1879.)

" 9. For the purpose of preventing any great damage to the inundation canals in Sind that may result from the execution of any of the scheduled projects, the Governor-General may prescribe maximum rates of withdrawal in excess of which water may not be taken for the project or projects concerned, when the gauge at Kotri or other selected reference gauge falls below certain specified levels, and may also order that water taken be released in specified quantities from any impounding reservoirs.

(*Explanatory Note.*—Where the inundation canals and the new project are in the same Province and it is found that the new project is causing material damage to the inundation canals, the Provincial Government has doubtless the power to regulate withdrawals for the purpose of preventing or mitigating the damage. Such a power seems implicit in the preamble to, and the provisions of Part IV of, the Act of 1873. Where the project is in one Province and the inundation canals in another, it seems reasonable that the Governor-General should be armed with the necessary power of regulation. It is the Punjab's contention before us that the additional withdrawals which they contemplate for their new schemes will not materially damage the inundation canals in Sind. If their prediction turns out to be correct, the power of regulation given by this paragraph to the Governor-General will not need to be used. If, on the other hand, their prediction is falsified, it is obvious that the Governor-General should have the power to regulate withdrawals so as to prevent any great damage.

Under paragraph 4 claims for compensation have to be presented within two years after the project comes into operation. If these happen to be years of high flow, there may not be many claims. Subsequently, there may be a year of very low flow like 1941. Hence the need for this provision in addition to the provision for compensation.)

" 10. The Governor-General may make rules and appoint officers for carrying out the provisions of paragraph 9 and the other provisions of this Order, and may assign to these officers such duties as he thinks fit, in particular—

(*a*) inspection of any dams, reservoirs, and other works on the Indus or its tributaries ;

(*b*) inspection of irrigated areas and the inflow, the outflow and the utilized flow of the said areas as well as all connected records ; and

(*c*) inspection of discharge and gauge sites and the meters and other appliances used at such sites.

(*Explanatory Note.*—Regulation will doubtless present difficulties, depending, as it may, on some kind of forecasting. Hence the need for this provision. The Governor-General may appoint, from among the members of the Technical Committee proposed earlier in this Report, an Indus Water Board to assist him in this and other matters.)

" 11. The Governor-General may require that, in lieu of paying, or in order to avoid having to pay, any compensation to individual claimants or to the Government of Sind under paragraph 3 of this Order, the Government of the Punjab shall pay to the Government of Sind such consolidated sum as he may specify, not exceeding Rs. 150 lakhs in the case of the first scheduled project (the Bhakra Dam Scheme) and Rs. 50 lakhs in the case of the second (the storage scheme on the main Beas) ; and he may also give directions to the Government of Sind as to how the money shall be applied.

" 12. (1) All expenses incurred for the carrying out of the provisions of this Order shall be borne in equal shares by the Governments of the Punjab and Sind.

" (2) The Governor-General reserves to himself the right to decide any question of interpretation arising out of the provisions of this Order and his decision will be final.

" (3) The powers of the Governor-General under this Order will be exercised by him in his discretion.

(*Explanatory Note.*—The second clause is necessary for the removal of any doubt on the subject. The third is a consequence of section 131 (9) of the Government of India Act, 1935.)

"SCHEDULE OF PROJECTS TO WHICH THE ORDER APPLIES.

1. The Bhakra Dam Scheme detailed in paragraphs 26 and 27 of the Punjab Defence, Vol. I, in the Sind-Punjab Dispute over the Indus Waters.

2. The storage scheme on the main Beas mentioned in paragraph 32 of the same volume."

92. Order to be made only in the last resort.—The proposed Order may appear somewhat cumbrous ; but two points have to be borne in mind. In the first place, it will not come into operation unless the parties fail to arrive at an approved agreement. We need not repeat our view that an agreement is the best solution or our hope that circumstances may make it possible for the Central Government to assist the parties to arrive at an agreement so that a valuable national resource may be utilized to the full. It is only when all attempts at securing an agreement have failed that we propose an Order of the kind detailed above. In the next place, we must remember that there are certain complexities inherent in the problem which cannot be avoided. Even when the inundation canals and the contemplated irrigation project are in the same Province, the solution, embodied in the Central Act of 1873 and the Bombay Act of 1879, and therefore presumably the best that the legislatures could think of, is not simple ; it is bound to be more difficult when the project and the canals are in different Provinces and we have to adapt the provisions of those Acts to an inter-provincial conflict of rights.

93. Complexities inherent in problem.—Nothing would have been simpler in form than for us to recommend that the Punjab should be allowed to execute the contemplated projects subject to a payment of, say, two crores of rupees to Sind as compensation and to no other conditions. But the apparent simplicity of this solution is due to the fact that it does not meet the requirements of all the situations which might arise. Let us consider the various possibilities. The most favourable case is where Sind, with the aid of the two crores from the Punjab and of loans from other sources, is able to take adequate measures to prevent any damage from the Punjab projects. In such a case the above solution would present no difficulty ; and indeed, it can be adopted even under the Order that we have proposed, by recourse to paragraph 11 thereof, which is sufficiently wide in its terms. But as we have no assurance that Sind will be in a position to take preventive measures of this kind, we have to consider other possibilities as well. Suppose, then, that protective

measures are not feasible and the Punjab goes ahead with the contemplated projects; suppose further that these projects, as apprehended by Sind, cause very serious damage to Sind's inundation canals. Obviously, cash compensation of two crores of rupees would hardly be an adequate remedy in such a contingency, and power will have to be reserved to the Governor-General to regulate the supplies for the new projects so as to mitigate the damage to the canals. Or, let us take another possibility of the opposite kind: that is to say, no protective measures are possible in Sind, but the Punjab executes the new projects and these projects, contrary to Sind's fears, are found, in actual experience, to do no damage at all or no appreciable damage to the inundation canals. Is the Punjab, nevertheless, to pay two crores of rupees as compensation? We must remember that anticipations of disaster sometimes go wrong. For example, in 1870, Bahawalpur viewed the projected Sirhind Canal in the Punjab with the greatest alarm; but the Canal was constructed in 1883-84 and subsequent experience showed that it had no material effect on Bahawalpur's inundation canals (Sind's Kharif Case, Vol. II, sheet 142). Similarly, Bombay's anticipations in 1925 of the probable effects of the Sutlej Valley Project which came into operation in the subsequent years appear to have been unduly gloomy (Punjab Defence, Vol. III, pp. 42, 43). Of course, when it is a question of assessing a fair contribution towards measures for *preventing* damage (such as Barrages in the present case), we have to go by predicted results, for, *ex hypothesi*, the damage is not allowed to occur. But if preventive measures are impossible and it is a question of assessing compensation for damage actually done, a sum based on mere prediction is not very satisfactory. Again, assuming actual damage, how is the sum awarded as compensation to be apportioned among the persons injured without some such enquiry as is provided for in the Act of 1873? All these difficulties are inherent in the problem and no solution can be called satisfactory unless it faces them all. It seems to us that an adaptation of the Act of 1873 such as we have proposed is the fairest solution which the circumstances permit. We are, however, bound to state that we are not yet aware of any case in which compensation has actually been assessed under the Act; there may be complications which we have not foreseen as well as those which we recognize; and so, we have inserted paragraph 11 in the proposed Order, which reserves power to the Governor-General to direct a lump-sum payment to Sind in lieu of compensation to individual claimants. The paragraph has been widely drawn and may be utilized (*a*) where a lump-sum payment would help Sind to take preventive measures to avoid damage; (*b*) where damage is done, but the claims for compensation are comparatively small; or (*c*) in any other case. We may mention that in the proceedings

before us, the Punjab supported the application of the principles of the Act of 1873 to the present case, while Sind was opposed to it; of course all the adaptations that we have now proposed were not then known to the parties, although some were.

94. Second Kharif issue.—We now turn to the second *Kharif* issue. Sind has put her case under this issue thus :—

"1. Sind has claimed that the limits for the Kharif season fixed in paragraph 34 of the Anderson Report should be allowed for non-perennial canals in Sind.

"2. Prior to 1935, the Kharif season in the Punjab and Bahawalpur was from 16th April to 15th October. The Anderson Committee recommended that on the Indus above Mithankot and on the Panjnad and Haveli Canals the Kharif season should be from the 16th April to 15th October, but should water be available, after the demands of the perennial canals have been met, the non-perennial canals may remain open up to the 31st October, and further if supplies are surplus at Sukkur the canals may open after the 1st of April.

"As for Sind, the Committee recommended that she may withdraw water as laid down in Table I of Volume I of the Report.

"3. This question arises with reference to—

"(*a*) non-perennial canals in the Sukkur Barrage System, namely, Rice and Thar canals ; and

"(*b*) non-perennial canals which may be constructed as part of the two Barrages-one in Upper Sind and the other in Lower Sind.

"(*a*) In these two canals, the rice duty at field is over 50. This duty can only be achieved by carrying out transplantation up to the end of August. After transplantation, water is required for at least 45 days, and it is therefore necessary to give supplies in these canals until about the middle of October.

"Experience of working at Sukkur has shown that there is a demand for water on the Rice Canal until well into October. The Thar canal also requires water in October.

"(*b*) For controlled non-perennial canals it is of course essential that October supplies should be provided. The crops grown will be rice, dubari, and dry Kharif, including cotton, and October supplies would therefore be essential.

"4.0. In any case, there is no reason why the limits of the Kharif season obtained in the Punjab should not be applied to Sind.

"5.0. The Committee's recommendation does not apply to inundation canals.

"5.1. In the past these canals have drawn supplies in October and it is proposed that whenever necessary and when water can be taken they should continue to do so." (Sind's Kharif Case, Volume I, sheet No. 185).

95. Recommendation on second Kharif issue—Although Sind has tried to make out that this issue arises both with reference to the non-perennial canals of the Sukkur Barrage system and the non-perennial canals which may be constructed as part of the two new barrages, we would state at once that no such issue can arise with respect to the new barrages, until the time comes for allotting water to them. We can express no useful opinion at this stage whether the non-perennial canals of the new barrage systems should be given supplies up to the end of October. This is one of the questions which the Technical Committee that we have proposed will doubtless consider. The issue framed in the proceedings before us had no reference to these hypothetical canals, but only to the existing non-perennial canals of the Sukkur Barrage system. As regards these, we find no sufficient reason for giving them a right to more water than they are entitled to under the Anderson Committee's recommendation, which was confirmed by the Government of India in their orders of 1937.

96. A point for clarification.—We should, however, like one point to be made clear. So far as we can see, there is nothing, either in the recommendations of the Anderson Committee or in the orders of the Government of India thereon, which requires that even when the Punjab and the other Provinces or States have taken all the water which they are entitled to take at present and there is surplus water in the Indus running waste to the sea past the Sukkur Barrage, Sind shall not utilize any part of that surplus. Undoubtedly, Sind cannot claim, *as a matter of right*, to take any water in excess of the authorized withdrawals for each month set out in Table I at page 17 of the Anderson Committee's Report, Vol. I. This follows from the first part of paragraph 12 on the same page : "No *claim* to any discharge in excess of the figures in column 9 of Table I can be made." This, however, is different from saying that Sind is debarred from taking surplus water even when no one else needs it. To remove any doubt, it may be made clear that Sind is not prohibited from taking any surplus water which may be running waste to the sea past the Sukkur Barrage, provided (1) that no prescriptive right to take water in this manner can ever be acquired or claimed by Sind, and (2) that the Governor-General may impose a prohibition,

if at any future time he thinks fit to do so. The taking of surplus water by Sind subject to these conditions cannot possibly injure any upper Province or State, whether in respect of its immediate rights or its future interests. We shall have occasion to make a similar recommendation in connection with issue No. 4 of Sind's Rabi Case where we deal with the general question in greater detail. We need hardly point out that the clarification we have suggested is only for the removal of doubt and does not imply any modification of the orders of the Government of India passed in 1937.

PART III.

SIND'S RABI CASE.

FINDINGS AND RECOMMENDATIONS.

97. Rabi issues —The issues arising for decision on this part of Sind's complaint are :—

(1) Should the Lloyd Barrage be given a prior right over the Thal and Haveli projects or either of them to the waters of the river Indus and its tributaries to the extent of the withdrawals authorized for the months of October to March as set out in Table I, read with paragraphs 12 and 30 of the Anderson Committee's Report, Vol. I ?

(2) Should the said authorized monthly withdrawals be regarded as mean monthly withdrawals ?

(3) In the event of a finding in the negative on Issue No. 1, between which parties should short supplies of water be shared, and should such sharing be on the basis of authorized mean monthly withdrawals ?

(4) In the event of supplies at Sukkur being in excess of the authorized withdrawals referred to in the said Report, should the Lloyd Barrage have a share of such surplus supplies and if so on what basis ?

98. A preliminary question of interpretation.—Before dealing with these issues in detail, we should like to dispose of a question of interpretation of some importance connected with issues (1) and (3) above. In paragraph 20, page 18, of the Anderson Committee's Report, Vol. I, that Committee prescribed a formula for the sharing of supplies when the water in the Indus was inadequate for the full requirements of the Thal, Paharpur and Sukkur Barrage canals. They said : " 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 ". But they immediately went on to add : " 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 ". Again, in the next paragraph of the Report, the Committee recommended 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. But this recommendation too has to be read in the light of what the Committee have said in the introductory part of their Report: "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". (See paragraph 3 of the Introduction at page 15 of Vol. I of the Report.)

99. With reference to the last observation, it may be pointed out that the Thal project was not amongst the matters expressly referred to the Committee; nor was there any mention of Thal in the Government of India's letter explaining the terms of reference. (Letter No. I.R.-18, dated November 8, 1934, printed at pp. 22—24 of the Anderson Committee's Report, Vol. II.) But in the brief submitted by the Punjab Government to the Committee, the question of Thal as well as of certain other projects was raised and it formed the subject-matter of issue No. 9 framed by the Committee (see the issues at page 107 of the Anderson Committee's Report, Vol. II). This is doubtless one of the "supplementary issues" referred to in paragraph 3 of the "Introduction to the Committee's Findings and Recommendations"; and, as they say in that paragraph, they found it possible to frame their recommendations on that issue, only because the hydrographs showed that there would be sufficient water for all schemes.

100. All the recommendations of the Committee as to what should be done in the event of short supplies were, in due course, accepted by the Government of India and were embodied in their orders of March 30, 1937. In paragraph 6 of the letter explaining these orders, the Government of India mention, as one of their reasons for accepting these recommendations, the Committee's finding already quoted, namely—to put it briefly—that the deficits would be small and rare. Again, in reporting the action taken to the Secretary of State, the Government of India stated that the recommendations of the Committee relating to the allotment of supplies were based on this finding. (Letter No. I.R.-18, dated July 15, 1937.)

101. The question of interpretation which now arises is whether the provision made by the Anderson Committee and accepted by the Government of India for the sharing of supplies at times of shortage should be construed as applying only to the situation con-

templated by them, *i.e.*, only if the anticipated deficits are small and rare or whether it should be applied in all cases, whatever may be the magnitude and frequency of the anticipated deficits. The question arises because, on present data, we cannot say with confidence that the probable deficits will be small and rare.

102. It seems plain to us that the limited interpretation is the correct one. Every recommendation of the Anderson Committee and every order of the Government of India based thereon must necessarily be construed with due regard to its preamble and its context. It is clear from what we have already quoted that the recommendations and orders in question were intended to apply only if there was expectation of " sufficient water in all but a few periods in exceptional years to meet the needs of all canals ", and only if the anticipated deficiencies were for the most part so small as to " create no difficulty ". To give the orders a wider application would be to do something which their authors never contemplated. We wish to stress the point that in adopting this limited construction we are not departing in any real sense from the recommendations of the Anderson Committee or the orders of the Government of India thereon ; on the contrary, we are only interpreting them according to their true meaning.

103. It follows that if, on a fuller study of the data available to the Anderson Committee and from the additional data now available, we find that there may be deficiencies at the Sukkur Barrage of a character not contemplated by that Committee, we can, without contravening their recommendations or the Government of India's orders of 1937, propose a different formula of distribution.

104. Character of the deficiencies contemplated by the Anderson Committee.—This brings us to the question : What is the precise character of the deficiencies which the Anderson Committee contemplated ? To answer the question we must briefly review the materials placed before the Committee. The Committee consisted of nine members of whom Mr. Nicholson represented the Punjab, and Mr. Trench represented Bombay, which then included Sind. At the meeting of the Committee held on March 3, 1935, when the question of available river supplies was being discussed, Mr. Trench said : " We have now reached the minimum supplies in the river (Indus) with which we can deal or which are sufficient for our commitments in Sind..... In regard to the Sukkur Barrage canals I am not prepared to state that the supplies are substantially short of what we expected to get. On the other hand, I do not propose to go quite as far as Mr. Nicholson, who shows in his diagrams which have been based on monthly averages, that there have

been no occasions on which our supplies have been short. What we would rather state is that we have now come down to bedrock in Sind for the supplies we require. ..... In 1932, under our present authorized withdrawals excluding those which Khairpur are demanding, we were short of water in 2 days in January and 3 days in February. In 1933 we were short of water in 17 days in February and 17 days in March. In 1934 we were short in 9 days in March and 17 days in April. Including the additional demand for Khairpur and for the British canals, there were in 1932, 4 days in January, 6 days in February and 3 days in March : In 1933, 7 days in January, 25 days in February and 19 days in March : in 1934, 3 days in February, 17 days in March and 16 days in April. I do not in any way claim that these have done serious damage, but I do claim that it is an indication that we are now very close to the limit of the available supplies. It is always open, of course, to people to say that these were exceptionally bad years, but it is impossible to say to what extent similar bad years will recur, because some of the Punjab schemes have only been in operation during recent years, and therefore it is not possible to say to what extent they will affect discharges in future years ". (Anderson Committee's Report, Vol. III, paragraphs 437, 438 and 441.) By way of discounting these statements, Mr. Nicholson pointed out that Mr. Trench had not mentioned the percentage shortages, a matter which he considered more important than the number of days of shortage ; also that Mr. Trench had not stated the number of days on which supplies were in excess of permissible withdrawals (*loc. cit.* paragraphs 465, 466). At the meeting held on March 5, 1935, Mr. Nicholson himself produced a hydrograph, referred to as P. 92, showing month by month (*a*) the supplies which were available on the Indus below Sukkur for the years 1928-1935, (*b*) the requirements of the Barrage canals, and (*c*) the requirements of the Haveli and Thal projects. This hydrograph disclosed deficiencies only in April 1934 ; and Mr. Nicholson observed : " It will be seen from the inspection of these hydrographs that in no case would there have been any restriction of the supplies required for Sukkur at the Barrage except for the 10-day periods in April 1934. But, as we know, Sind have closures at that period and to adjust this small item would not be an insuperable obstacle ". (*Loc. cit.* paragraph 746.)

105. That there might be deficiencies in December, January, February and March as well as April would have appeared from Annexure C to the Brief submitted by the Bombay Government to the Anderson Committee and also in greater detail, from Annexure E to the Bahawalpur Brief (Anderson Committee's Report, Vol. II, page 31 and page 55). The figures relating to the

shortages appearing in Annexure C differ to some extent from those given by Mr. Trench in his oral statements and from the written statement printed in Vol. III, Appendix IX (*loc. cit.* p. 125); the explanation appears to be that in the latter, he excluded the leakage through the Barrage gates while in Annexure C he took them into account. It must be remembered that neither in his oral statements nor in Annexure C nor in Appendix IX was any allowance made for the requirements of Thal or Haveli.

106. As to the magnitude of the shortages we have already quoted Mr. Trench's statement that he could not claim that they had so far done any serious damage. He mentioned, however, that in 1934 Sind had been short by 15 per cent. of the authorized withdrawals for 17 days at Sukkur (Anderson Committee's Report, Vol. III, paragraph 766) and he went on to say that the deficiency of water supply in April 1934 was important. "The deficiency is important in that month particularly; because it has occurred in one out of the first three years of the operation of the Barrage and secondly because it has occurred in a month in which both the Thal and Haveli projects' mean discharge for that month will suddenly rise from a comparatively small figure to a very much higher one" (*loc. cit.* paragraph 769). Upon this Mr. Nicholson replied: "It is fully realised by me and I think it has been fully realised by everyone connected with the problem in the past that there must be years of shortage at infrequent intervals which will necessitate an adjustment of the utilisation of supplies for any new canal project above Sukkur on the Indus. In most years during April, no difficulty would arise, but in years in which the shortage occurred, undoubtedly the Punjab would be only too glad to reduce its demands on the river at Kalabagh so as to ensure an equitable distribution between the Punjab and Sind".

107. Of the other material before the Committee, it is necessary to mention only (*a*) the volumes of the Indus River Commission Records, and (*b*) the hydrographs prepared by Mr. Gunn of the Punjab and produced before the Committee on March 5, 1935. These latter are reproduced as Plate III at the end of Vol. III of the Anderson Committee's Report. They merely show the average and minimum supplies for the 12 years, 1923—34, by 10 day periods, but not the requirements of the various projects. It is not therefore possible by a mere inspection of these hydrographs to tell whether and to what extent supplies would have fallen short of requirements.

108. Certain other hydrographs, mentioned in paragraphs 425 and 427-436 of the Anderson Committee's Report Vol. III, were also produced before them; but that mentioned in paragraph 425

concerned only the Sutlej, while, of the others, the Committee themselves have stated in a footnote " One is shown as Plate III summarising the information obtained by the Committee, upon which their recommendations are based ". In paragraph 797, Vol. III, the Chairman remarked with reference to Plate III : " May we accept these hydrographs for the purpose of ascertaining the available supplies which can be distributed to the different parties..... ?" The suggestion was unanimously accepted. We have already commented upon Plate III.

109. There was some general discussion on the subject of regeneration (*loc. cit.* paragraph 551 *et seq*) but nothing tangible appears to have been produced. Mr. Trench described how inconclusive a statistical investigation of the problem undertaken by Mr. Wilsdon (in 1928-29) had been, and Mr. Nicholson admitted that he himself had no knowledge of what happens below Mithankot (*loc. cit.* paragraphs 557 and 560).

110. Evidence before the Anderson Committee summarised.— The evidence before the Anderson Committee on this subject may therefore be summed up thus : supplies were short of the authorized withdrawals, notably in February and March 1933, and March and April 1934 ; the deficiencies were of the order of 15 per cent. at one period cited ; no serious damage had yet resulted, although the shortage in April 1934 was considered important by Mr. Trench ; but it was pointed out by Mr. Nicholson that owing to Sind having closures about that time, this should not prove an insuperable difficulty and that the Punjab would be only too glad to reduce its demands if any difficulty arose. No definite allowance for regeneration at Sukkur was claimed.

111. Sub-committee's findings.—On this evidence (on March 8, 1935) a sub-committee appointed by the Anderson Committee recorded their findings thus :—

" RABI.

" The sub-committee found from a study of the records of discharges at Sukkur in the rabi from November to March that it was only in exceptional years that withdrawals contemplated for the Sukkur Barrage project (including a conversion of the Khairpur channels to a perennial basis), the Thal project and the Paharpur extension on the Indus, and the modifications of the Haveli (Trimmu) and Panjnad Headworks (withdrawals on the Chenab), would not be fully met. Any insufficiency of supply would be so small that it would not cause any difficulty.

" On the Indus the Thal project would share any possible shortage rateably with the Sukkur Barrage canals on the rabi author-

ized capacities of the channels. This would occur only on rare occasions for a few days" (*loc. cit.* paragraphs 914 and 915). The Anderson Committee unanimously accepted these findings of the sub-committee (*loc. cit.* paragraph 928; also paragraphs 1015 and 1040).

112. None of the hydrographs which were placed before the Committee and upon which they based their estimates of the supplies available in the Indus seem to have allowed for regeneration or any other ameliorative factor. Obviously, supplies were considered to be adequate (save for small and exceptional deficits) even without any definite assistance from these factors.

113. Anderson Committee's finding that deficiencies would be small and rare.—Such, then, were the materials on which the Anderson Committee based their finding that it would be in exceptional years only that the total requirements of the several irrigation systems would exceed the supplies available and that any deficiency of supply would ordinarily be so small as to create no difficulty. We have set out the materials in full so that the finding may be better understood. It is clear from that finding, read in the light of the materials quoted, that the situation envisaged by the Committee in making their recommendations was (1) that even without making any definite allowance for regeneration, etc., there would be deficits of material amount only in exceptional years; (2) that the deficiency might occasionally be of the order of 15 per cent.; (3) that only the April shortages were likely to create any difficulty; (4) that the shortages would be usually so small that by adjusting closures and by distributing the shortages between the Punjab projects and the Sukkur Barrage canals, all difficulties could be surmounted; and (5) that even this would be necessary only for a few days on rare occasions.

114. Situation disclosed by present data very different.—The situation disclosed by the data now placed before us is very different. The hydrograph P. 92 to which we have referred has been criticised by Sind as misleading on various grounds: (*a*) that it proceeded for the most part on monthly averages, which were pronounced by the Indus Discharge Committee in 1928 as liable to prove deceptive at certain periods of the year (paragraph 6 of the Report of the Indus Discharge Committee, 1928); (*b*) that it contained a large number of mistakes in plotting, some of them serious; and (*c*) that it omitted to show the rabi discharge necessary for the Panjnad canals. There is no doubt about (*a*) and (*c*), but we do not think it necessary in the present proceedings to express any opinion on (*b*) or on the question whether the Anderson Committee were justified by the materials that were placed before them in arriving

at their conclusion that there would seldom be any deficiency of water. It is enough for our purposes to state that on the data now available to us we are unable with confidence to record a similar finding.

115. The parties have placed before us certain agreed figures for the 10 years, 1932—1941 inclusive. (See the proceedings of January 28, 1942: "Sind: 'These represent the agreed shortages checked by the Punjab and ourselves, excluding pond figures, regeneration, and loss'.....Punjab: 'I have, of course, my own statement, but I think the position is that those are the agreed figures corrected only for lag.'") These are the first 10 years since the opening of the Sukkur Barrage; the Anderson Committee had before them only the figures relating to the first 3 of these 10 years so that we have now additional data for the seven years, 1935—1941 inclusive. In the agreed figures for these 10 years allowance has been made not only for the full authorized withdrawals of the Sukkur Barrage canals (whether for British Sind or for Khairpur), but also for the requirements of the Haveli, Panjnad, and Thal projects. The figures are based on a daily analysis of available supplies and authorized withdrawals instead of on monthly averages. Allowance has been made for lag; but not for any other ameliorative factor, such as regeneration, closures, or the effects of ponding. The parties have been unable to agree what allowance, if any, should be made for these factors. So far as we can judge, the Anderson Committee made no definite allowance for them in their estimates.

116. One other feature of the mode of computation of these figures must be mentioned. The shortages have been calculated, not on the actual requirements of the crop at the time, but on the authorised allocations of the several projects. For obvious reasons, we have refused, in this investigation, to go into the question whether the authorized allocations for the Sukkur Barrage or any other project have been on too lavish a scale. We have assumed that the full allocations will be required for each of the projects concerned, if its financial stability is not to be jeopardised. Moreover, it has been assumed, for instance, that the daily requirements of the Sukkur Barrage canals in March are 25,721 cusecs and of Thal, 3,600 cusecs, although (as will be explained later in the case of the Barrage) these are the authorized supplies for the month as a whole rather than for each day.

117. Leaving aside for the moment the question how far these agreed, but possibly defective, figures can be said to present a true picture, let us proceed to consider them as they stand. To avoid misunderstanding we shall refer to the shortages disclosed by these

figures as "gross shortages," that is to say, shortages corrected for lag but not for any other ameliorative factor.

118. Agreed figures now put before us disclose gross shortages which are neither small nor rare.—The first fact that emerges from the agreed figures is that if the Punjab projects had been in full operation during the ten years, 1932—1941, there would have been gross shortages, large or small and more or less prolonged, in February, March and December 1932; January, February and March 1933; February, March and April 1934; February 1936; January and February 1939; January, February, March and December 1940; and January, February and March 1941. Although we have described the figures as "agreed figures", there are certain minor differences between the Sind and Punjab computations, the Sind computations showing in some cases larger shortages than the Punjab. For our purposes we have been content to take the Punjab figures. Thus, it seems clear even from the Punjab figures that there would have been gross shortages, during 7 out of the 10 years examined since the opening of the Sukkur Barrage. It can, therefore, hardly be said that these shortages would have shown themselves only in exceptional years.

119. Nor can it be said that these shortages would have been small or of short duration. As regards duration, there would have been shortages for 22 days in February, 15 days in March and 29 days in December 1932; 30 days in January, 28 days in February and 19 days in March 1933; 22 days in February, 29 days in March and 14 days in April 1934; 27 days in February 1936; 21 days in January and 26 days in February 1939; 20 days in January, 17 days in February, 31 days in March and 21 days in December 1940; 31 days in January, 28 days in February and 31 days in March 1941.

120. Then, as regards the magnitude of the shortages, the figures put before us show that in 1932 there would have been continuous shortages from the 20th February until 15th March, going up frequently to over 4,000 cusecs, sometimes over 5,000 cusecs, and once over 7,000 cusecs. In other words, the shortages would often have exceeded 16 per cent. and sometimes even 20 per cent. of the total Barrage allocations in these months of 1932. In 1933 there would have been continuous shortages from the 24th January, right through February, up to the 19th March, the shortages in March ranging from over 7,000 cusecs to over 12,000 cusecs; that is, between about 30 per cent. and 50 per cent. of the total allocations. In 1934 there would have been continuous shortages from the 8th February to the 25th March, more often than not exceeding 4,000 cusecs and sometimes over 7,000 cusecs. And so on. 1941 would have been one of

the worst years of all, with continuous shortages right through January, February and March, more often than not exceeding 4,000 cusecs, and never falling below 6,000 cusecs between the 14th February and the 31st March. These shortages can hardly be described as small or rare or lasting for only a few days; and they would have occurred during the crucial maturing period for wheat. As for their causing no difficulty, we have to state that in spite of our best efforts, we have not been able to get the parties to agree to any system of closures and of distributing the deficits which they now seem to apprehend.

121. Reduction of gross shortages by ameliorative factors possible but not dependable.—Now, as we have already indicated, these gross shortages may not present a true picture of what is actually going to happen in the years to come, because they do not take into account such facts as regeneration. But the real point is this: In face of these figures, can we say with confidence that the expectations of the Anderson Committee of "sufficient water in all but a few periods in exceptional years" will come true? Can regeneration and other ameliorative factors be counted upon with reasonable certainty so to reduce the gross shortages of the future that "they would create no difficulty"? For reasons to be explained presently, we have to answer these questions in the negative, which means that the situation disclosed by the data placed before us is materially different from that envisaged by the Anderson Committee. To put it in other words, the data placed before the Anderson Committee disclosed a situation which was considered safe, from the point of view of the adequacy of supplies, even without the uncertain aid of regeneration; the data placed before us disclose a situation which is not safe unless there is sufficient regeneration. It seems to us that the two situations are materially different, and the solution which the Anderson Committee designed for the former cannot be applied to the latter without doing injustice to the parties and, indeed, to the Committee themselves. We are therefore free to recommend what we consider to be the most equitable method of dealing with the new situation.

122. Uncertainty of regeneration for quantitative estimation.—We must now proceed to explain why we regard regeneration as an uncertain factor. There is a good deal of material on the subject in the Punjab Defence Vol. II (pp. 46—54) and the conclusion sought to be drawn is that in conjunction with the other ameliorative factors, regeneration will reduce shortages to innocuous proportions. Sind, on the other hand, describe regeneration as a highly speculative factor. To put the issue in concrete terms, can we say, for example, that because 3,600 cusecs are withdrawn from the Indus at

Kalabagh on a certain date, the discharge at Sukkur, which is hundreds of miles away down the river, will on a certain subsequent date (depending upon the "lag" or the time taken by the water of the river to flow down from Kalabagh to Sukkur) be reduced by 3,600 cusecs ? The argument against such an assumption is that the water which is taken out of the river from day to day is not commonly utilized in its entirety by the crop irrigated : some of it goes into the subsoil and thence, in due course, back into the river. In fact, the subsoil acts under some conditions as a large underground reservoir, alternately fed from and feeding the river. How much of the water thus returns to the river must depend upon the nature of the sub-soil and other factors. Elaborately worked-out statistics extending over 40 years, 1901—40, have been produced before us by the Punjab and inferences have been sought to be drawn from them as to the percentage of the abstracted water that returns to the river. Thus, it is said that if the Punjab were to withdraw an extra 1,000 cusecs at Kalabagh in the month of January, the discharge at Sukkur would be reduced, not by the whole of the 1,000 cusecs withdrawn but only by about 55 per cent. (or, on another interpretation allowing a month's lag, about 70 per cent.) thereof, the balance being accounted for by regeneration between the two points and other factors. But while it seems certain that some of the abstracted water must return in this way, we doubt whether the ratio of the one to the other can be evaluated with sufficient precision to enable us to make a definite allowance for regeneration.

123. Government of India's views in 1927.—In the Government of India's despatch to the Secretary of State for India, dated June 2, 1927, it was stated that accurate records of river discharges had been in existence only since 1923-24 so that the statistics of the first 23 or 24 years of the aforesaid 40-year period are not a certain guide. Regarding the figures of the next three years, the despatch went on to say : "But it is interesting to note that, in so far as they go, they (the discharge observations) 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 has been quoted by the Punjab engineers in support of their contention that it is possible to abstract water from that Province without affecting the supplies at Sukkur, on the ground that the water so abstracted percolated back into the river." Sind have prepared an analysis of the figures for the subsequent years, *i.e.*, 1926—1941 purporting to show that the drop in the discharges at Sukkur in the months of January and February is more than the corresponding rise in the Punjab withdrawals (whether

allowance is made for lag or not)—a result which, whatever its meaning may be, does not support the theory of regeneration in these months.

124. Indus Discharge Committee's views in 1929.—The Indus Discharge Committee in 1929, after referring to Mr. Wilsdon's researches, stated their conclusions thus : " The crux of the matter is that there is no change perceptible in the discharge at Sukkur which is proportional to the steadily increasing withdrawals which have taken place in the Punjab. More than this it is, however, at the moment, impossible to state. We are not yet in a position to establish quantitatively the reality of regeneration over the entire reach of the river."

125. American researches.—The subject of regeneration or return flow has been studied a great deal in America, in connection with a number of rivers, such as the North and South Platte Rivers, the Arkansas, the Rio Grande, and the rivers of the Great Salt Lake Basin. No one who has studied the relevant literature can have any doubts as to the fact of regeneration, but only as to the interval after which, and the extent to which, it will make itself felt. To the information given in the Punjab Defence, we should like to add the following extracts from the evidence given before the Colorado River Commission in 1922 :—

1. *Return Flow Data from the Great Salt Lake Basin.*—" Mr. Doremus : ..... For the purpose of a very general illustration of this matter, we invite attention to that part of the Bonneville Basin, known as the ' Great Salt Basin ', which includes Bear River, Weber River, Provo River, Spanish Fork River, and numerous other minor streams—from all of which water has been used for irrigation during a period of at least sixty years. In this basin are located the greater portion of the people, and the chief industries of the entire state.

" The basin has no outlet. Great Salt Lake occupies the lowest portion and is the final receptacle for all water flowing in the basin. Originally all the water flowed through natural unobstructed channels, directly into Great Salt Lake. Under these natural conditions the flow was very irregular. Overfull channels in June and empty channels in August were the rule. Gradually, obstructions, such as are necessary to divert water for irrigation, were placed in these stream channels, until the number is now sufficient to practically prevent any direct flow into the Great Salt Lake, except during very high water. Under these changed conditions, the stream flow is now comparatively uniform, and constant. The June surplus, which is now diverted into, and stored in, the soil cover of the upper river basin, slowly returns to the natural channel and constitutes the present August flow which, originally, was *nil.*

" . . * * * Another interesting and important fact is that, after diversion from the stream of sufficient water to irrigate the large area of land now under cultivation in the Great Salt Lake Basin, the lake still receives approximately 5,000,000 acre-feet of water annually. The Lake surface is now higher than when the first water was diverted, and the streams were free from obstructions and discharged directly into the lake. And this in spite of all the efforts tending to destroy the lake.

" * * * We think these facts are significant in this case as showing:

" (1) That irrigation on the upper areas of the stream basin is a potent and economical means of equalizing the stream flow;

" (2) That it furnishes a measure for the supplemental storage needed to complete the equalization of flow;

" (3) That detention of the water on the shed does not diminish materially the available supply that finally reaches the mouth of the stream;

" (4) That it makes the watershed a valuable farming and storage area, instead of a mere catchment area or cattle range.

" It is not to inform you, but to remind you, that these phenomena are not peculiar to Utah streams, but are common, in greater or less degree, to all streams where water has been long and largely used, on up-stream lands. * * * "

" Mr. Hoover: From your experience do you consider there is no consumptive use of the water at all,—according to your point of view, is there no loss of water in use?

" Mr. Doremus: No, Sir. There is some loss due to evaporation and transpiration; there is some difference between the quantity of water that is placed upon the land and the quantity that drains from the lands and returns to the water course. But our experience teaches that repeated use of the unconsumed remnant accomplishes the irrigation of more land than is possible by a single application of the undiminished flow.

" Before we learned better, lower stream users, fearful of diminished crops through diversion of the water for irrigating upstream lands, armed with shot-guns and six-shooters, raided the upper regions of the river, tore out all diverting dams, and turned the water down for use of the valley land owners whose rights were prior to those above. We now encourage the use of water on the upstream lands, as a better means of water protection for the lowland users, than that formerly afforded by the shot-gun method." (Colorado

River Commission, *Salt Lake City Hearing*, State Capital Building, Salt Lake City, pp. 4—13, passim, March 27, 1922).

2. *Experience on the Sevier River.*—" Mr. C. J. Ullrich : One other fact that must be borne in mind is that the irrigation of the high land reaches of the river system in effect produces storage regulation for the river without cost to the lower water users. This has been illustrated in the case of the Sevier River.

" Away back in 1890 all the direct flow of the river was appropriated at the lower end. Today all these rights are being satisfied and new rights have accrued, and there is still a surplus of water going into Sevier Lake. This is the result mainly of return flow from the upper reaches of the river where the water has been spread over the land for a period of years and the sub-soil drainage has reached its equilibrium, the water not consumed returning to the river almost as fast as applied. "

3. *Return Flow on the South Platte River.*—" Mr. Tobin : We also contend, and prove conclusively from the State Engineer's office and from records, that the more water stored and applied on the upper lands, the better is the water right in the adjoining States. At Julesburg on the Platte, the Platte River went dry. On account of the construction of the large reservoir around Fort Morgan, and other sections, and the storing of water in them and transfer of early priorities to the head of the Platte, today Julesburg, in Eastern Colorado, has some of the best water rights in the State. And in Kansas, on the Arkansas or any other place, they have never been injured by the water that has been diverted in Colorado ; on the contrary, they have been benefited, and it has made possible the construction of large reservoirs in the Arkansas Valley, and the same thing will exist in Western Colorado ; the more water put on the land, the more that is stored, the more continuous flow the Colorado River will have, and there is no doubt but what, if the Government did build on the lower end of this River and store these flow waters, that there will be ample water for everybody, down on the Colorado. " (Colorado River Commission, *Grand Junction Hearing*, Grand Junction, p. 75, March 29, 1922.)

4. *Judge Thurman on Return Flow.*—" Mr. Hanson : I should like here to quote the Hon'ble Judge S. R. Thurman, of Utah, a gentleman of renowned authority on irrigation and drainage :

" ' Early in the history of nearly every valley, there came a time when the inhabitants and users of waters arrived at the conclusion that all the water had been appropriated and that the area of cultivation could not be further extended. Every old settler in Utah will bear testimony to the truth of this

assertion. Many instances could be brought to your attention in which the area of cultivation has been increased from three to six times beyond the supposed capacity of the streams. Even at this late date, new land is being brought under cultivation and is being irrigated from streams, rights to which were supposed to be exhausted more than a quarter of a century ago. Probably many reasons could be assigned for this apparent phenomenon—I need only mention two. The first reason for the supposed phenomenon to which I have referred, is the fact that it requires many years of irrigation upon the arid lands of the desert, to fill up the interstices of the soil and establish a level of ground-water below which irrigation, of course, is not required. Until this occurs it is practically self-evident that the farmer must depend entirely upon water from the melting snow and other forms of precipitation. After this, however, springs begin to appear in the lower portions of the valley. These find their way into the original streams and augment their flow. Seepage appears along the banks of the streams; much of the land becomes saturated, and is no longer dependent upon regular turns of irrigation. At this point we cast our eyes over the area in cultivation, and find, to our surprise, as I suggested before, there are many times as much land in cultivation as there was near the beginning when the original appropriators thought the limit of the stream's capacity had been reached." (Colorado River Commission, *Salt Lake City Hearing*, Salt Lake City, pp. 63-64, March 27, 1922.)

5. *Estimate of Return Flow.*—"Governor Mechem: This formula New Mexico will accept with the following qualifications:

(1) That where a state permits diversion from the watershed of the Colorado River, or its tributaries, the amount of water should be charged against the quota of said state at the ratio of 5 to 4; it having been estimated that the return flow of the water applied to irrigation of land within the watershed is from twenty-five to forty per cent. as not only the water diverted is a use out of the apportionment, but the return flow is forever lost, the state diverting water in such a manner should make good the return flow." (Colorado River Commission, *Denver Hearing*, State Senate Chamber, Denver, p. 162, April 1, 1922.)

"Mr. Caldwell: I have heard engineers speaking of return flow, try to express it in percentages. It seems to me it would not be expressed at all in percentage; so far as our experience in Utah goes, it cannot be expressed in percentage unless we know the actual condition established. For instance, if we divert 3 acre-feet of water to a piece of land, only $1\frac{1}{2}$ acre-feet returns to the river, or 50 per cent., making a consumptive use of $1\frac{1}{2}$ acre-feet. If we turn out $4\frac{1}{2}$ say, acre-feet, we return 3 acre-feet, and the consumptive use remains

the same, but the percentage returned is much higher ; does that agree with your notion of return flow ?

" Mr. Foster : Yes, Sir. " (Colorado River Commission, *Grand Junction Hearing*, p. 68, March 29, 1922.)

126. A study of all this evidence and of the material contained in the Punjab Defence leaves no doubt as to the possibilities of regeneration. But when and in what measure its actual aid will be forthcoming in a given case it is difficult to tell. Mr. Meeker's statement, at page 88 (27) of the Punjab Defence, Vol. II, runs : " The magnitude of return flow or seepage waters is not generally known for three reasons : (1) several years are usually required to build up the water table, or underground soil reservoir, to equilibrium.....". Judge Thurman's statement, which we have already quoted, is that many years of irrigation upon arid lands are required before return flow can establish itself. How long the process will take in the case of Thal or any other project we have no means of estimating. As to the magnitude of the return flow, we find various opinions. Mr. Meeker thinks 20 to 40 per cent. of the water applied to irrigation ultimately returns to the stream-channel. The Rio Grande figures quoted in the Punjab Defence are, in one unit 6·5 per cent., in another 12 per cent., in three others 27 or 28 per cent., and in one as high as 52·8 per cent., of the water originally diverted : 36 per cent. of the diversions is said to be " the relative volume of return water experienced in general ". Governor Mechem's formula is 25 to 40 per cent. Professor Harding of California states that under favourable conditions the return flow may exceed 30 per cent. of the amount diverted (" Water Rights for Irrigation ", 1936, page 28). Certain observations on the subject occur in a comparatively recent case in the Supreme Court of the United States : we refer to the case Wyoming *versus* Colorado [1936] (298 U. S. 573,581).

127. In this suit, [to which we have referred once before, see paragraph 56(1) *supra*] the State of Wyoming complained against the State of Colorado, asserting that the latter had been infringing a decree of the Court made in an earlier suit between the two States. One of the infractions alleged was that whereas the decree had empowered Colorado to abstract 4,250 acre-feet of water per year from the Laramie river and its tributaries to irrigate certain meadows, Colorado was actually withdrawing a great deal more. In answer to this complaint, Colorado admitted the excess withdrawals ; but contended that the quantity actually consumed on the meadows did not exceed the decretal amount, because, it was said, the rest of the water returned to the river through surface drainage and percolation. The Court dealt with this plea thus : " It is true that, when water is

so applied (*i.e.*, by a process of continuous flooding), a considerable portion ultimately finds its way back into the stream, unless the place of application be remote from the stream or in another watershed, which is not the case in this instance. But it is also true that a material percentage of the water is lost by evaporation and other natural processes and that there is no way of determining with even approximate certainty how much of the water returns to the stream." To add to the uncertainty, there is the possibility of intervening landowners abstracting a portion of the return flow (see paragraph 73 *supra*).

128. Evidence before the Anderson Committee, 1935, inconclusive.—The subject was discussed before the Anderson Committee (see paragraph 551, *et seq.* Anderson Committee's Report, Vol. III). But nothing definite appears to have emerged. Indeed, Mr. Trench referred to the difficulty of converting the general idea that regeneration takes place into a definite quantitative statement; and, as already mentioned, the hydrographs put before the Committee left regeneration out of account.

129. Punjab calculations.—We notice that in the first volume of the Punjab Defence (page 40) the regeneration claimed for Thal was only 510 cusecs in January, 425 cusecs in February, and 340 cusecs in March. These figures were worked out on the basis of the ascertained regeneration in the Sukkur-Kotri reach. But in the second volume, the claim, worked out in another way, (on the basis of the 40 years' statistics already mentioned) is put at 1,000 cusecs in January, 1,800 cusecs in February and 2,880 cusecs in March. A factor which presents such variations when worked out according to different sets of data is extremely difficult to assess.

130. It is not without significance that the Punjab, in working out the effects which the shortages would have on the Punjab projects if Sind's priority claim were allowed, find it necessary to neglect regeneration and all the other ameliorative factors (see para. 2·1·4, page 10, Punjab Defence, Vol. II). Obviously the Punjab themselves feel that the financial stability of their irrigation schemes should not be made to depend upon the operation of these factors.

131. For all these reasons, we have called regeneration an uncertain factor.

132. Uncertainty of other ameliorative factors: readjusting of closures, ponding, and rainfall.—We have been unable, in spite of our best efforts, to obtain from the parties any agreed programme of closures. Sind have said that since 1937 they have been having only one closure at Sukkur at the end of December for about 20 days. It is further said that even if this closure is cancelled it will be of

little use in meeting shortages in February and March. It has therefore not been possible for us to make any definite allowance for the relief likely to be afforded by the cancellation or readjustment of canal closures.

133. The effects of ponding depend upon the excess supplies, if any, immediately preceding a period of shortage, as well as upon the magnitude and duration of the shortages. The total storage possibilities claimed by the Punjab from pondage at the Sukkur Barrage are 14,177 cusec-days and at Kalabagh 7,381 cusec-days. Sind's estimate is 3,310 cusec-days for pondage at the Sukkur Barrage while as regards Kalabagh they say that they are not in a position to check the Punjab calculations. On these data, the possibilities of assistance from this factor must also be regarded as indefinite.

134. Nor, on the figures before us, are we able to make any definite allowance for the effects of rainfall.

135. In these circumstances, we consider that the ameliorative factors cannot be counted upon to alter, within any predictable period or to any predictable extent, the general conditions which have been disclosed by the present investigation and upon which we have, therefore, to base our recommendations. If the factors actually come into play, so much the better for all concerned, for they will reduce the burden of the shortage to be borne by each project.

136. First Rabi issue—We shall now proceed to discuss the issues in order. The first issue concerns Sind's claim to priority for the Sukkur Barrage over the Thal and Haveli projects. To understand this claim, we must first examine the effects of the Government of India's orders of 1937. The relevant orders are numbered 5 and 7 in the statement annexed to the letter of March 30, 1937; they confirm the recommendations of the Anderson Committee. As regards the Haveli and Panjnad systems, the Committee's recommendation was that they should have a prior claim on the waters of the Chenab up to their authorized withdrawals, and that in the event of any shortage at Sukkur, they should not be called upon to forego any part of their withdrawals up to their authorized figures. Thus, these systems were expressly given priority, up to their authorized withdrawals, over the Sukkur Barrage canals.

137. As regards the Thal and Paharpur systems, the Committee's recommendation was that "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." Before we work out the results of this formula, we should like to make certain preliminary observations. The recommendation cited speaks of the sharing of "supplies available". If all the three systems

Thal, Paharpur, and Sukkur Barrage, were being fed from the same point of the river, there would be no difficulty either in determining the supplies available on any particular day or in distributing them rateably. In fact, however, the three systems withdraw water from widely separated points. Owing to the time-lag between these points, the determination and distribution of available supplies will offer certain practical difficulties, and will have to be based on some kind of forecasting. Thus, assuming a lag of 10 days between Kalabagh and Sukkur, the Thal withdrawals of March 1st will have to be regulated with reference to the supply likely to be available at Sukkur on March 11th. We understand that this will not prove a serious difficulty in practice. The other observation that we should like to make concerns the requirements of Thal. Taking, for instance, the month of March, Thal has a " mean monthly " authorized supply of 3,600 cusecs, liable to be reduced according to the formula already quoted when the anticipated supply is insufficient and liable to be supplemented according to another formula when the anticipated supply is in excess, but always subject to a maximum of 6,000 cusecs. Not only is the authorized supply subject to these fluctuations, but it is also unrelated to any estimate of *rabi* areas requiring irrigation. This was admitted by the Punjab at the New Delhi Session of January 27, 1942. In these circumstances, we have no doubt that so long as Thal gets its basic allotment of 3,600 cusecs in March, it cannot be said to suffer any shortage. The Punjab themselves have acted on this view in computing the shortages at Sukkur shown in Table I at page 9 of the Punjab Defence, Vol. II, where, it will be noticed, the mean monthly figures for Thal, and Haveli in January, February, and March are taken as the authorized supplies. This necessarily implies that 3,600 cusecs represent the full requirements of Thal in March and that so long as it gets them, it suffers no shortage. We mention this point, because paragraph 99 at page 44 of the Punjab Defence, Vol. I and paragraph 2·3·65 at page 41 of the Punjab Defence Vol. II might suggest that even when Thal is drawing 3,600 cusecs in March, it is getting only a " reduced " supply—reduced in the interests of Sukkur.

138. Let us now analyse the effects of the recommendation that in periods of shortage, available supplies should be divided between the Thal, Paharpur, and Sukkur Barrage canals on the basis of their " authorized monthly maximum withdrawals " for the period concerned. In form, this looks like a mode of sharing the deficit ; in effect, as will be seen presently, it throws the whole deficit on the Sukkur Barrage canals for all practical purposes. This is because in the *rabi* months in which deficits are likely to occur, the Thal and Paharpur systems have mean allotments much smaller than their

maximum, whereas the sharing proceeds on the basis of the maximum allotments. From paragraph 30 of the Recommendations (page 21, Anderson Committee's Report, Vol. I), it will be seen that the mean monthly allotment of the Thal canal in March is 3,600 cusecs and the maximum 6,000 cusecs. Similarly, from paragraph 19, it appears that the mean monthly supply for Paharpur in March is 360 cusecs and the maximum 700 cusecs. But in the case of the Sukkur Barrage canals, we have only a single figure for the authorized withdrawal of each month (see Table I at page 17 of the Anderson Committee's Report, Vol. I). In the month of March, the figure for the British Canals is 23,454 cusecs with an addition of 267 cusecs in the Eastern Nara for Khairpur lands ; and the figure for the Khairpur Feeders is 2,000 cusecs. So far as the British Canals are concerned, the figure of 23,454 + 267 cusecs is apparently to be treated as the authorized maximum monthly withdrawal, for the purpose of the above formula (see the opinion of the Independent Members of the Anderson Committee, item 4, page 27 of the Anderson Committee's Report, Vol. I, confirmed by order No. 24 in the statement annexed to the Government of India's letter of March 30, 1937 ; also paragraph 2·5·9 at page 57 of the Punjab Defence, Vol. II ; and paragraph 52·2 at page 71 of Sind's Rabi Complaint). We shall deal with this point at greater length in connection with issue No. 2. The figure of 2,000 cusecs for the Khairpur Feeders is the mean monthly allotment for March (see paragraphs 10 and 12 at pages 16 and 17 and the heading to column 8 of Table I at page 17 of the Anderson Committee's Report, Vol. I) ; what is to be regarded as the maximum for March does not appear. During the session of the Commission at New Delhi on January 30, 1942, the representative for Khairpur claimed that their authorized maximum is 4,000 cusecs ; let us accordingly assume (the assumption may be right or wrong) that this is their maximum for March, so that the total authorized maximum withdrawal for all the Barrage canals is 23,454 + 267 + 4,000 or 27,721 cusecs, as compared with 6,000 cusecs for Thal and 700 cusecs for Paharpur.

139. Let us now work out the distribution for a day in March when the total supply available for all three systems is 27,368 cusecs —the case mentioned in paragraph 92·5 at page 140 of Sind's Rabi Case. This has to be shared among the three in the proportion of 27,721 : 6,000 : 700 ; the shares would be :

Sukkur 22,041 cusecs { British Canals including the Nara supply for Khairpur lands. 18,861 cusecs. ; Khairpur .. 3,180 cusecs.

Thal 4,770 cusecs.

Paharpur 557 cusecs.

As the March mean monthly allotments for Khairpur, Thal, and Paharpur are respectively 2,000, 3,600, and 360 cusecs, the above distribution throws no burden at all on these canals ; the entire deficit falls on the British Canals of the Sukkur Barrage. This is so, even if, as suggested in paragraph 102 at page 46 of the Punjab Defence, Vol. I, Thal and the other systems are limited to their mean monthly allotments ; for, then the distribution would be :

British Canals—21,408 cusecs.

Khairpur—2,000 cusecs.

Thal—3,600 cusecs.

Paharpur—360 cusecs.

The only canals short of their authorized withdrawals in this distribution, as in the former, are the British Canals of the Barrage. Indeed, it is easy to see that until the total supplies available fall to a figure below about 21,000 cusecs, no part of the deficit would fall on Thal or Paharpur or Khairpur, so that in the case of small deficiencies, such as the Anderson Committee contemplated, the effect of their recommendations is to give priority to Thal, Paharpur, and Khairpur over the British canals of the Barrage. Whatever assumptions we may make, it is certain that the recommendations of the Anderson Committee do not give priority to the Sukkur Barrage over Thal or Paharpur while, as we have already seen, they definitely give priority to Haveli and Panjnad over the Sukkur Barrage.

140. Sind have strongly disputed the equity of this arrangement. The allocations made to the Barrage canals in British Sind by the Secretary of State in 1923 were prior in point of time to the allocations made by the Government of India in 1937 to Thal or Haveli. Not to give priority to the earlier allocations over the later contravenes, it is urged, not only a well-established rule observed in all countries, but also numerous past assurances given by the Government of India themselves. The Government of India had time and again declared that the Barrage supplies " must be assured " before any subsequent project could be approved, that there must be definite proof that the Barrage supplies " will not be endangered," and so forth. Even when appointing the Anderson Committee, the Government of India took care to see that existing projects would not be jeopardised ; and accordingly, the terms of reference required the Committee to report whether the additional supplies required for Khairpur, Bahawalpur, and Haveli could be found " without detriment to the parties interested in the waters of the Indus and its tributaries." Even the Punjab themselves in forwarding their Brief to the Anderson Committee claimed priority

only in respect of " supplies which are not required for the canals included in the Sukkur Barrage Project as sanctioned by the Secretary of State in 1923," thus conceding the superior claim of the Barrage supplies of 1923. Bahawalpur too asked the Committee only for a share of the water that would be available after allowing for the requirements of the Sukkur canals. (See paragraph 60·1 to 60·10 at pages 129 to 131 of Sind's Rabi Case.)

141. These are some of the grounds upon which Sind now claim priority for the Sukkur Barrage supplies sanctioned by the Secretary of State in 1923. We must admit that there is a great deal of force in them ; but, in view of what has happened since the Anderson Committee's Report, we are unable to accept the claim in full.

142. Let us briefly review some of the events that have happened since the Anderson Committee submitted their report. The Report was sent to all local Governments for comment in December 1935. In March 1936, the Government of Bombay sent their reply accepting almost every single recommendation of the Committee ; in particular, they accepted the recommendations regarding the sharing of supplies and they also accepted the view expressed by the Independent Members of the Committee as to the maximum authorized monthly discharges. Presumably, Bombay accepted all these recommendations because they were getting certain benefits for the Sukkur Barrage as the result of some of the recommendations. They were getting an additional allotment of 6,500 cusecs for the British Canals in October. They were also getting 2,267 cusecs for Khairpur in each of the months, January, February, and March, which, they doubtless thought, would appease Khairpur, and as the result of which Khairpur could be expected to cease to demur to paying a share of the expenditure on the Barrage. Whatever may have been the reason, Bombay, as already stated, accepted almost all the recommendations. Sind, which became a separate Province in 1936, did not withdraw or modify Bombay's acceptance. Accordingly, in March 1937 the Government of India confirmed the recommendations in all material respects. It was in October 1939 that Sind, for the first time, complained of the possible effect of the Punjab withdrawals on Sind's inundation canals, and it was in December 1939 that Sind first suggested that the Punjab should hold up work on the Thal or any other new project. Meanwhile, however, the Punjab had already (in the spring of 1939) completed the Haveli Project and had already commenced construction of the Thal Project. These projects had been constructed or commenced on the faith of the orders passed by the Government of India in 1937 which allocated certain supplies to them and prescribed a certain mode of sharing supplies during periods of shortage. The Thal

Project is now nearing completion, the first intimation which the Punjab had of Sind's objection to Thal being apparently a letter dated May 30, 1940, by which time the project was already in the second year of construction.

143. Recommendation on first Rabi issue.—It is thus clear that the Punjab have incurred a good deal of expenditure or have entered into heavy commitments on the basis of the Government of India's orders of 1937. The effect of giving priority to the Sukkur Barrage would be to throw the entire burden of the deficits on these new projects. We have already indicated the possible magnitude and frequency of these shortages, and if they were thrown entirely on the new Punjab projects, whose capacity to bear them is necessarily very much less than that of the Barrage, the projects might be financially crippled. A deficit of 3,000 cusecs might be inconvenient to a system which normally takes 25,000 cusecs ; it would be disastrous to a system whose normal intake is only 3,600 cusecs. The fact is that we are no longer writing on a clean slate and have to devise the most equitable solution of a problem in which equity is no longer all on one side. For whatever reason, whether for lack of time or of material or for any other cause, Sind's objections to the orders of 1937 were not raised until after the Punjab had already spent money or entered into commitments on the faith of those orders. This is a factor which we are bound to take into account and accordingly we are unable at this late stage to endorse in full Sind's claim to priority.

144. Second Rabi issue.—We now proceed to deal with issue No. 2, " Should the said authorized monthly withdrawals be regarded as mean monthly withdrawals ?" The controversy between the parties on this issue is confined to the original authorizations for the British Canals as set out in the Barrage Project ; there is no dispute about the subsequent authorizations for Khairpur being " mean monthly withdrawals". The former are reproduced in columns 2 and 6 of Table I at page 17 of the Anderson Committee's Report, Vol. I ; and the controversy has arisen mainly because the Independent Members of the Committee were of the opinion, which was accepted by the Government of India, that these withdrawals must be treated as " maximum authorized monthly discharges ", whatever may be the precise meaning of this phrase. In what follows (on this issue) we shall be speaking only of the authorizations for the British Canals of the Barrage.

145. These withdrawals have been stated for each month at a certain rate—so many cubic feet of water per second—and Sind contend that, having regard to the manner in which the figures were calculated in the Barrage Project, they are mean monthly with-

drawals. Sind point out that if they are treated " as maxima, *i.e.* not to be exceeded on any one day, the Barrage canals cannot be operated on a rational basis in accordance with irrigation demand". (Paragraph 17, item 24, Sind's Complaint, Part II.) The Punjab contend, on the other hand, that whatever may have been the intention of those who framed the Barrage Project in the first instance, the Government of India in forwarding , and the Secretary of State in sanctioning, the withdrawals regarded them " as maxima not to be exceeded on any day of the month ". (Paragraph 2·2·1, pages 15 and 16 of the Punjab Defence, Vol. II.) The real issue between the parties is therefore this : according to the Punjab, the rate of withdrawal sanctioned for the Barrage canals in any month, *e.g.* 23,454 cubic feet per second in the month of March, must not be exceeded on any day, or indeed at any moment, of the month ; according to Sind, it may be exceeded on some days, provided it is not exceeded for the month as a whole. We have now to choose between these two interpretations. It must be noted that, on either view, the total withdrawals, say, during March, cannot exceed 23,454 × 31 cusec-days in volume and that there is a similar maximum limit for the total withdrawals during the other months.

146. The Sukkur Barrage authorized withdrawals were sanctioned by the Secretary of State in the form in which they were submitted with the Project Report. The method of derivation of these withdrawals is explained in Vols. V and XX of the 1919-20 Sukkur Barrage Report. The canal requirements were arrived at on a basis of duties. Duty is the relation between the area of crops irrigated and the quantity of irrigation water required to supply it. As the quantity required by the crops varies at different times during the season, the duty for the whole crop period is an average figure and does not give information as to the actual rate of supply on any day. The Sukkur authorized withdrawals were calculated on this basis for each month and are therefore mean monthly supplies. In paragraph 24 at page 7 of the Sukkur Project Volume V, already cited, the manner of computing the supply required is described thus : " For calculating the discharge required in each canal *month by month* as shown in Statements Nos. III to VIII, the proportions of crops taking water each month as adopted by Messrs. Baker and Lane on page 6 of their printed Report have been adopted ". Then follows Statement No. I, giving the total combined discharge of all proposed canals *month by month*. Statement II is the abstract of the total *monthly* discharges required by the three canals on the right bank. Statements III to VIII show the discharges required for each system separately *for each month*. It is clear from the above that the require-

ments of each canal were calculated on a monthly basis, that is to say, with reference to the total supply estimated to be required during each month. To interpret the monthly withdrawals thus determined as if they were meant to limit the withdrawals on any day, or, worse still, at any moment, of the month would lead to absurd results. Thus, if for any reason, *e.g.* on account of canal closures, no water can be taken from the river during certain days, Sind would be unable to make up the deficiency by drawing extra water on other days. This could hardly have been the intention of those who proposed or sanctioned the Barrage allocations. These considerations show beyond doubt that Sind's interpretation is the true one.

147. As against this, the Punjab in their Defence (Vol. II, pages 15 to 23) have invited our attention to certain statements in the Government of India's despatch, dated December 16, 1920, forwarding the Sukkur Barrage Project to the Secretary of State for sanction. We shall examine one of them ; the same argument applies to all the others.

148. In paragraph 14 of the despatch there occurs this statement : " Our Inspector-General of Irrigation considers that they (certain irrigation estimates) may be accepted as *maxima* but that both in March and April it would be possible to reduce them, without material damage to the crops concerned. * * * We agree with the views expressed by our Inspector-General of Irrigation and consider that though the percentages proposed by Messrs. Baker and Lane may suitably be adopted in the calculations for the full supply capacity of the canals, it is unlikely that any material damage will occur to the crops if the full discharges corresponding to these capacities are not available in the months of March and April." As we have already seen, the requirements of the Barrage canals shown in the Project were calculated for each month as the unit. In this paragraph of the despatch the authors merely say that there would be no material damage to crops if the requirements for the months of March and April were not fully met. We fail to see how this supports the Punjab's interpretation. We would once more point out that whether we proceed on the Punjab interpretation or on the Sind interpretation, the authorized monthly withdrawals are in one sense maximum figures, because they limit the total withdrawals during each month : *e.g.* during March to 23,454 × 31 cusec-days. The words " they may be accepted as maxima " occurring in the despatch are therefore equally consistent with both interpretations ; indeed, the fact that the references in the despatch are throughout to whole months supports Sind's rather than the Punjab's view. A similar indication is to be found in paragraph 15

of the despatch : " The Statement No. I following paragraph 24 of Volume V of the Project details the *maximum* discharges, calculated on the above data, that will be required in all canals *during each month* of the year as follows."

149. The Punjab next rely upon the correspondence printed at Appendices A and B at pages 33 and 34 of Vol. I of the Anderson Committee's Report. Appendix A is a letter (dated June 3, 1929) from the Government of Bombay to the Government of India, asking whether the Government of India had any objection to one of the canals in the Sukkur Barrage Project (the Eastern Nara) being designed to draw, subject to certain conditions, a larger volume of water than that allowed to it in the Project. Appendix B is the reply of the Government of India stating that they had no objection. The Punjab's contention is that, if the Government of Bombay had believed that the sanctioned withdrawals were " mean " monthly figures, they could, without any reference to the Government of India, have designed their canals to take somewhat more when occasion required. Therefore, it is said, the fact that they thought a reference to the Government of India necessary indicates that they themselves believed that they could never draw more than the authorized figure. This argument would have been good, if the object of the applicants had been merely to draw more on some days and less on others, while keeping within the sanctioned figure for the total of each month ; but such was not the case. They wanted to exceed the total allotment for each month on the ground of increased transit losses in the Eastern Nara. They agreed that the additional water would be taken only when available instead of being allowed to run waste to the sea ; but that is a different matter. The point is that they were seeking to do something which would, in certain circumstances, have enabled them to exceed the Project allotments for the several months, and so they sounded the Government of India. It seems to us, therefore, that this correspondence does not necessarily bear out the Punjab's interpretation rather than Sind's : it is equally consistent with both.

150. The Punjab next rely upon a letter from Mr. Trench to the Secretary of the Central Board of Irrigation, dated May 21, 1935, in which he said : " From what I have already said, it will be clear that I find it impossible to admit that these ever were intended by Sind to be maxima at any moment in the month, although this was assumed to be the case by the Government of India. ..... "

151. The document containing the alleged assumption has not been produced before us. We cannot regard the above letter as proving either that the Government of India actually made such an

assumption or that the assumption is correct. In fact, Mr. Trench himself has disputed its correctness in the very passage cited.

152. Another line of argument relied upon by the Punjab is, we fear, due to the confusion created by a loose use of the term "maximum". We shall reproduce the relevant paragraphs from the Punjab Defence, Vol. II :

"If it was intended that the Sukkur withdrawals should be mean discharges it is unlikely that the Government of India could have given or the Secretary of State accepted an assurance of adequacy of supply, when as recently as March and April, 1917, and January, 1919, the supplies at Sukkur were below the combined requirements for the Barrage canals plus the Sutlej Project. He was also aware from page 12 of Volume V of Sukkur Project that such conditions would have arisen in January, February, March, and April, 1903. If, however, the Sukkur discharges were sanctioned as maxima there would be no incongruity in the available discharges being occasionally less than the maxima.

"Furthermore, apart from the withdrawals of the Sukkur Barrage Project now under consideration, there is no case on record in Northern India where the Secretary of State sanctioned mean monthly withdrawals for any project, the withdrawals sanctioned being invariably maxima. It is inconceivable that the Government of India who have the responsibility for control of the rivers in India would recommend a project without fixing the maximum amount which may be drawn by it. In the case of the Sukkur Barrage they did in fact fix the maxima and those maxima are the discharges which Sind is now endeavouring to change to mean." (Punjab Defence, Vol. II, p. 19.)

153. The short answer to both these contentions is that there is no question but that in one sense the sanctioned figures for the Barrage canals are *maxima*, the only question being whether they are maxima intended to limit the withdrawals from moment to moment or only to limit the total withdrawals of the month. Having regard to the manner in which they were computed, we have no doubt that they were meant to limit only the total withdrawals for each month. The withdrawals on certain days may exceed the rate sanctioned for the month, (if the carrying capacity of the canals permits) so long as the total withdrawals during the month, when reduced to cusecs, are within the sanctioned figure.

154. We must now say a word as to the effect of the Government of India's orders of 1937 on this issue. Those orders confirmed the opinion of the Independent Members that "the discharges tabulated in columns 2 and 6 of Table I (page 17) must be treated

as maximum authorised monthly discharges." (Page 27, item 4, Anderson Committee's Report, Vol. I.) The expression " maximum monthly discharge," standing by itself, is ambiguous, and should not have been used. It may mean (*a*) the maximum discharge at any moment during the month, or (*b*) the maximum discharge for the month as a whole, *i.e.*, the figure which the mean discharge for the month must not exceed. It appears to have the former meaning in paragraph 30, page 20 of the Anderson Committee's Report, Vol. I, which speaks of " mean " and " maximum monthly discharges". Mr. Trench, the Bombay Member of the Committee, on the other hand, in his letter reproduced as Serial No. 4 at page 75 of Sind's Rabi Case, used it in the latter sense, that is to say, as the equivalent of the authorised mean monthly draw-off. In what sense the Government of Bombay understood it when they accepted the opinion of the Independent Members of the Anderson Committee and in what sense the Government of India understood it when they confirmed that opinion, we cannot be quite certain. We must, however, assume that in the Government of India's orders it has the same meaning as in paragraph 30 of the Anderson Committee's Report, Vol. I, upon which those orders were based ; that is to say, it means the maximum at any time during the month.

155. We may, at this stage, also draw attention to an unexplained inconsistency in the Anderson Committee's Report, Vol. I. At page 14, in paragraph 34, it is stated that the " unanimous findings of the Members of the Committee " are being presented for the information of the Government of India. Amongst these unanimous findings occurs paragraph 12 at page 17, which runs thus : " No claim to any discharge in excess of the figures in column 9 of Table I can be made. Since, however, the authorised 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 June 29, 1929, is re-affirmed. 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." Now the first sentence of this paragraph merely states that the figures in column 9 cannot, as a matter of right. be exceeded. That is quite consistent either with the interpretation that the figures cannot be exceeded at any time during the month or merely that they cannot be exceeded for the month as a whole. But the rest of the paragraph clearly implies that, whereas the authorized Khairpur withdrawals are mean withdrawals which can sometimes be exceeded (provided the mean for the whole month is not exceeded), the other figures, that is to say, the figures for the British canals, are maximum withdrawals which cannot be exceeded

at any time during the month. If such was the unanimous finding of the Committee, it is difficult to understand why the same finding is repeated at page 27 of the Report as the opinion of the Independent Members (that is to say, only the Chairman and the Vice-Chairman) on a point " upon which the Committee as a whole were unable to pass unanimous resolutions". It may, however, be contended that, whether the finding was that of the whole Committee or only of the Independent Members, it was confirmed by the Government of India in March 1937. (See item No. 24 in the list of orders annexed to the Government of India's letter No. I. R. 18, dated March 30, 1937.) We have, therefore, now to see what is the precise effect of the Government of India's orders.

156. The orders confirm the recommendation of the Independent Members ; and the recommendation of the Independent Members was that the discharges in question must be treated as " *maximum* authorized monthly discharges." It is important to note that the Independent Members did not say that in their opinion the discharges *are* " maximum monthly discharges," but only that they must be *treated* as such. We think that this means no more than that they must be so treated for the purposes of paragraph 20, at page 18 of Vol. I of the Anderson Committee's Report, where the authors have used a similar term. In that paragraph the Committee (as has been mentioned more than once) recommended that in times of shortage, the Thal, Paharpur and Sukkur Barrage canals should share supplies available on the basis of their *authorised monthly maximum withdrawals* for the period concerned. To apply the formula, we have to know what are the " authorized monthly maximum withdrawals " for the Sukkur Barrage as well as other canals. The term has nowhere been defined in their Report. For the canals of the other systems the " maximum " figures have been explicitly stated in the Report ; but for the Barrage canals the figures have nowhere been explicitly stated. It was presumably to fill this lacuna that the Independent Members recorded their opinion as to what these withdrawals for the Barrage canal should be deemed to be. But in other respects we do not construe either the opinion of the Independent Members or the orders of the Government of India confirming the opinion as intended to modify or as modifying in any way the nature or extent of the allocations made by the Secretary of State. Any general modification of the kind was outside the terms of reference of the Anderson Committee ; they framed no issue on the point ; and we cannot hold that any of the Members or the Government of India meant to deal with any such general modification of the Secretary of State's orders.

157. Finding on second issue.—Our answer to this issue, therefore, is as follows :

The authorized monthly withdrawals of the Sukkur Barrage canals are "mean monthly withdrawals" in the sense that the canals may, so far as their carrying capacity permits, draw more than the sanctioned figure on one day and less on another, so long as the total withdrawal for each month, when reduced to cusecs, does not exceed the sanctioned figure. They may exceed even the month's authorized total when there is surplus water running waste to the sea, but not as a matter of right. This is clear from certain subsequent orders; the point is dealt with in connection with the fourth issue.

158. Third Rabi issue.—We now turn to the third issue. Having come to a finding in the negative on issue No. 1, we have now to recommend how and between which parties supplies available in times of shortage should be shared. We have already explained why the formula of distribution recommended by the Anderson Committee is not applicable to the situation disclosed by the data produced before us. We have also explained why we are unable to recommend a new formula which shall give complete priority to the Sukkur Barrage when supplies are in deficit. We shall now proceed to explain how, in our view, short supplies should be shared.

159. The distribution of deficit supplies on the basis of so-called "authorized maximum monthly withdrawals" results as we have seen, in virtual priority for Thal over the Sukkur Barrage. Thal has been nearly completed on the basis of the orders of 1937 which provided for such a distribution. On the other hand, assurances were also given in the past to the effect that the Barrage supplies would have priority over later projects. In the events that have happened, we consider that the most equitable course would be to give priority neither to the one nor to the other, but to distribute deficit supplies between the two on the basis of "mean monthly withdrawals".

160. We do not think it necessary to disturb the provision made in the orders of 1937 as regards Haveli and Panjnad.

161. Nor is it necessary to throw any part of the deficit on a small system like Paharpur whose "mean monthly withdrawal" in the *rabi* season is only 360 cusecs. None of the other systems can get any appreciable relief by making Paharpur share in the deficit. We consider, therefore, that even in times of shortage, Paharpur should be allowed to retain its full allotment of 360 cusecs in the *rabi* season.

162. The British and Khairpur canals will be taken as a single unit, the figures in column 9 of Table I at page 17 of the Anderson

Committee's Report Vol. I, being regarded as the "mean authorized monthly withdrawals" for the purpose of sharing deficits with Thal on the basis that we have now recommended.

163. In justification of our present recommendation, we would point out, first, that this mode of sharing deficits is precisely what Sind have asked for in the event of their claim to priority for the Sukkur Barrage being rejected (see paragraph 2 at page 113 of Sind's Rabi Case). Our recommendation differs from Sind's alternative claim only in leaving Paharpur out of the distribution. For reasons already explained, this should make no appreciable difference to the other projects concerned. In the next place, we would point out that sharing according to "mean monthly withdrawals" is exactly what the framers of the Thal Project provided for in their calculations. At page 47 of the Thal Project, 1936, Vol. II, occurs the following statement: "In paragraph 20 (that is, paragraph 20 of the Anderson Committee's Report, Vol. I) the words 'on the basis of their authorised monthly maximum withdrawals for the period concerned' are not clear. In the statement put up the shortages in the Indus have been shown as shared by the Thal, Paharpur, and Sukkur Barrage canals in the ratio of their mean monthly withdrawals. For the Sukkur Barrage, the figures given in column 9 of Table I, page 17 of Vol. I of the Report, have been taken for this purpose, while for Paharpur canal, the figures given in paragraph 19 of the same Report were used. The mean monthly withdrawals for the Thal project are given in column 7, Table II, page 20 of the same volume." It appears from this extract that the framers of the Thal Project distributed deficits on the basis of "mean monthly withdrawals", because the words in which the Anderson Committee recommended the other basis were "not quite clear". We have proposed the same thing, because we think sharing on "mean monthly withdrawals" is the most equitable course. In any event, since the framers of the Thal Project themselves worked out the expected supplies for that project on the basis of distribution according to "mean monthly withdrawals" in times of shortage, their expectations are in no way prejudiced by our present recommendations.

164. Recommendation on third issue.—On this issue, therefore, we recommend that, in the event of the supplies in the Indus proper being insufficient, Paharpur should first be given 360 cusecs and the rest of the available supplies should be divided between the Thal and Sukkur Barrage canals on the basis of their "authorized mean monthly withdrawals" for the period concerned, the figures in column 9 at page 17 of the Anderson Committee's Report, Vol. I being treated as the "authorized mean monthly withdrawals" for this purpose.

We should like to make it clear that we leave open the question as to how deficits should be shared between the British canals and the Khairpur feeders: it does not arise out of the present complaint and must be dealt with separately.

165. Fourth Rabi issue.—We now come to the fourth issue, "In the event of supplies at Sukkur being in excess of the authorized withdrawals referred to in the Anderson Committee's Report, should the Lloyd Barrage have a share of such surplus, and, if so, on what basis?" Sind have explained that, when they asked for the framing of this issue, they were under a misapprehension. They apparently thought that the recommendation in paragraph 30 at page 20 of the Anderson Committee's Report Vol. I, enabled Thal, Haveli, and Panjnad to draw *without limit* any excess supplies, subject only to the condition that they must share these supplies according to the formula prescribed in that paragraph. It now transpires that, according to an interpretation of the aforesaid recommendation given by the Government of India in 1936 on a reference from the Government of the Punjab, Thal, Haveli and Panjnad can in no circumstances draw more than their respective maximum authorised allotments, even when supplies are in excess. For example, in the months from November to March (both inclusive) Thal can in no circumstances draw more than 6,000 cusecs, Haveli more than 2,750 cusecs, and Panjnad more than 1,500 cusecs. (See letter No. I. R. 18, dated July 3, 1936 from the Government of India in reply to letter No. 5054-Con., dated April 27, 1936 from the Government of the Punjab at pages 10 and 11 of the Correspondence Volume.) Should there be any surplus water at Sukkur after these three systems have had their maximum allotments, there is, it is said, nothing in the recommendations of the Anderson Committee or in the Government of India's orders of 1937 to prevent Sind from utilizing it instead of allowing it to run waste to the sea past the Barrage. In these circumstances Sind do not press this issue, except to the extent of asking us to re-affirm, in more general terms, but subject to the same conditions, the permission given to them by the Government of India in 1929 to utilize surplus water. The permission, as then given, was limited to the Eastern Nara and was subject to the conditions "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." (See letter No. I. R. 6, dated June 29, 1929, from the Government of India to the Government of Bombay, printed as Appendix B to the Anderson Committee's Report, Vol. I.) Sind now ask that this permission be reaffirmed and made applicable to all the canals of the Barrage, subject to the same conditions. The

Punjab, however, desire that if, as we have already held, the authorized Barrage allocations mentioned in the Anderson Committee's Report are to be regarded as "mean monthly" allocations, we must fix a maximum which Sind must not be allowed to exceed at any time, whatever may be the surplus supplies available.

166. We have, in an earlier part of this Report, set out the legal position of Provincial Governments in respect of the right to use and control the waters of rivers and streams flowing in natural channels. As regards the Government of Sind, the position appears to be that, subject to any orders that may be made by competent authority under section 131 of the Government of India Act, 1935, and subject to the provisions of the Bombay Irrigation Act, 1879, as amended in Sind, that Government is free to use and control for public purposes the water of the Indus in Sind. The aforesaid Irrigation Act imposes no limit on the quantity of water that may be taken, and if no such limit is imposed under section 131 of the Government of India Act as the result of our recommendations in the present case, Sind would be able to take, for public purposes, any surplus water which is running past the Barrage, subject, possibly, to the payment of compensation under the Irrigation Act cited. We have, therefore, to consider whether we should recommend the imposition of a maximum as desired by the Punjab.

167. Now, there is no Province or State on the down-stream side of Sind, which can be affected by Sind's withdrawals at the Sukkur Barrage. As regards Provinces and States on the upstream side, they might be affected, if, as the result of having actually used a certain volume of surplus water for a series of years, Sind were to claim a "prescriptive right" to continue to draw that volume of water ever afterwards. Sind are, however, prepared to accept the position that they will only withdraw water when it is available and that they will never claim any "prescriptive right". It is possible that if any new Barrage below Sukkur is undertaken, a maximum, as desired by the Punjab, may have to be imposed on the Sukkur Barrage withdrawals in the interests of the new Barrage.

168. There is another point to be made clear in this connection. Even if no maximum is prescribed, as desired by the Punjab, the "mean monthly" allotments themselves imply that there is a maximum for the total withdrawals of each month. Thus when it is said that the authorized "mean monthly withdrawals" for the British Canals of the Sukkur Barrage in March are 23,454 cusecs, it is implied that their total withdrawals during March must not exceed $23,454 \times 31$ cusecs-days, although they may withdraw more than 23,454 cusecs-days on some days of the month and less on others. Undoubtedly Sind cannot, *as a matter of right*, exceed the limit thus

placed on the total withdrawals of each month. This, however, need not debar Sind from taking any surplus water that is running waste, subject to the conditions already mentioned ; for she will be taking this water with a clear admission that she has not and never will have any prescriptive right to it. The Sukkur Barrage has lost a part of its priority to Haveli and Thal, and may well be given some relief by not being restrained from drawing surplus water. It could, however, be pointed out to Sind that internal difficulties might arise, if the liberty is unduly utilized and if at a later date the water is not available owing to the requirements of other barrages or storages, whilst wasteful methods of irrigation are meanwhile encouraged.

169. Recommendation on fourth issue.—Our recommendation on this issue, is, therefore, as follows :

It should be made clear that Sind is not debarred at present from taking any surplus water which may be running waste to the sea past the Sukkur Barrage, provided (1) that no prescriptive right to take water in this manner can ever be acquired or claimed by Sind, and (2) that the Governor-General may impose a bar if at any future time he thinks fit to do so. This is intended to be merely a clarification of the existing orders on a point on which there may be some doubt.

PART IV.

ISSUE REGARDING CONSEQUENTIAL MODIFICATIONS.

170. Issue as to consequential modifications in the orders of 1937.—

This issue is in the following terms :—

> In the event of any of the orders of the Government of India passed on March 30, 1937, upon the recommendations of the Anderson Committee being modified, what consequential modifications, if any, should be made in any of the other orders ?

171. We have therefore to consider first whether our recommendations would involve any modification of the orders of the Government of India passed in 1937. We shall deal with them in order.

172 (1). On the first *Kharif* issue, we have made certain recommendations as to the Bhakra Dam Project. So far as these are concerned, there can be no question of any modification of the orders of 1937, because those orders did not deal with the Bhakra Dam Project.

(2). We have made similar recommendations as to the Beas Dam Project, which also do not involve any modification of the orders of 1937. It is true that the Anderson Committee after recommending that small schemes of a capacity not exceeding half-a-million acre-feet on the affluents of the Indus and its tributaries for storage during July and August might be undertaken by any Provincial or State Government entitled to do so, without the formal sanction of any other party, went on to add that any scheme with a proposed storage capacity of more than the above figure must have the prior approval of all interested parties. But while the Government of India confirmed the former recommendation relating to storages on the affluents of the main rivers, no orders were passed on the latter. Strictly speaking, therefore, our present recommendations as to the Beas Dam Project, which is on the main Beas and has a capacity of 2 million acre-feet, do not conflict with any of the orders passed in 1937.

(3). We have next made certain recommendations as to the Balloki-Suleimanke Link Project which are in accordance with the orders of 1937. These orders permitted the transfer of water from the Chenab to the Sutlej provided that such action would not effect the Sind inundation canals. We have already stated (paragraph 87 *supra*) that the Link is not likely to have any appreciable affect on the inundation canals in Sind if it does not take any water after June

so that, in recommending that it should be permitted subject to that condition, we are following the orders of 1937.

(4). Finally, our recommendations as to small storages on the affluents of the main rivers merely repeat the orders of 1937.

173. On the second *Kharif* issue, we have not suggested any modification of the orders of 1937, but only a clarification enabling Sind to take surplus water when no one else needs it, the existing rights as well as the future interests of the upper Provinces and States being adequately safeguarded.

174. On the first *Rabi* issue we have said that we cannot endorse Sind's claim for absolute priority in respect of the Sukkur Barrage supplies. This merely restates the effect of the orders of 1937 and does not seek to modify them in any way.

175. The second *Rabi* issue is concerned with a matter of interpretation, whether certain withdrawals are to be regarded as " mean monthly withdrawals ". Our affirmative finding cannot be regarded as any modification of the existing orders. It merely states our opinion as to their true meaning.

176. On the third *Rabi* issue we have recommended a different formula for sharing supplies in times of shortage from that recommended by the Anderson Committee and confirmed by the Government of India. But as we have already explained, our recommendations deal with a situation which we consider to be materially different and which was not contemplated by the Anderson Committee or the Government of India. By way of a rough analogy, we would mention what sometimes happens in contracts of sale. The property sold is described as being of a certain area, " more or less ", and a provision is inserted in the contract that if the area turns out to be actually more or less than that specified in the deed, there will be a proportionate increase or reduction in the stipulated price. The courts interpret such a contract as applying only to cases where the difference between the actual area and the area specified in the deed is small ; if the difference is large, the contract connot be enforced at all and the parties are free to enter into a new contract. Similarly here, the Anderson Committee made certain agreed recommendations (confirmed by the Government of India) on the basis that there would be—more or less—sufficient water in the river for all the projects concerned, save for small deficits in exceptional years, and they made provision for the sharing of these deficits if they should actually occur. It is now found that the probable deficits cannot be described as either small or infrequent. We are, therefore, free to make our own recommendations to meet the new situation.

177. On the fourth *Rabi* issue we have recommended a clarificatory order exactly as in the case of the second *Kharif* issue.

178. No consequential modifications necessary.—It is therefore clear that none of our recommendations involves a modification of the orders of 1937. Even if anything that we have suggested is to be described as a modification of those orders in any respect, we do not think that it is of such a character as to necessitate any consequential modifications.

PART V.

DIRECTIONS AS TO COSTS.

179. Costs to be shared equally between the Punjab and Sind.—In accordance with the practice followed in America in inter-State disputes, we recommend that the Punjab and Sind should bear their own costs as regards counsel's fees, establishment charges, etc., and that the expenses of the Commission should be borne by them in equal shares.

PART VI.

180. Power to decide questions of interpretation to be reserved by the Governor-General.—For the removal of any possible doubt we suggest that the Governor-General should reserve to himself the right to decide all questions of interpretation arising out of any decision given or any order made by him in the matter of the present complaint, his decision on such questions being made final.

181. Acknowledgments.—We cannot conclude this Report without an acknowledgment of the great assistance given to us by the parties, their Counsel, and their technical representatives. Nor must we omit to mention the special debt which we owe to our Secretary, Mr. Hakumat Rai, for the unobtrusive efficiency with which he has discharged his duties.

B. N. RAU,
Chairman.

P. F. B. HICKEY,
E. H. CHAVE,
Members.

SIMLA,
July 13, 1942.

APPENDICES.

APPENDIX I.

(Para. 8 of the Report.)

FROM

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

Joint Secretary to the Government of India,

Department of Industries and Labour, Public Works Branch.

To

THE SECRETARY TO THE GOVERNMENT OF THE PUNJAB, ETC.

PUBLIC WORKS DEPARTMENT, IRRIGATION BRANCH.

No. I. R.-18, dated New Delhi, the 30th March, 1937.

Subject.—DISTRIBUTION OF THE WATERS OF THE INDUS AND ITS TRIBUTARIES.

SIR,

I AM directed to refer to the correspondence ending with your letter 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 Sukkur, 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 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 systems should share, with the Sukkur Barrage canals, the supplies available during any period of shortage, on the basis of their authorized 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 discharges of 500 and 360 cusecs respectively. It appears from item 3 of the Summary of Findings and Recommendations in Volume I of the Committee'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 the 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 Sutlej 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 accommodation which has enabled agreement to be reached on the recommendations of the Indus Committee, and that they will settle them in consonance with the main framework of its recommendations and with due regard to the requirements of the parties interested 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 authorized withdrawals.	The Government of India confirm the recommendation of the Committee.
3	Paharpur Canal—Allotment of discharges.	Ditto ditto.
4	Thal Canal—Settlement of mean and maximum withdrawals.	Ditto ditto.
5	Shares of Thal and Paharpur systems in relation to Sukkur Barrage during times of shortage.	Ditto ditto.
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 provisions which have been agreed upon between the Government 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 authorized discharges at the time.

Serial No. of findings or recommendations.	Substance.	Orders and remarks where necessary.
		(*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 authorized 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.
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 rivers to give similar additional supplies to the Haveli and Panjnad Canals. Similarly the Haveli and Panjnad Canals 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.

Serial No. of findings or recommendations.	Substance.	Orders and remarks where necessary.
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, Bahawalpur and Bikaner :—
		(*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*.
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.	(*ii*) The Bahawalpur Government will give back this 1 per cent. *when the Madhopur-Beas Link*, which is, also referred to in paragraph 5 of the covering letter to these orders, *is constructed*.
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.
17	Woolar lake scheme	Ditto ditto.
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.

Serial No. of findings or recommendations.	Substance.	Orders and remarks where necessary.
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 remarks 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 Agreement 1920, 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.

APPENDIX II.

(Para. 11 of the Report.)

No. 129/41-GG (A).

GOVERNOR-GENERAL'S SECRETARIAT (PUBLIC).

Simla, the 11th September 1941.

NOTIFICATION.

In pursuance of the provisions of section 131 of the Government of India Act, 1935, the Governor-General has been pleased to appoint, with effect from the 15th September, 1941, a Commission to investigate the complaint of the Government of Sind about their interests in the water from the river Indus. The Commission will consist of the following persons :—

Chairman.—The Honourable Mr. Justice B. N. Rau, Kt., C.I.E., I.C.S., a Judge of the Calcutta High Court.

Members.—Mr. P. F. B. Hickey, D.S.O., retired Chief Engineer, Irrigation Branch, United Provinces ; and

Mr. E. H. Chave, I.S.E., Chief Engineer, Madras.

Mr. Hakumat Rai, a Superintendent in the Labour Department of the Government of India, has been appointed to act as Secretary to the Commission.

(Sd.) J. A. THORNE,

Secretary to the Governor-General (Public).

APPENDIX III.

(Para. 32 of the Report).

1. Treaty between the United States and Mexico to regulate the use of the waters of the Rio Grande, signed at Washington, May 21, 1906.

"*Art. I.*—After the completion of the proposed storage dam near Engle, New Mexico, and the distributing system auxiliary thereto, and as soon as water shall be available in the said system for the purpose, the United States shall deliver to Mexico a total of 60,000 acre-feet of water annually in the bed of the Rio Grande at the point where the headworks of the Acequia Madre, known as the Old Mexican Canal, now exist above the city of Juarez, Mexico.

"*Art. II.*—The delivery of the said amount of water shall be assured by the United States and shall be distributed through the year in the same proportion as the water supply proposed to be furnished from the said irrigation system to lands in the United States in the vicinity of El Paso, Texas, according to the following schedule :—.... In case, however, of extraordinary drought or serious accident to the irrigation system in the United States, the amount delivered to the Mexican Canal shall be diminished in the same proportion as the water delivered to lands under the said irrigation system in the United States.

"*Art. III.*—The said delivery shall be made without cost to Mexico, and the United States agrees to pay the whole cost of storing the said quantity of water to be delivered to Mexico, of conveying the same to the international line, of measuring the said water, and of delivering it in the river bed above the head of the Mexican Canal. It is understood that the United States assumes no obligation beyond the delivering of the water in the bed of the river above the head of the Mexican Canal.

"*Art. IV.*—The delivery of the water as herein provided is not to be construed as a recognition by the United States of any claim on the part of Mexico to the said waters ; and it is agreed that in consideration of such delivery of water, Mexico waives any and all claims to the waters of the Rio Grande for any purpose whatever between the head of the present Mexican Canal and Fort Quitman, Texas, and also declares fully settled and disposed of, and hereby waives, all claims heretofore asserted or existing, or that may hereafter arise, or be asserted, against the United States on account of any damage alleged to have been sustained by the owners of land in Mexico, by reason of the diversion by citizens of the United States of waters from the Rio Grande.

"*Art. V.*—The United States, in entering into this treaty, does not thereby concede, expressly or by implication, any legal basis for any claims heretofore asserted or which may be hereafter asserted by reason of any losses incurred by the owners of land in Mexico due or alleged to be due to the diversion of the waters of the Rio Grande within the United States ; nor does the United States in any way concede the establishment of any general principle or precedent by the concluding of this treaty. The understanding of both parties is that the arrangement contemplated by this treaty extends only to the portion of the Rio Grande which forms the international boundary, from the head of the Mexican Canal down to Fort Quitman, Texas, and in no other case."

(NOTE.—It will be noticed that under this agreement it was stipulated that Mexico should receive a defined quantity of water at a defined place in Mexico, all the necessary arrangements for delivery, measurement, etc., falling to be made by the United States.)

2. Agreement between Madras and Mysore relating to the construction of the Krishnarajasagara Storage Dam on the Cauvery river, signed on February 18, 1924.

"1. Whereas by an agreement, dated 18th February 1892, commonly known and cited as the 1892 agreement, entered into between the Government of His Highness the Maharaja of Mysore, hereinafter referred to as the Mysore Government and the Government of Madras, hereinafter referred to as the Madras Government, certain rules and schedules defining the limits within which no new irrigation works are to be constructed by the Mysore Government without previous reference to the Madras Government were framed and agreed to ; and

"2. Whereas under clause III of the said agreement the Mysore Government asked for the consent of the Madras Government to the construction of a dam and a reservoir across and on the river Cauvery at Kannambadi now known as the Krishnarajasagara dam and reservoir ; and

"3. Whereas a dispute arose as to the terms under which the Mysore Government were to construct the dam in the manner and form proposed by them ; and

"4. Whereas such dispute was referred to the arbitration of Sir H. D. Griffin who gave an award in the year 1914 as to the terms and conditions under which the Madras Government should consent to the construction of the said dam and reservoir ; and

"5. Whereas the Madras Government, after the said award of the said arbitrator was ratified by the Government of India, appealed to the Secretary of State for India who re-opened the question ; and

"6. Whereas thereupon the Mysore Government and the Madras Government with a view to an amicable settlement of the dispute entered into negotiations with each other ; and

"7. Whereas as the result of such negotiations, certain Rules of Regulation of the Krishnarajasagara Reservoir were framed and agreed to by the Chief Engineers of the Mysore and Madras Governments on the 26th day of July of the year 1921, such Rules of Regulation forming Annexure I to this agreement ; and

"8. Whereas thereafter the technical officers of the two Governments have met in conference and examined the question of extension of irrigation in their respective territories with a view to reaching an amicable arrangement ; and

"9. Whereas as the result of such examination and conference by the technical officers of the two Governments, certain points with respect to such extension were agreed to respectively by the Chief Engineer for Irrigation, Madras, and the Special Officers, Krishnarajasagara Works, at Bangalore, on the 14th day of September 1923, such points forming Annexure III to this agreement.

"10. Now these presents witness that the Mysore Government and the Madras Government do hereby agree and bind themselves, their successors and representatives as follows :—

"(*i*) The Mysore Government shall be entitled to construct and the Madras Government do hereby assent under clause III of the 1892 agreement to the Mysore Government constructing a dam and a reservoir across and on the river Cauvery at Kannambadi, now known as the Krishnarajasagara, such dam and reservoir to be of a storage capacity of not higher than 112 feet above the sill of the under-sluices now in existence corresponding to 124 feet above bed of the river before construction of the dam, and to be of the effective capacity of 44,827 m.c. ft., measured from the sill of the irrigation sluices constructed at 60 feet level above the bed of the river up to the maximum height of 124 feet above the bed of the river ; the level of the bed of the river before the construction of the reservoir being taken as 12 feet below the sill level of the existing under-sluices ; and such dam and reservoir to be in all respects as described in schedule forming Annexure II to this agreement.

"(*ii*) The Mysore Government on their part hereby agree to regulate the discharge through and from the said reservoir strictly in accordance with the Rules of Regulation set forth in Annexure I, which Rules of Regulation shall be and form part of this agreement.

"(*iii*) The Mysore Government hereby agree to furnish to the Madras Government within two years from the date of the present agreement dimensioned plans of anicuts and sluice or open heads at the off-takes of all existing irrigation channels having their source in the rivers Cauvery, Lakshmanathirtha and Hemavati, showing thereon in a distinctive colour all alterations that have been made subsequent to the year 1910, and further to furnish maps similarly showing the location of the areas irrigated by the said channels prior to or in the year 1910.

"(*iv*) The Mysore Government on their part shall be at liberty to carry out future extensions of irrigation in Mysore under the Cauvery and its tributaries to an extent now fixed at 110,000 acres. This extent of new irrigation of 110,000 acres shall be in addition to and irrespective of the extent of irrigation permissible under the Rules of Regulation forming Annexure I to this agreement, *viz.*, 125,000 acres *plus* the extension permissible under each of the existing channels to the extent of one-third of the area actually irrigated under such channel in or prior to 1910.

"(*v*) The Madras Government on their part agree to limit the new area of irrigation under their Cauvery-Metur Project to 301,000 acres, and the capacity of the new reservoir at Metur, above the lowest irrigation sluice, to ninety-three thousand five hundred million cubic feet.

"Provided that, should scouring sluices be constructed in the Dam at a lower level than the irrigation sluice, the dates on which such scouring sluices are opened shall be communicated to the Mysore Government.

"(*vi*) The Mysore Government and the Madras Government agree with reference to the provisions of clauses (*iv*) and (*v*) preceding, that each Government shall arrange to supply the other as soon after the close of each official

or calendar year, as may be convenient, with returns of the areas newly brought under irrigation, and with the average monthly discharges at the main canal heads, as soon after the close of each month as may be convenient.

"(*vii*) The Mysore Government on their part agree that extensions of irrigation in Mysore as specified in clause (*iv*) above shall be carried out only by means of reservoirs constructed on the Cauvery and its tributaries mentioned in Schedule A of the 1892 agreement. Such reservoirs may be of an effective capacity of 45,000 m.c. ft., in the aggregate and the impounding therein shall be so regulated as not to make any material diminution in supplies connoted by the gauges accepted in the Rules of Regulation for the Krishnarajasagara forming Annexure I to this agreement, it being understood that the rules for working such reservoirs shall be so framed as to reduce to within 5 per cent. any loss during any impounding period, by the adoption of suitable proportion factors, impounding formula or such other means as may be settled at the time.

"(*viii*) The Mysore Government further agree that full particulars and details of such reservoir schemes and of the impounding therein, shall be furnished to the Madras Government to enable them to satisfy themselves that the conditions in clause (*vii*) above will be fulfilled. Should there arise any difference of opinion between the Madras and Mysore Governments as to whether the said conditions are fulfilled in regard to any such scheme or schemes, both the Madras and Mysore Governments agree that such difference shall be settled in the manner provided in clause (*xv*) below.

"(*ix*) The Mysore Government and the Madras Government agree that the reserve storage for power generation purposes now provided in the Krishnarajasagara may be utilized by the Mysore Government according to their convenience from any other Reservoir hereafter to be constructed, and the storage thus released from the Krishnarajasagara may be utilized for new irrigation within the extent of 110,000 acres provided for in clause (*iv*) above.

"(*x*) Should the Mysore Government so decide to release the reserve storage for power generation purposes from the Krishnarajasagara, the working tables for the new reservoir from which the power water will then be utilised shall be framed after taking into consideration the conditions specified in clause (*vii*) above and the altered conditions of irrigation under the Krishnarajasagara.

"(*xi*) The Mysore Government and the Madras Government further agree that the limitations and arrangements embodied in clauses (*iv*) to (*viii*) *supra* shall, at the expiry of fifty years from the date of the execution of these presents, be open to reconsideration in the light of the experience gained and of an examination of the possibilities of the further extension of irrigation within the territories of the respective Governments and to such modifications and additions as may be mutually agreed upon as the result of such reconsideration.

"(*xii*) The Madras Government and the Mysore Government further agree that the limits of extension of irrigation specified in clauses (*iv*) and (*v*) above shall not preclude extensions of irrigation effected solely by improvement of duty, without any increase of the quantity of water used.

"(*xiii*) Nothing herein agreed to or contained shall be deemed to qualify or limit in any manner the operation of the 1892 agreement in regard to matters.

other than those to which this agreement relates or to affect the rights of the Mysore Government to construct new irrigation works on the tributaries of the Cauvery in Mysore not included in Schedule A of the 1892 agreement.

" (*xiv*) The Madras Government shall be at liberty to construct new irrigation works on the tributaries of the Cauvery in Madras and, should the Madras Government construct, on the Bhavani, Amaravati or Noyil rivers in Madras, any new storage reservoir, the Mysore Government shall be at liberty to construct, as an off-set, a storage reservoir, in addition to those referred to in clause (*vii*) of this agreement on one of the tributaries of the Cauvery in Mysore, of a capacity not exceeding 60 per cent. of the new reservoir in Madras.

" Provided that the impounding in such reservoirs shall not diminish or affect in any way the supplies to which the Madras Government and the Mysore Government respectively are entitled under this agreement, or the division of surplus water which it is anticipated will be available for division on the termination of this agreement as provided in clause (*xi*).

" (*xv*) The Madras Government and the Mysore Government hereby agree that, if at any time there should arise any dispute between the Madras Government and the Mysore Government touching the interpretation or operation or carrying out of this agreement, such dispute shall be referred for settlement to arbitration, or if the parties so agree shall be submitted to the Government of India."

(NOTE.—This agreement is of interest to us for two reasons. In the first place, it will be noticed that the parties appear to have come to the conclusion that a solution of any dispute by agreement is in the end best for both. Paragraphs 3 to 7 of the preamble show that even when a dispute arose under the agreement of 1892 and an arbitration award was made, they ultimately found it best to settle the matter by negotiation. The other point of interest lies in the Annexure containing the Rules of Regulation. There are 33 rules for this purpose with an appendix of instructions. The rules are arranged under various heads such as " Limit Gauges and Discharges at the Upper Anicut ", " Impounding Formula ", " Gauge Reading and Inflow Computations ", " Computation of Issues ", " Hot Weather Computation of Issues from the Krishnarajasagara ", " Regulation ", and " Inspection of Records by either Government." These rules serve to show that even when there is an agreed solution between the parties it is necessary and worthwhile to provide in detail for matters of this kind. We cannot expect fully to utilize the resources of a river without laborious attention to detail.)

3. Notes on agreement between Great Britain and Egypt regulating the use of the Nile for irrigation, signed at Cairo on May 7, 1929.

" The Egyptian Government therefore accept the findings of the 1925 Nile Commission, whose report is considered an integral part of the present agreement. They propose, however, that, in view of the delay in the construction of the Gebel Aulia Dam, which, under paragraph 40 of the Nile Commission's Report, is regarded as a counterpart of the Gezira scheme, the dates and quantities of gradual withdrawals of water from the Nile by the Sudan in flood months as given in Article 57 of the Commission's Report be modified in such a manner that the Sudan should not withdraw more than 126 cubic metres per second before 1936, it being understood that the schedule contained in the above-mentioned Article will remain unaltered until the discharge of 126 cubic metres per second is reached. These quantities are based on the Nile Commission's Report, and are therefore subject to revision as foreseen therein.

" It is further understood that the following arrangements will be observed in respect of irrigation works on the Nile :—

" (*i*) The Inspector-General of the Egyptian Irrigation Service in the Sudan, his staff, or any other officials whom the Minister of Public Works may nominate, shall have the full liberty to co-operate with the Resident Engineer of the Sennar Dam in the measurement of discharges and records to satisfy the Egyptian Government that the distribution of water and the regulation of the dam are carried out in accordance with the agreement reached. Detailed working arrangements agreed upon between the Minister of Public Works and the Irrigation Adviser to the Sudan Government will take effect as from the date of the confirmation of this note.

" (*ii*) Save with the previous agreement of the Egyptian Government, no irrigation or power works or measures are to be constructed or taken on the River Nile and its branches, or on the lakes from which it flows, so far as all these are in the Sudan or in countries under British administration, which would, in such a manner as to entail any prejudice to the interests of Egypt, either reduce the quantity of water arriving in Egypt, or modify the date of its arrival, or lower its level.

" (*iii*) The Egyptian Government, in carrying out all the necessary measures required for the complete study and record of the hydrology of the River Nile in the Sudan, will have all the necessary facilities for so doing.

" (*iv*) In case the Egyptian Government decide to construct in the Sudan any works on the river and its branches, or to take any measures with a view to increasing the water supply for the benefit of Egypt, they will agree beforehand with the local authorities on the measures to be taken for safeguarding local interests. The construction, maintenance and administration of the above-mentioned works shall be under the direct control of the Egyptian Government.

" (*v*) His Britannic Majesty's Government in the United Kingdom of Great Britain and Northern Ireland shall use their good offices so that the carrying out of surveys, measurements, studies and works of the nature mentioned in the two preceding paragraphs is facilitated by the Governments of those regions under British influence.

" (*vi*) It is recognised that in the course of the operations here contemplated uncertainty may still arise from time to time either as to the correct interpretation of a question of principle or as to technical or administrative details. Every question of this kind will be approached in a spirit of mutual good faith.

" In case of any difference of opinion arising as to the interpretation or execution of any of the preceding provisions, or as to any contravention thereof, which the two Governments find themselves unable to settle, the matter shall be referred to an independent body with a view to arbitration.

" The present agreement can in no way be considered as affecting the control of the river, which is reserved for free discussion between the two Governments in the negotiations on the question of the Sudan."

(NOTE.—This agreement, though it does not deal with regulation in such detail as the last one, does contain provisions for regulation and for co-operation between the officers of the two Governments concerned for the purposes of regulation.)

4. The Boulder Canyon Project Act passed by the United States Congress on December 21, 1928.

Be it enacted by the Senate and House of Representatives of the United States of America in Congress assembled, That for the purpose of controlling the floods, improving navigation and regulating the flow of the Colorado River, providing for storage and for the delivery of the stored waters thereof for reclamation of public lands and other beneficial uses exclusively within the United States, and for the generation of electrical energy as a means of making the project herein authorized a self-supporting and financially solvent undertaking, the Secretary of the Interior, subject to the terms of the Colorado River compact hereinafter mentioned, is hereby authorized to construct, operate, and maintain a dam and incidental works in the main stream of the Colorado River at Black Canyon or Boulder Canyon adequate to create a storage reservoir of a capacity of not less than twenty million acre-feet of water and a main canal and appurtenant structures located entirely within the United States connecting the Laguna Dam, or other suitable diversion dam, which the Secretary of the Interior is hereby authorized to construct if deemed necessary or advisable by him upon engineering or economic considerations, with the Imperial and Coachella Valleys in California, the expenditures for said main canal and appurtenant structures to be reimbursable, as provided in the reclamation law, and shall not be paid out of revenues derived from the sale or disposal of water power or electric energy at the dam authorized to be constructed at said Black Canyon or Boulder Canyon, or for water for potable purposes outside of the Imperial and Coachella Valleys : *Provided, however,* That no charge shall be made for water or for the use, storage, or delivery of water for irrigation or water for potable purposes in the Imperial or Coachella Valleys ; also to construct and equip, operate, and maintain at or near said dam, or cause to be constructed, a complete plant and incidental structures suitable for the fullest economic development of electrical energy from the water discharged from said reservoir ; and to acquire by proceedings in eminent domain, or otherwise, all lands, rights of way, and other property necessary for said purposes.

Section 2.—(*a*) There is hereby established a special fund, to be known as the " Colorado River Dam fund " (hereinafter referred to as the " fund "), and to be available, as hereafter provided, only for carrying out the provisions of this Act. All revenues received in carrying out the provisions of this Act shall be paid into and expenditures shall be made out of the fund, under the direction of the Secretary of the Interior.

(*b*) The Secretary of the Treasury is authorized to advance to the fund from time to time and within the appropriations therefor, such amounts as the Secretary of the Interior deems necessary for carrying out the provisions of this Act, except that the aggregate amount of such advances shall not exceed the sum of $165,000,000. Of this amount the sum of $25,000,000 shall be allocated to flood control and shall be repaid to the United States out of 62½ per centum of revenues, if any, in excess of the amount necessary to meet periodical payments during the period of amortization, as provided in section 4 of this Act. If said sum of $25,000,000 is not repaid in full during the period of amortization, then 62½ per centum of all net revenues shall be applied

to payment of the remainder. Interest at the rate of 4 per centum per annum accruing during the year upon the amounts so advanced and remaining unpaid shall be paid annually out of the fund, except as herein otherwise provided.

(*c*) Moneys in the fund advanced under sub-division (*b*) shall be available only for expenditures for construction and the payment of interest, during construction, upon the amounts so advanced. No expenditures out of the fund shall be made for operation and maintenance except from appropriations therefor.

(*d*) The Secretary of the Treasury shall charge the fund as of June 30 in each year with such amount as may be necessary for the payment of interest on advances made under subdivision (*b*) at the rate of 4 per centum per annum accrued during the year upon the amounts so advanced and remaining unpaid, except that if the fund is insufficient to meet the payment of interest, the Secretary of the Treasury may, in his discretion, defer any part of such payment, and the amount so deferred shall bear interest at the rate of 4 per centum per annum until paid.

(*e*) The Secretary of the Interior shall certify to the Secretary of the Treasury, at the close of each fiscal year, the amount of money in the fund in excess of the amount necessary for construction, operation, and maintenance, and payment of interest. Upon receipt of each such certificate the Secretary of the Treasury is authorized and directed to charge the fund with the amount so certified as repayment of the advances made under subdivision (*b*), which amount shall be covered into the Treasury to the credit of miscellaneous receipts.

Section 3.—There is hereby authorized to be appropriated from time to time, out of any money in the Treasury not otherwise appropriated, such sums of money as may be necessary to carry out the purposes of this Act, not exceeding in the aggregate $165,000,000.

Section 4.—(*a*) This Act shall not take effect and no authority shall be exercised hereunder and no work shall be begun and no moneys expended on or in connection with the works or structures provided for in this Act, and no water rights shall be claimed or initiated hereunder, and no steps shall be taken by the United States or by others to initiate or perfect any claims to the use of water pertinent to such works or structures unless and until (1) the States of Arizona, California, Colorado, Nevada, New Mexico, Utah, and Wyoming shall have ratified the Colorado River compact, mentioned in section 13 hereof, and the President by public proclamation shall have so declared, or (2) if said States fail to ratify the said compact within six months from the date of the passage of this Act then, until six of the said States, including the State of California, shall ratify said compact and shall consent to waive the provisions of the first paragraph of Article XI of said compact, which makes the same binding and obligatory only when approved by each of the seven States signatory thereto, and shall have approved said compact without conditions, save that of such six-State approval, and the President by public proclamation shall have so declared, and, further, until the State of California, by act of its legislature, shall agree irrevocably and unconditionally with the United States and for the benefit of the States of Arizona, Colorado, Nevada, New Mexico,

Utah and Wyoming, as an express covenant and in consideration of the passage of this Act, that the aggregate annual consumptive use (diversions less returns to the river) of water of and from the Colorado River for use in the State of California, including all uses under contracts made under the provisions of this Act and all water necessary for the supply of any rights which may now exist, shall not exceed four million four hundred thousand acre-feet of the waters apportioned to the lower basin States by paragraph (a) of Article III of the Colorado River compact, plus not more than one-half of any excess or surplus waters unapportioned by said compact, such uses always to be subject to the terms of said compact.

* * * * * * * * *

(*b*) Before any money is appropriated for the construction of said dam or power plant, or any construction work done or contracted for, the Secretary of the Interior shall make provision for revenues by contract, in accordance with the provisions of this Act, adequate in his judgment to insure payment of all expenses of operation and maintenance of said works incurred by the United States and the repayment, within fifty years from the date of the completion of said works, of all amounts advanced to the fund under subdivision (*b*) of section 2 for such works, together with interest thereon made reimbursable under this Act.

Before any money is appropriated for the construction of said main canal and appurtenant structures to connect the Laguna Dam with the Imperial and Coachella Valleys in California, or any construction works is done upon said canal or contracted for, the Secretary of the Interior shall make provision for revenues, by contract or otherwise, adequate in his judgment to insure payment of all expenses of construction, operation, and maintenance of said main canal and appurtenant structures in the manner provided in the reclamation law.

If during the period of amortization the Secretary of the Interior shall receive revenues in excess of the amount necessary to meet the periodical payments to the United States as provided in the contract, or contracts, executed under this Act, then, immediately after the settlement of such periodical payments, he shall pay to the State of Arizona $18\frac{3}{4}$ per centum of such excess revenues and to the State of Nevada $18\frac{3}{4}$ per centum of such excess revenues.

Section 5.—That the Secretary of the Interior is hereby authorized, under such general regulations as he may prescribe, to contract for the storage of water in said reservoir and for the delivery thereof at such points on the river and on said canal as may be agreed upon, for irrigation and domestic uses, and generation of electrical energy and delivery at the switchboard to States, municipal corporations, political subdivisions, and private corporations of electrical energy generated at said dam, upon charges that will provide revenue which, in addition to other revenue accruing under the reclamation law and under this Act, will in his judgment cover all expenses of operation and maintenance incurred by the United States on account of works constructed under this Act and the payments to the United States under subdivision (*b*) of section 4. Contracts respecting water for irrigation and domestic uses shall be for permanent service and shall conform to paragraph (*a*) of section 4 of this Act. No

person shall have or be entitled to have the use for any purpose of the water stored as aforesaid except by contract made as herein stated.

After the repayments to the United States of all money advanced with interest, charges shall be on such basis and the revenues derived therefrom shall be kept in a separate fund to be expended within the Colorado River Basin as may hereafter be prescribed by the Congress.

General and uniform regulations shall be prescribed by the said Secretary for the awarding of contracts for the sale and delivery of electrical energy, and for renewals under subdivision (*b*) of this section, and in making such contracts the following shall govern :

* * * * * * * * *

Section 6.—That the dam and reservoir provided for by section 1 hereof shall be used : First, for river regulation, improvement of navigation, and flood control ; second, for irrigation and domestic uses and satisfaction of present perfected rights in pursuance of Article VIII of the Colorado River compact ; and third, for power. The title to said dam, reservoir, plant and incidental works shall for ever remain in the United States, and the United States shall, until otherwise provided by Congress, control, manage and operate the same, except as herein otherwise provided : *Provided, however*, That the Secretary of the Interior may, in his discretion, enter into contracts of lease of a unit or units of any Government-built plant, with right to generate electrical energy, or, alternatively, to enter into contracts of lease for the use of water for the generation of electrical energy as herein provided, in either of which events the provisions of section 5 of this Act relating to revenue, term, renewals, determination of conflicting applications, and joint use of transmission lines under contracts for the sale of electrical energy, shall apply.

The Secretary of the Interior shall prescribe and enforce rules and regulations conforming with the requirements of the Federal Water Power Act, so far as applicable, respecting maintenance of works in condition of repair adequate for their efficient operation, maintenance of a system of accounting, control of rates and service in the absence of State regulation or inter-state agreement, valuation for rate-making purposes, transfers of contracts, contracts extending beyond the lease period, expropriation of excessive profits, ecapture and/or emergency use by the United States of property of lessees and penalties for enforcing regulations made under this Act or penalizing failure to comply with such regulations or with the provisions of this Act. He shall also conform with other provisions of the Federal Water Power Act and of the rules and regulations of the Federal Power Commission, which have been devised or which may be hereafter devised, for the protection of the investor and consumer.

The Federal Power Commission is hereby directed not to issue or approve any permits or licenses under said Federal Water Power Act upon or affecting the Colorado River or any of its tributaries, except the Gila River, in the States of Colorado, Wyoming, Utah, New Mexico, Nevada, Arizona, and California until this Act shall become effective as provided in section 4 herein.

Section 7.—That the Secretary of the Interior may, in his discretion, when repayments to the United States of all money advanced, with interest, reimbursable hereunder, shall have been made, transfer the title to said canal and ap-

purtenant structures except the Laguna Dam and the main canal and appurtenant structures down to and including Syphon Drop, to the districts or other agencies of the United States having a beneficial interest therein in proportion to their respective capital investments under such form of organisation as may be acceptable to him. The said districts or other agencies shall have the privilege at any time of utilizing by contract or otherwise such power possibilities as may exist upon said canal, in proportion to their respective contributions or obligations toward the capital cost of said canal and appurtenant structures from and including the diversion works to the point where each respective power plant may be located. The net proceeds from any power development on said canal shall be paid into the fund and credited to said districts or other agencies on their said contracts, in proportion to their rights to develop power, until the districts or other agencies using said canal shall have paid thereby and under any contract or otherwise an amount of money equivalent to the operation and maintenance expense and cost of construction thereof.

* * * * * * * * *

Section 9.—That all lands of the United States found by the Secretary of the Interior to be practicable of irrigation and reclamation by the irrigation works authorized herein shall be withdrawn from public entry. Thereafter, at the direction of the Secretary of the Interior, such lands shall be opened for entry, in tracts varying in size but not exceeding one hundred and sixty acres, as may be determined by the Secretary of the Interior, in accordance with the provisions of the reclamation law, and any such entryman shall pay an equitable share in accordance with the benefits received, as determined by the said Secretary, of the construction cost of said canal and appurtenant structures; said payments to be made in such instalments and at such times as may be specified by the Secretary of the Interior, in accordance with the provisions of the said reclamation law, and shall constitute revenue from said project and be covered into the fund herein provided for: *Provided*, That all persons who have served in the United States Army, Navy, or Marine Corps during the war with Germany, the war with Spain, or in the suppression of the insurrection in the Philippines, and who have been honorably separated or discharged therefrom or placed in the Regular Army or Navy Reserve, shall have the exclusive preference right for a period of three months to enter said lands, subject, however, to the provisions of subsection (*c*) of section 4, Act of December 5, 1924 (Forty-third Statutes at Large, page 702); and also, so far as practicable, preference shall be given to said persons in all construction work authorized by this Act: *Provided further*, That in the event such an entry shall be relinquished at any time prior to actual residence upon the land by the entryman for not less than one year, lands so relinquished shall not be subject to entry for a period of sixty days after the filling and notation of the relinquishment in the local land office, and after the expiration of said sixty-day period such lands shall be open to entry, subject to the preference in this section provided.

* * * * * * * * *

Section 11.—That the Secretary of the Interior is hereby authorized to make such studies, surveys, investigations, and do such engineering as may be necessary to determine the lands in the State of Arizona that should be embraced within the boundaries of a reclamation project, heretofore commonly known

and hereafter to be known as the Parker-Gila Valley reclamation project, and to recommend the most practicable and feasible method of irrigating lands within said project, or units thereof, and the cost of the same; and the appropriation of such sums of money as may be necessary for the aforesaid purposes from time to time is hereby authorized. The Secretary shall report to Congress as soon as practicable, and not later than December 10, 1931, his findings, conclusions, and recommendations, regarding such project.

* * * * * * * * *

Section 13.—(*a*) The Colorado River compact signed at Santa Fe, New Mexico, November 24, 1922, pursuant to Act of Congress approved August 19, 1921, entitled "An Act to permit a compact or agreement between the States of Arizona, California, Colorado, Nevada, New Mexico, Utah, and Wyoming respecting the disposition and apportionment of the waters of the Colorado River, and for other purposes," is hereby approved by the Congress of the United States, and the provisions of the first paragraph of article 11 of the said Colorado River compact, making said compact binding and obligatory when it shall have been approved by the legislature of each of the signatory States, are hereby waived, and this approval shall become effective when the State of California, and at least five of the other States mentioned, shall have approved or may hereafter approve said compact as aforesaid and shall consent to such river, as herein provided.

* * * * * * * * *

Section 15.—The Secretary of the Interior is authorized and directed to make investigation and public reports of the feasibility of projects for irrigation, generation of electric power, and other purposes in the States of Arizona, Nevada, Colorado, New Mexico, Utah, and Wyoming for the purpose of making such information available to said States and to the Congress, and of formulating a comprehensive scheme of control and the improvement and utilization of the water of the Colorado River and its tributaries. The sum of $ 250,000 is hereby authorized to be appropriated from said Colorado River Dam fund, created by section 2 of this Act, for such purposes.

Section 16.—In furtherance of any comprehensive plan formulated hereafter for the control, improvement, and utilization of the resources of the Colorado River system and to the end that the project authorized by this Act may constitute and be administered as a unit in such control, improvement, and utilization, any commission or commissioner duly authorized under the laws of any ratifying State in that behalf shall have the right to act in an advisory capacity to and in co-operation with the Secretary of the Interior in the exercise of any authority under the provisions of sections 4, 5, and 14 of this Act, and shall have at all times access to records of all Federal agencies empowered to act under said sections, and shall be entitled to have copies of said records on request.

Section 17.—Claims of the United States arising out of any contract authorized by this Act shall have priority over all others, secured or unsecured.

Section 18.—Nothing herein shall be construed as interfering with such rights as the States now have either to the waters within their borders or to adopt such policies and enact such laws as they may deem necessary with respect

to the appropriation, control, and use of waters within their borders, except as modified by the Colorado River compact or other interstate agreement.

Section 19.—That the consent of Congress is hereby given to the States of Arizona, California, Colorado, Nevada, New Mexico, Utah, and Wyoming to negotiate and enter into compacts or agreements, supplemental to and in conformity with the Colorado River compact and consistent with this Act for a comprehensive plan for the development of the Colorado River and providing for the storage, diversion, and use of the waters of said river. Any such compact, or agreement may provide for the construction of dams, headworks, and other diversion works or structures for flood control reclamation, improvement of navigation, division of water, or other purposes and/or the construction of power houses or other structures for the purpose of the development of water power and the financing of the same; and for such purposes may authorize the creation of interstate commissions and/or the creation of corporations, authorities, or other instrumentalities.

(*a*) Such consent is given upon condition that a representative of the United States, to be appointed by the President, shall participate in the negotiations and shall make report to Congress of the proceedings and of any compact or agreement entered into.

(*b*) No such compact or agreement shall be binding or obligatory upon any of such States unless and until it has been approved by the legislature of each of such States and by the Congress of the United States.

* * * * * * * * *

(NOTE.—Sections 2 and 3 give details as to the constitution of the Colorado River Dam Fund and are of interest from the financial point of view. The rate of interest charged on the advances made to the Fund by the Federal Government is 4% per annum.

Section 4(*b*) has fixed 50 years as the period of amortization.

Section 6 recites the purposes of the Boulder Dam and reservoir in order of precedence: first, river regulation, improvement of navigation and flood control; then, irrigation, and domestic uses; and last of all, power. It also provides that the title to the dam and other works shall be in the United States as also the right to control, manage and operate the same.

Section 15 is interesting as showing the concern of the Federal Government that every scheme for the improvement and utilization of the water of the Colorado system, no matter in which State, shall be fully investigated and the results intimated to the Congress. The sum of $250,000 has been authorized to be appropriated from the Colorado River Dam Fund for this purpose.)

APPENDIX IV:

(Para 89 of Report.)

NOTE IN EXPLANATION OF THE ALTERNATIVE RECOMMENDATION, REQUIRING APPLICATION OF THE NORTHERN INDIA CANAL AND DRAINAGE ACT, 1873, WITH POWERS OF REGULATION.

If the proposed barrages or other ameliorative measures for the Sind inundation canals are found to be not feasible, then it will be necessary to evolve some means of giving effect to regulation.

We would state at once that this Commission has not got the necessary data to draw up detailed rules for regulation. But we have certain observations to make on the subject.

1. Only in the last resort have we recommended application of the Act and taking powers of regulation. We are hopeful that barrage schemes will prove feasible and that there will be sufficient accommodation between the parties to permit acceptance of our main recommendations and render unnecessary the imposition of this alternative solution. It may, however, be necessary, if the investigation of the barrage schemes shows that their construction would not be justified and if other ameliorative measures also are found to be not feasible.

2. The regulation must be done in such a manner that it will not starve the new Punjab canals and yet will give the Sind inundation canals some degree of protection during critical periods.

3. We have no information of the nature of the site of either the Bhakra or the Beas Dam or of the natural facilities for surplussing at full reservior level or of the surplussing intended by low-level sluices.

We are reluctant to impose unduly large low-level surplussing arrangements for the purpose of regulating the Kotri or other selected gauge, as they may be prohibitive in cost. The low-level surplussing capacity needed will depend on the discharge which the Sutlej Valley Project canals may require from the Sutlej under the most unfavourable conditions of supply in the Beas, apart from the Sirhind and New Canal requirements and the regulation water needed for the Kotri or other selected gauge under these proposals.

4. The reference-gauge to be selected and the minimum gauge-level to be fixed for giving Sind the appropriate measure of protection are matters on which the Punjab and Sind are not likely to agree.

5. If there is a bad flood level at the beginning of the season rather than at the end, there will be less damage to crops, because the area planted will be less and the maturing season flood will be sufficient to mature the restricted area sown. The worst damage likely to occur to the Sind inundation canals is when the river flood falls away in late August or early September; and it is then that protection is needed most. (*Vide* I.R.C. records for dates for obtaining specific water levels on the falling stage of the Indus at Kotri. This graph also shows the variability in the rate of fall at different levels in different years.

6. The existing Kotri gauges and the reduced gauges, as estimated by Sind, after the contemplated Punjab withdrawals for the years 1931-41 are given on Sind Sheet 300. Sarhad gauges are given on Sind Sheet 298. The protection that can be given to the Sind inundation canals without undue wastage of water and without crippling the contemplated Punjab canals will have to be based on about the minimum gauge prevailing at present at Kotri (or other selected gauge site). The above sheet numbers refer to the Sind's Kharif Case, Vol. I.

7. A rough examination is made below of the effect of fixing Kotri gauges in August and September, for purposes of protection, at the levels noted.

Period at Kotri.	Proposed Kotri gauge to receive protection.	Approximate number of years that regulation would be needed under present conditions for 1931-41.	Approximate number of years that regulation would be needed under Set A calculations after contemplated Punjab withdrawals for 1931-41 conditions.
August 15th ..	18 ft. ..	1	7
September 1st ..	17 ft. ..	Probably 1	2
September 15th ..	14½ ft. ..	Probably 1	6

8. Regulation would be required for a relatively short period under the Punjab "Set C" calculations, if their predictions regarding rise of bed should materialize.

9. The height of the Kotri gauge has been recorded since 1863. If we analyse the figures by 20-year periods, 1863-82, 1883-1902, 1903-22, we find that the *average* gauge during the first of these periods was: August 15th—17·0 ft., September 1st—16·3 ft., September 15th—14·2 ft., the corresponding figures for the entire 60-year period being 18·4 ft., 17·8 ft., and 15·6 ft. respectively. *The protection levels proposed above are thus* slightly higher than the mean levels reached during at least one continuous period of 20 years.

10. Unless the parties are agreed on other arrangements before regulation comes into force, we suggest that the Kotri gauge should be the reference gauge. The levels mentioned in para. 7 above should be the protection levels and proportionate daily levels should be fixed within the above limits. Regulation at the storages would be done only between August 15th and September 15th.

11. As already stated, we consider that the worst effect of the contemplated Punjab withdrawals will be on the supplies to the Sind inundation canals in or about September. We therefore propose rules only for protecting these supplies.

12. The basic rules may be as follows :—

(1) As soon as the river level at the reference gauge in Sind falls below the protected level on or after the 15th August, the Punjab storages shall begin to release water for aiding Sind supplies. Issues shall continue until the reference gauge rises above the protected level, but in no case shall they continue beyond the 15th September.

(2) Rates of issue shall be measured by the discharge below Islam Weir. Accordingly, the issue rate from storages on the dates in Column 1 below shall be such as to secure the discharge shown in Column 2, as measured below Islam on the corresponding Islam date. (This Islam date will be fixed by adding to the date of issue the time-lag from the storages to Islam.)

Column 1.	Column 2.
August 15th	$\frac{300{,}000}{31}$ cusecs.
August 16th	$\frac{300{,}000}{30}$ cusecs.
August 17th	$\frac{300{,}000}{29}$ cusecs.
	and so on up to
August 31st	$\frac{300{,}000}{15}$ cusecs.
September 1st and thereafter, while protection lasts.	20,000 cusecs.

(3) On any day on which the reference gauge rises above the protected level, no water need be released.

(4) No new or repair river works except Railway works shall be permitted within 5 miles above and 5 miles below the selected reference gauge without agreement between the Punjab and Sind Chief Engineers.

13. Prediction of probable gauges in Sind from known hydraulic data in the Punjab has not been found possible in the past for this period. The difficulty of prediction has not yet been overcome. We have, however, considered the lag effect in framing our proposals.

N. B.—1. The Punjab have objected to the use of the Kotri gauge as a reference gauge for regulation of supplies to be given from the Bhakra and Beas Dams. The alternative site is Sarhad.

During the proceedings it was explained by the Chief Engineer, Sind, that, during floods, it would be difficult to make accurate discharge measurements at Sarhad, as the far river bank is not in view at such a river stage. (Mithankot discharges have also been found to be incapable of accurate measurement at such stages.) However, at such river stages as those at which regulation would be required, accurate gaugings are presumably feasible. It may be that Sarhad will ultimately be found to be more suitable, though, with the river data available at present, Kotri is the best gauge. The Punjab also criticised the Sarhad gauge during the proceedings. The Punjab remarks on the subject are given below :—

Quotation from the Punjab Note.

" The reason for selecting the Kotri gauge for these investigations was that this gauge has been regularly read and recorded for many years past.

" It has, however, been pointed out that the Kotri gauge is most unsuitable for purposes of judging the effect of Bhakra withdrawals on the river levels of the Indus in Sind. In addition to the actual effects of these withdrawals, and of the uncertain effects of time-lag, and gain or loss between Bhakra and the Punjab-Sind border, there are superimposed, in the case of Kotri, the further effects of Sind withdrawals for the Upper Sind inundation canals and the Sukkur Barrage, and of time-lag and gain and loss in a further 350 miles of the river. These are peculiarly difficult to assess for this reach of the river as it shows large gains on a rising river in May and June and other months which are contrary to all experience of other reaches on the river and are probably due to regeneration. However their origin be debated, they are a most unusual feature and vitiate calculations of effects considerably. In addition there are the physical effects of the Sukkur Barrage in disturbing the river regime ; not all of these may have worked themselves out yet.

" For all these reasons it is submitted that if the effects of Bhakra withdrawals are to be estimated on any Sind gauge, it should be on a gauge near the Punjab-Sind border. The Sarhad gauge, though not quite on the border and though suffering from certain defects, has been in operation since 1931 and by the earliest time that Bhakra can come into operation will have been read and recorded for 20 years. It is submitted that this gauge should be brought into operation as the test gauge, its defects removed and regular daily discharge observations instituted at this site. It can hardly be contended that reasonably accurate discharge observations cannot be carried out at this site if a real attempt be made to do so, particularly at those river stages which are vital to the supplies in the inundation canals. "

N. B.—2. The idea of regulation was put to the parties at a very early stage. We quote the relevant extracts from the proceedings of October 2, 1941 :—

" *Chairman.*—The New Jersey case suggests several methods by which such problems may be solved. There also it was alleged that the impounding and diversion of water by New York might hurt New Jersey in various ways : by making the water in the lower reaches salty, by lowering levels, etc. Inquiry showed that some of these effects might happen, others not. The Court made a decree reducing the quantity that New York may draw and ordering,

further, that when the level of the river at certain points should fall below a certain figure, New York must release a certain quantity of water from the impounding reservoirs; in addition, as already mentioned, the decree was expressly declared to be liable to modification at the instance of any party at any time.

" *Mr. Coltman* (for Sind).—Whether or not it will be a workable proposition in the present case may depend upon the nature of the river and the nature of the bed. We will consider it.

" *Chairman.*—It is really for the technical experts to say whether any solution is feasible on these lines without hurting either Sind or the Punjab.

" *Sir N. N. Sircar* (for the Punjab).—It will be quite feasible; speaking off-hand, without committing myself, it will be quite feasible if you were to lay down some general standard as to what is meant by Sind being hurt. I mean to say, assuming for the sake of argument that we come to the conclusion that their levels must not be interfered with too much, supposing there is just a small diminution, that may not amount to what I call in technical language a 'cause of action'. Therefore some kind of general guidance should be given as to what is meant by their being hurt. This matter is certainly worth consideration.

" *Chairman.*—I should like both sides to think about it and see if a solution is possible which does not hurt either side appreciably.

" *Mr. Coltman.*—Quite obviously that is the proper way. Nobody wants, and Sind certainly does not want, to be obstructive, not in the least. We are quite willing to consider any constructive suggestion. I am authorized to say this. "

It is clear from these extracts that the first reaction of the parties to the idea of regulation was far from unfavourable. It is possible that their views have changed—Sind may have apprehensions that regulation might not go far enough, while the Punjab may be afraid that regulation might go too far.

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