Public Works (1898) Department.

G.O., No. 519 S

DATED 8 July '98

[Despatch Abstract.]

Report of Irrigation Works on the Sarpanth Estate in India in review of the ——— for 1896-97, communicated to the Superintendent of Irrigation.

Indexed.

[P. W. 21. 1,000—23-6-98.]

BACK PAPERS.

G.O.	No.	Department.	Date.	G.O.	No.	Department.	Date.
	5282		24-6-97				

FURTHER PAPERS.

G.O.	No.	Department.	Date.	G.O.	No.	Department.	Date.

Public works (1898) Department.

CURRENT No 5327

P/Sec/

No. 5192 dated 8-7-98

From The Govt. of India.

Order thereon
Communicated
to the Chief Engr for Irrigation

No. 99d

Dated 16-6-98

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Enclosures 1

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4/7/98

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2

To
The Chief Engr for Irrigation with 1 book.

4/7/98

SUBJECT.

Review of the Revenue report
of Irrigation works in the
Punjab for 1896-97.

2/7/98

[P. W. 29
1,000—23-4-98.]

BACK PAPERS.

No.	Date.

FURTHER PAPERS.

No.	Date.

No. 99 I.

GOVERNMENT OF INDIA.

PUBLIC WORKS DEPARTMENT.

CIVIL WORKS.

Irrigation.

Simla, the 16th June 1898.

Review of the Revenue Report of Irrigation Works in the Punjab for 1896-97.

Read—

Letter No. 242 A. I., dated 5th February 1898, from the Government of the Punjab, Public Works Department, forwarding the Revenue Report of Irrigation Works in the Punjab for 1896-97 and the Resolution by that Government reviewing the Report.

Capital Outlay.

Observations.—The capital expenditure (exclusive of contributions) incurred on these works during the past financial year amounted to nearly 41½ lakhs of rupees, being nearly 2¾ lakhs in excess of that incurred in 1895-96. Of this sum 2 lakhs were expended on Minor Works and the balance on Major Works; and of the latter 28 lakhs were spent on the new Chenab Canal alone, raising the total outlay on this project to 204 lakhs (exclusive of interest charges) and leaving nearly 61 lakhs still to be spent to complete the works. On the Western Jumna Canal 4¾ lakhs were spent chiefly on the new Nardak and Petwar distributaries and on improving the Hansi Branch. On the Bari Doab Canal 2⅓ lakhs were spent mainly on the construction of new distributaries for the irrigation of Government waste lands in the Lahore District and remodelling the Kasur and Sobraon Branch Canals. Nearly one lakh was spent on the Sirhind Canal, chiefly on the construction of permanent outlets on distributaries. On the Swat River Canal 2 lakhs were spent, chiefly on the Trans-Kalpani distributary which was opened for irrigation in April 1897, and large sums were expended on the Jhelum and Ghaggar Canals which were started during the year as Famine Relief Works, the outlay representing the normal value of the work executed.

The total capital expenditure on Major and Minor Imperial Works to the end of 1896-97 including indirect charges amounted to Rs. 8,61,78,528.

Under "Contribution Works" the capital expenditure during the year was Rs. 54,493 and to the end of the year Rs. 1,50,65,158, this being the share of the capital outlay on the Western Jumna and Sirhind Canal systems contributed by Native States for the irrigation of lands in their territories.

Mileage of Channels.

2. The aggregate length of main and branch canals amounted to 4,153 miles at the close of the year, the addition of 67 miles to the total length during the year being due chiefly to the opening of two branches of the Chenab Canal. There was no increase in the aggregate length of navigable channels which is 386 miles.

The total mileage of distributaries increased from 7,278 miles in March 1896 to 8,007 miles at the close of the year under review, the principal additions being 645 miles of new channels from the two recently opened branches of the Chenab Canal, 64 miles of channels on the Western Jumna Canal, and 16 miles on the Shahpur (Imperial) Canals.

There was no change in the total length—258 miles—of completed canals in Native States, nor was any addition made to the 2,163 miles of distributaries from those canals.

Area Irrigated.

3. The total area irrigated during the year reached the very large total of 4,621,627 acres or 7,221 square miles, of which 456,707 acres or 713½ square miles were in Native States which contributed to the capital cost of the works. This is nearly 22 per cent. in excess of the area irrigated last year, which was the largest on record, and, excluding the area in Native States, is nearly one-fifth of the total cultivated area of the Province as given in the last census report.

The causes which contributed to this gratifying result are stated to be the general scarcity and high prices which prevailed over the greater part of the Province and the scanty rainfall which characterized the seasons. But if, for these reasons, the demand for water was unusually high, the supply of water in the rivers to meet it was unusually low, and the Government of India cannot but regard the success with which the demand was met as affording striking evidence of the high state of efficiency attained in the management of the Punjab Canals. Taking the large canal systems separately, the Sirhind Canal heads the list with an area of 1,338,080 acres, exceeding the previous year's total, which was the highest on record, by 44 per cent. The Western Jumna and Bari Doab Canals come next with 739,752 acres and 731,942 acres, respectively, and are followed by the Chenab Canal, which, though still incomplete, irrigated 520,279 acres, an area 41 per cent. in excess of that irrigated in the previous year and very nearly double the area—272,000 acres—entered in the forecast of 1891 as the probable area the canal would irrigate in 1896-97. The Swat River Canal eclipsed all previous records with an area of 123,087 acres, and the Sidhnai Canal with 149,454 acres nearly reached its 1893-94 record.

The year was not a favourable one for the Inundation canals on account of the early cessation of the rains and the absence of high floods, and consequently the area irrigated from them was not above the normal.

Of the total area, including that in Native States, irrigated from all canals, 1,441,408 acres were under wheat, 210,730 under rice, and 555,008 under other cereals; 357,770 under gram, 276,673 under jowar, 127,017 under sugarcane, 537,247 under cotton, and 137,399 under indigo.

The estimated value of the crops irrigated in both British and Native territory exceeds 15 crores of rupees, the value per acre being Rs. 33. The average rate levied for the use of the water, including owner's rate and indirect revenue, was Rs. 3-4-0 or one-tenth of the value of the crop.

4. The Government of India regard with satisfaction the highly successful results attained in the irrigation operations in Native States. The area irrigated from the Patiala branches of the Sirhind Canal far exceeded the irrigation effected in 1895-96, which was nearly double that of any previous year. On the Patiala section of the Sirsa branch, the area irrigated was again in excess of the proportion nominally due to the State, while the profit to the Durbar on collections amounted to 15·9 per cent. on the capital cost against 5·3 per cent. in the previous year.

Irrigation Duty.

5. The figures given in the table in paragraph 10 of the Local Government's Resolution afford further testimony to the success of the efforts made to distribute the water to the utmost advantage. Thus on the Western Jumna Canal the areas irrigated per cubic foot of the volume entering the canal were 103 acres in the *kharif* and 152 acres in the *rabi* season, as compared with the average for the previous five years of 71 acres and 82 acres, respectively, while on the Sirhind Canal the areas irrigated per cubic foot of water were 77 acres in the *kharif* and 197 acres in the *rabi* against the average of 38 and 114 acres, respectively.

Instructive as are the figures in this table and in the various statements in the Report, giving the duties obtained on individual distributaries of the different canals, the Government of India concur with the remarks made in the latter portion of paragraph 10 of the Resolution regarding the necessity of recording the duties on distributaries more accurately. They also attach much importance to the training of the native revenue establishment in the measurement of distributary discharges and to requiring them to maintain such registers of the volumes of water consumed in their respective sections as will enable these officials to institute a comparison of the quantity of water used with the area of irrigation effected. The Government of India consider that a practical knowledge of the technical points connected with the distribution of canal water should not be confined to the engineering staff. A knowledge of the process of gauging and measuring the flow of water in open channels and through outlets, in a manner sufficiently accurate for practical purposes, is, it is found, readily acquired and applied by the intelligent class of natives composing the canal revenue establishment; and as the first requisite towards a fair distribution of canal water is to have a clear perception of the supply available at any time, it is very desirable to persist in the effective measures already taken in the Punjab to ensure that the establishment in question receive the technical training indicated in the remarks at the end of paragraph 10 of the Local Government's Resolution. With this training they will be much better fitted for the intelligent performance of their duties.

Working Expenses.

6. The total working expenses for the major works (Imperial) amounted to Rs. 30,87,005 as compared with Rs. 28,40,474 in 1895-96, Rs. 26,50,549 in 1894-95, and Rs. 24,45,060 in 1893-94. The growth of expenditure necessarily follows the development of the Chenab Canal project and the extensions of the Western Jumna Canal. The increased expenditure during the year under review was moderate, considering the very large area irrigated, and much of it is stated to have been due to the increase in fees for collection of revenue.

The rate per acre irrigated has fallen steadily from 1·55 in 1894-95 and 1·12 in 1895-96 to 0·96 in the year under review, and the percentage on gross revenue has dropped to 28·2 from 40 in the previous year and 44·4 in 1894-95.

On the minor works the working expenses were less than in either of the two previous years, though the rate per acre is still somewhat above the normal.

The working expenses of both major and minor works together amounted to 33·6 per cent. of the gross revenue of Rs. 1,25,12,321 realized during the year.

The figures given above do not include the cost of maintaining the works by which irrigation in Native States from the Sirsa Branch of the Western Jumna Canal and from the Sirhind Canal is effected. These States pay a share of the maintenance charges of the Head Works and main canals, as well as the entire cost of maintaining, under the agency of the Public Works Department, those Branch canals constructed exclusively for irrigation in their territories. The account of these charges is kept separately, under the head "Contribution Works", from those payable from Imperial Revenues. They amounted during the year under review to Rs. 2,75,713 as compared with Rs. 2,68,917 in 1895-96, Rs. 2,30,640 in 1894-95 and Rs. 1,95,681 in 1893-94. In addition to these charges the Native States pay the cost of maintaining subsidiary works under their own agency which amounted during the year to Rs. 1,80,412. The total working expenses for works for irrigation in Native States therefore amounted to Rs. 4,56,125 during the year.

Financial Results.

7. The financial results of the Punjab Canals in operation during the year may be summarized as follows :—

Imperial Works.	Capital outlay to end of year.	Net revenue.	Interest charges.	Return on capital outlay.
	Rs.	Rs.	Rs.	Per cent.
Major works	8,41,00,265	78,57,443	31,59,651	9·34
Minor works for which Capital and Revenue Accounts are kept	18,27,294	2,66,240	...	14·57
Major and minor works	8,59,27,559	83,04,317	...	9·45*
Works in Native States (Contribution Works)	1,50,65,158	9,92,093	...	6·59

* This percentage is based on a net revenue of Rs 81,23,683 which excludes that derived from the Muzaffargarh and Shahpur (Provincial) canals for which Capital Accounts are not kept.

The net revenue derived from major works amounted to 78½ lakhs, nearly double that collected in any previous year, and represents a return of 9½ per cent. on the capital outlay. After paying all interest charges these canals contributed nearly 47 lakhs, during the year, to the revenues of the country, the total accumulated net profits amounting to 310 lakhs of rupees.

When it is remembered that one of these works, the Swat River Canal, was constructed not as a productive but as a protective work, and that another large project, the Chenab Canal, is still incomplete, these figures must be regarded as highly satisfactory and fully justify the claim of the Punjab Irrigation works to be considered as very profitable investments to Government.

Excluding the two Canals just mentioned the five productive works which are in full operation paid nearly 10½ per cent. on the capital outlay incurred on them.

8. Turning to the individual canals, the Swat River Canal exceeded all previous records with a net revenue of Rs. 2,58,959 and a return of 6½ per cent. on its capital cost ; but of this about 1½ per cent. is due to arrears of indirect land revenue, amounting to Rs. 58,464, which were credited to the canal for the first time during the year ; excluding this receipt the net return may be taken at 5 per cent. The canal has nearly paid off its interest debt, the balance of which was only Rs. 6,99,337 at the end of the year.

The Western Jumna Canal exhibits a most satisfactory account. Excluding the Sirsa Branch, it yielded a net revenue of 13½ lakhs. This Branch has, however, cleared its interest debt, and shows a return of over 14 per cent. against 1·39 per cent. in the previous year. The canal as a whole, including the Sirsa Branch, paid a dividend of 11·29 per cent. as compared with 3·28 per cent. in 1895-96. Its value to the State may be judged from the fact that after paying interest charges on the capital invested it has altogether contributed a sum of no less than 319 lakhs to the Imperial Revenues. The clear profit during the year, *i.e.*, the excess of net revenue over the interest charges, amounted to nearly 12 lakhs.

The Bari Doab Canal established a record by returning nearly 12 per cent. on the capital invested up to the end of the year, the highest previous dividend being 10·29 in 1895-96. After deducting interest charges, the operations of the year resulted in a clear profit of 14½ lakhs.

On the Sirhind Canal equally favourable results were obtained as compared with the records of previous years, the net revenue amounting to Rs. 20,70,633 equivalent to a return of 8·59 per cent. on the total capital invested as compared with 2·9 per cent. in 1895-96, the clear profit during 1896-97 being 11½ lakhs.

9. But the canal, which exhibits the most interesting results, is the Chenab. Notwithstanding the fact that about half the capital expenditure of the year was on incomplete or undeveloped channels not earning revenue and that the project

as a whole is still incomplete, the net revenue during the year amounted to Rs. 13,79,442 equivalent to a profit of 6¾ per cent. on the total capital expenditure (including indirect charges) to the end of the year. The canal has achieved a success far beyond expectations, sanguine as these were. Although the total direct capital expenditure up to the end of the year falls short of that estimated in 1891 by more than 5 lakhs of rupees, the area irrigated has exceeded the area of the forecast by over 91 per cent. The extraordinarily rapid development of the canal is clearly shown by the following comparative statement of the results actually obtained and those forecasted in 1891 :—

	Forecast of 1891.	Actuals.
	Rs.	Rs.
Capital outlay, direct and indirect, up to end of 1896-97	2,11,41,454	2,04,31,137
Net revenue in 1896-97	1,80,448	13,79,442
Percentage of net revenue in 1896-97 on capital outlay (direct and indirect) incurred to end of 1896-97	0·85	6·75
Total net revenue to end of 1896-97 ...	—1,11,741	21,58,088
Total interest charges, less total net revenue at end of 1896-97.	39,78,810	15,71,039
	Acres.	Acres.
Irrigated area in 1896-97	272,000	520,279

The Government of India regard these results with much satisfaction. Not only has the Chenab Canal been of great use in providing the means of sustenance for thousands of cultivators by fertilizing vast tracts of waste land, but it has already yielded a large return on the money invested in its construction, and bids fair to become in the near future a most reliable source of direct revenue.

10. The minor works as a whole did well and irrigated a slightly larger area than in 1895-96, but the net revenue fell from Rs. 5,26,264 in that year to Rs. 4,46,874 in the year under review, for reasons which are explained in the report and referred to in paragraph 3 of this review. The year was a very unfavourable one for the inundation canals.

General Remarks.

11. The benefits conferred on the people by the Punjab Irrigation Works in a year of such general and severe scarcity as that under review can hardly be exaggerated. Rather more than 3¼ million acres of food crops were matured by canal water, the amount of edible produce made available being sufficient, allowing 2 people to the acre, to feed more than a quarter of the entire population of the Punjab for twelve months. The value of these food crops is estimated at 1,173 lakhs of rupees, the wheat crop alone being worth 562 lakhs. The total value of other crops such as cotton, indigo, tobacco, etc., is estimated at 336 lakhs and may be assumed to have afforded the means of subsistence to 1¼ millions of people for twelve months.

The estimated value of all the crops raised by canal water exceeded by 50 per cent. the total amount of capital invested by both the Government of India and Native States in these canals.

12. The report was received by the Government of India on the 8th February 1898, and as usual bears evidence of careful preparation. It gives a clear record of very extensive and important irrigation operations carried on successfully under unusually difficult and trying conditions.

13. The Resolution concludes with a reference to the services rendered during the year by Mr. Higham, who vacated the office of Chief Engineer on his promotion to Inspector General of Irrigation, and by the officers who succeeded him, Lieutenant-Colonel Miller and Mr. Beresford, as well as by the officers of the Department generally, Colonel Jacob being specially mentioned among the latter as discharging his duties with singular devotion and energy. The Government of India concur with the Government of the Punjab in acknowledging the manner in which these officers met the severe strain arising from

a year of drought and famine, and by skill and care in the distribution of water contributed so largely to the excellent results recorded in the body of the report.

ORDER.—Ordered that copies of this Review and of the Report and the Resolution by the Punjab Government be forwarded to the Revenue and Agricultural Department for information.

Ordered, also, that copies of the Review be forwarded to the Government of the Punjab for information and guidance and that copies of the Review and of the Report and Resolution by the Punjab Government be forwarded to the Local Governments and Administrations in the Public Works Department noted on the margin, for information.

The Governments of Madras, Bombay, Bengal, North-Western Provinces and Oudh and Burma, Public Works Department.
The Chief Commissioners of the Central Provinces and Coorg.
The Residents at Hyderabad and Mysore.
The Agents to the Governor General in Central India, Rajputana and Baluchistan.

Ordered, further, that the Review and the Resolution by the Punjab Government be published in the *Gazette of India*, and that copies of the Review and of the Report and Resolution by the Punjab Government be forwarded to Her Majesty's Secretary of State for India.

J. J. Berresford

Offg. Joint Secy. to the Govt. of India.

To

The Secretary to the
Government of Madras,
Public Works Department.

with Report & Appendix copies

G. C. Press, Simla.—No. 371 P. W. D.—17-6-98.—250.

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J. S. BERESFORD,
Offg. Joint Secy. to the Govt. of India.

No 519 I 787-98.
communicated to the
Chief Engineer for Irrigation.
(sd). A. S. Russell.
for Joint Secretary to Govt
Irrigation Branch

To.
Ch. Engr for I.

G. C. Press, Simla.—No. 371 P. W. D.—17-6-98.—250.

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9. But the canal, which exhibits the most interesting results, is the Chenab. Notwithstanding the fact that about half the capital expenditure of the year was on incomplete or undeveloped channels not earning revenue and that the project as a whole is still incomplete, the net revenue during the year amounted to Rs. 13,79,442 equivalent to a profit of 6¾ per cent. on the total capital expenditure (including indirect charges) to the end of the year. The canal has achieved a success far beyond expectations, sanguine as these were. Although the total direct capital expenditure up to the end of the year falls short of that estimated in 1891 by more than 5 lakhs of rupees, the area irrigated has exceeded the area of the forecast by over 91 per cent. The extraordinarily rapid development of the canal is clearly shown by the following comparative statement of the results actually obtained and those forecasted in 1891 :—

	Forecast of 1891.	Actuals.
	Rs.	Rs.
Capital outlay, direct and indirect, up to end of 1896-97	2,11,41,454	2,04,31,137
Net revenue in 1896-97	1,80,448	13,79,442
Percentage of net revenue in 1896-97 on capital outlay (direct and indirect) incurred to end of 1896-97	0·85	6·75
Total net revenue to end of 1896-97 ...	—1,11,741	21,58,088
Total interest charges, less total net revenue at end of 1896-97.	39,78,810	15,71,039
	Acres.	Acres.
Irrigated area in 1896-97	272,000	520,279

The Government of India regard these results with much satisfaction. Not only has the Chenab Canal been of great use in providing the means of sustenance for thousands of cultivators by fertilizing vast tracts of waste land, but it has already yielded a large return on the money invested in its construction, and bids fair to become in the near future a most reliable source of direct revenue.

10. The minor works as a whole did well and irrigated a slightly larger area than in 1895-96, but the net revenue fell from Rs. 5,26,264 in that year to Rs. 4,46,874 in the year under review, for reasons which are explained in the report and referred to in paragraph 3 of this review. The year was a very unfavourable one for the inundation canals.

General Remarks.

11. The benefits conferred on the people by the Punjab Irrigation Works in a year of such general and severe scarcity as that under review can hardly be exaggerated. Rather more than 3¼ million acres of food crops were matured by canal water, the amount of edible produce made available being sufficient, allowing 2 people to the acre, to feed more than a quarter of the entire population of the Punjab for twelve months. The value of these food crops is estimated at 1,173 lakhs of rupees, the wheat crop alone being worth 562 lakhs. The total value of other crops such as cotton, indigo, tobacco, etc., is estimated at 336 lakhs and may be assumed to have afforded the means of subsistence to 1¼ millions of people for twelve months.

The estimated value of all the crops raised by canal water exceeded by 50 per cent. the total amount of capital invested by both the Government of India and Native States in these canals.

12. The report was received by the Government of India on the 8th February 1898, and as usual bears evidence of careful preparation. It gives a clear record of very extensive and important irrigation operations carried on successfully under unusually difficult and trying conditions.

13. The Resolution concludes with a reference to the services rendered during the year by Mr. Higham, who vacated the office of Chief Engineer on his promotion to Inspector General of Irrigation, and by the officers who succeeded him, Lieutenant-Colonel Miller and Mr. Beresford, as well as by the officers of the Department generally, Colonel Jacob being specially mentioned among the latter as discharging his duties with singular devotion and energy. The Government of India concur with the Government of the Punjab in acknowledging the manner in which these officers met the severe strain arising from

a year of drought and famine, and by skill and care in the distribution of water contributed so largely to the excellent results recorded in the body of the report.

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The Chief Commissioners of the Central Provinces and Coorg.
The Residents at Hyderabad and Mysore.
The Agents to the Governor General in Central India, Rajputana and Baluchistan.

Ordered, further, that the Review and the Resolution by the Punjab Government be published in the *Gazette of India*, and that copies of the Review and of the Report and Resolution by the Punjab Government be forwarded to Her Majesty's Secretary of State for India.

J. S. BERESFORD,
Offg. Joint Secy. to the Govt. of India.

No 519 I 9787-28
communicated to the
Chief Engineer for Irrigation.
(sd). A·S· Russell.
for Joint Secretary to Govt
Irrigation Branch.

To
Ch. Engr for I.

G. C. Press, Simla.—No. 371 P. W. D.—17-6-98.—250.

6

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The total mileage of distributaries increased from 7,278 miles in March 1896 to 8,007 miles at the close of the year under review, the principal additions being 645 miles of new channels from the two recently opened branches of the Chenab Canal, 64 miles of channels on the Western Jumna Canal, and 16 miles on the Shahpur (Imperial) Canals.

There was no change in the total length—258 miles—of completed canals in Native States, nor was any addition made to the 2,163 miles of distributaries from those canals.

Area Irrigated.

3. The total area irrigated during the year reached the very large total of 4,621,627 acres or 7,221 square miles, of which 456,707 acres or 713½ square miles were in Native States which contributed to the capital cost of the works. This is nearly 22 per cent. in excess of the area irrigated last year, which was the largest on record, and, excluding the area in Native States, is nearly one-fifth of the total cultivated area of the Province as given in the last census report.

The causes which contributed to this gratifying result are stated to be the general scarcity and high prices which prevailed over the greater part of the Province and the scanty rainfall which characterized the seasons. But if, for these reasons, the demand for water was unusually high, the supply of water in the rivers to meet it was unusually low, and the Government of India cannot but regard the success with which the demand was met as affording striking evidence of the high state of efficiency attained in the management of the Punjab Canals. Taking the large canal systems separately, the Sirhind Canal heads the list with an area of 1,338,080 acres, exceeding the previous year's total, which was the highest on record, by 44 per cent. The Western Jumna and Bari Doab Canals come next with 739,752 acres and 731,942 acres, respectively, and are followed by the Chenab Canal, which, though still incomplete, irrigated 520,279 acres, an area 41 per cent. in excess of that irrigated in the previous year and very nearly double the area—272,000 acres—entered in the forecast of 1891 as the probable area the canal would irrigate in 1896-97. The Swat River Canal eclipsed all previous records with an area of 123,087 acres, and the Sidhnai Canal with 149,454 acres nearly reached its 1893-94 record.

The year was not a favourable one for the Inundation canals on account of the early cessation of the rains and the absence of high floods, and consequently the area irrigated from them was not above the normal.

Of the total area, including that in Native States, irrigated from all canals, 1,441,408 acres were under wheat, 210,700 under rice, and 555,008 under other cereals; 357,770 under gram, 276,673 under jowar, 127,017 under sugarcane, 537,247 under cotton, and 137,399 under indigo.

The estimated value of the crops irrigated in both British and Native territory exceeds 15 crores of rupees, the value per acre being Rs. 33. The average rate levied for the use of the water, including owner's rate and indirect revenue, was Rs. 3-4-0 or one-tenth of the value of the crop.

4. The Government of India regard with satisfaction the highly successful results attained in the irrigation operations in Native States. The area irrigated from the Patiala branches of the Sirhind Canal far exceeded the irrigation effected in 1895-96, which was nearly double that of any previous year. On the Patiala section of the Sirsa branch, the area irrigated was again in excess of the proportion nominally due to the State, while the profit to the Durbar on collections amounted to 15·9 per cent. on the capital cost against 5·3 per cent. in the previous year.

Irrigation Duty.

5. The figures given in the table in paragraph 10 of the Local Government's Resolution afford further testimony to the success of the efforts made to distribute the water to the utmost advantage. Thus on the Western Jumna Canal the areas irrigated per cubic foot of the volume entering the canal were 103 acres in the *kharif* and 152 acres in the *rabi* season, as compared with the average for the previous five years of 71 acres and 82 acres, respectively, while on the Sirhind Canal the areas irrigated per cubic foot of water were 77 acres in the *kharif* and 197 acres in the *rabi* against the average of 38 and 114 acres, respectively.

Instructive as are the figures in this table and in the various statements in the Report, giving the duties obtained on individual distributaries of the different canals, the Government of India concur with the remarks made in the latter portion of paragraph 10 of the Resolution regarding the necessity of recording the duties on distributaries more accurately. They also attach much importance to the training of the native revenue establishment in the measurement of distributary discharges and to requiring them to maintain such registers of the volumes of water consumed in their respective sections as will enable these officials to institute a comparison of the quantity of water used with the area of irrigation effected. The Government of India consider that a practical knowledge of the technical points connected with the distribution of canal water should not be confined to the engineering staff. A knowledge of the process of gauging and measuring the flow of water in open channels and through outlets, in a manner sufficiently accurate for practical purposes, is, it is found, readily acquired and applied by the intelligent class of natives composing the canal revenue establishment; and as the first requisite towards a fair distribution of canal water is to have a clear perception of the supply available at any time, it is very desirable to persist in the effective measures already taken in the Punjab to ensure that the establishment in question receive the technical training indicated in the remarks at the end of paragraph 10 of the Local Government's Resolution. With this training they will be much better fitted for the intelligent performance of their duties.

Working Expenses.

6. The total working expenses for the major works (Imperial) amounted to Rs. 30,87,005 as compared with Rs. 28,40,474 in 1895-96, Rs. 26,50,549 in 1894-95, and Rs. 24,45,060 in 1893-94. The growth of expenditure necessarily follows the development of the Chenab Canal project and the extensions of the Western Jumna Canal. The increased expenditure during the year under review was moderate, considering the very large area irrigated, and much of it is stated to have been due to the increase in fees for collection of revenue.

The rate per acre irrigated has fallen steadily from 1·55 in 1894-95 and 1·12 in 1895-96 to 0·96 in the year under review, and the percentage on gross revenue has dropped to 28·2 from 40 in the previous year and 44·4 in 1894-95.

On the minor works the working expenses were less than in either of the two previous years, though the rate per acre is still somewhat above the normal.

The working expenses of both major and minor works together amounted to 33·6 per cent. of the gross revenue of Rs. 1,25,12,321 realized during the year.

The figures given above do not include the cost of maintaining the works by which irrigation in Native States from the Sirsa Branch of the Western Jumna Canal and from the Sirhind Canal is effected. These States pay a share of the maintenance charges of the Head Works and main canals, as well as the entire cost of maintaining, under the agency of the Public Works Department, those Branch canals constructed exclusively for irrigation in their territories. The account of these charges is kept separately, under the head "Contribution Works", from those payable from Imperial Revenues. They amounted during the year under review to Rs. 2,75,713 as compared with Rs. 2,68,917 in 1895-96, Rs. 2,30,640 in 1894-95 and Rs. 1,95,681 in 1893-94. In addition to these charges the Native States pay the cost of maintaining subsidiary works under their own agency which amounted during the year to Rs. 1,80,412. The total working expenses for works for irrigation in Native States therefore amounted to Rs. 4,56,125 during the year.

Financial Results.

7. The financial results of the Punjab Canals in operation during the year may be summarized as follows :—

	Capital outlay to end of year.	Net revenue.	Interest charges.	Return on capital outlay.
Imperial Works.	Rs.	Rs.	Rs.	Per cent.
Major works	8,41,00,265	78,57,443	31,59,651	9·34
Minor works for which Capital and Revenue Accounts are kept .	18,27,294	2,66,240	...	14·57
Major and minor works . .	8,59,27,559	83,04,317	...	9·45*
Works in Native States (Contribution Works) .	1,50,65,158	9,92,093	...	6·59

* This percentage is based on a net revenue of Rs 81,23,683 which excludes that derived from the Muzaffargarh and Shahpur (Provincial) canals for which Capital Accounts are not kept.

The net revenue derived from major works amounted to 78½ lakhs, nearly double that collected in any previous year, and represents a return of 9½ per cent. on the capital outlay. After paying all interest charges these canals contributed nearly 47 lakhs, during the year, to the revenues of the country, the total accumulated net profits amounting to 310 lakhs of rupees.

When it is remembered that one of these works, the Swat River Canal, was constructed not as a productive but as a protective work, and that another large project, the Chenab Canal, is still incomplete, these figures must be regarded as highly satisfactory and fully justify the claim of the Punjab Irrigation works to be considered as very profitable investments to Government.

Excluding the two Canals just mentioned the five productive works which are in full operation paid nearly 10½ per cent. on the capital outlay incurred on them.

8. Turning to the individual canals, the Swat River Canal exceeded all previous records with a net revenue of Rs. 2,58,959 and a return of 6½ per cent. on its capital cost ; but of this about 1½ per cent. is due to arrears of indirect land revenue, amounting to Rs. 58,464, which were credited to the canal for the first time during the year ; excluding this receipt the net return may be taken at 5 per cent. The canal has nearly paid off its interest debt, the balance of which was only Rs. 6,99,337 at the end of the year.

The Western Jumna Canal exhibits a most satisfactory account. Excluding the Sirsa Branch, it yielded a net revenue of 13½ lakhs. This Branch has, however, cleared its interest debt, and shows a return of over 14 per cent. against 1·39 per cent. in the previous year. The canal as a whole, including the Sirsa Branch, paid a dividend of 11·29 per cent. as compared with 3·28 per cent. in 1895-96. Its value to the State may be judged from the fact that after paying interest charges on the capital invested it has altogether contributed a sum of no less than 319 lakhs to the Imperial Revenues. The clear profit during the year, *i.e.*, the excess of net revenue over the interest charges, amounted to nearly 12 lakhs.

The Bari Doab Canal established a record by returning nearly 12 per cent. on the capital invested up to the end of the year, the highest previous dividend being 10·29 in 1895-96. After deducting interest charges, the operations of the year resulted in a clear profit of 14½ lakhs.

On the Sirhind Canal equally favourable results were obtained as compared with the records of previous years, the net revenue amounting to Rs. 20,70,633 equivalent to a return of 8·59 per cent. on the total capital invested as compared with 2·9 per cent. in 1895-96, the clear profit during 1896-97 being 11½ lakhs.

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as a whole is still incomplete, the net revenue during the year amounted to Rs. 13,79,442 equivalent to a profit of 6¾ per cent. on the total capital expenditure (including indirect charges) to the end of the year. The canal has achieved a success far beyond expectations, sanguine as these were. Although the total direct capital expenditure up to the end of the year falls short of that estimated in 1891 by more than 5 lakhs of rupees, the area irrigated has exceeded the area of the forecast by over 91 per cent. The extraordinarily rapid development of the canal is clearly shown by the following comparative statement of the results actually obtained and those forecasted in 1891 :—

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General Remarks.

11. The benefits conferred on the people by the Punjab Irrigation Works in a year of such general and severe scarcity as that under review can hardly be exaggerated. Rather more than 3¼ million acres of food crops were matured by canal water, the amount of edible produce made available being sufficient, allowing 2 people to the acre, to feed more than a quarter of the entire population of the Punjab for twelve months. The value of these food crops is estimated at 1,173 lakhs of rupees, the wheat crop alone being worth 562 lakhs. The total value of other crops such as cotton, indigo, tobacco, etc., is estimated at 336 lakhs and may be assumed to have afforded the means of subsistence to 1¼ millions of people for twelve months.

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No 5192 dt 8-7-98
Communicated to the
Chief Engineer for Irrigation.
(sd). A. S. Russell.
for Joint Secretary to Govt
Irrigation Branch.

To
Sch. Engr. for I.

G. C. Press, Simla.—No. 371 P. W. D.—17-6-98.—250.

No. 99 I.

GOVERNMENT OF INDIA.

PUBLIC WORKS DEPARTMENT.

CIVIL WORKS.

Irrigation.

Simla, the 16th June 1898.

Review of the Revenue Report of Irrigation Works in the Punjab for 1896-97.

Read—

Letter No. 242 A. I., dated 5th February 1898, from the Government of the Punjab, Public Works Department, forwarding the Revenue Report of Irrigation Works in the Punjab for 1896-97 and the Resolution by that Government reviewing the Report.

CAPITAL OUTLAY.

OBSERVATIONS.—The capital expenditure (exclusive of contributions) incurred on these works during the past financial year amounted to nearly 41½ lakhs of rupees, being nearly 2¾ lakhs in excess of that incurred in 1895-96. Of this sum 2 lakhs were expended on Minor Works and the balance on Major Works; and of the latter 28 lakhs were spent on the new Chenab Canal alone, raising the total outlay on this project to 204 lakhs (exclusive of interest charges) and leaving nearly 61 lakhs still to be spent to complete the works. On the Western Jumna Canal 4¾ lakhs were spent chiefly on the new Nardak and Petwar distributaries and on improving the Hansi Branch. On the Bari Doab Canal 2⅓ lakhs were spent mainly on the construction of new distributaries for the irrigation of Government waste lands in the Lahore District and remodelling the Kasur and Sobraon Branch Canals. Nearly one lakh was spent on the Sirhind Canal, chiefly on the construction of permanent outlets on distributaries. On the Swat River Canal 2 lakhs were spent, chiefly on the Trans-Kalpani distributary which was opened for irrigation in April 1897, and large sums were expended on the Jhelum and Ghaggar Canals which were started during the year as Famine Relief Works, the outlay representing the normal value of the work executed.

The total capital expenditure on Major and Minor Imperial Works to the end of 1896-97 including indirect charges amounted to Rs. 8,61,78,528.

Under "Contribution Works" the capital expenditure during the year was Rs. 54,493 and to the end of the year Rs. 1,50,65,158, this being the share of the capital outlay on the Western Jumna and Sirhind Canal systems contributed by Native States for the irrigation of lands in their territories.

MILEAGE OF CHANNELS.

2. The aggregate length of main and branch canals amounted to 4,153 miles at the close of the year, the addition of 67 miles to the total length during the year being due chiefly to the opening of two branches of the Chenab Canal. There was no increase in the aggregate length of navigable channels which is 386 miles.

The total mileage of distributaries increased from 7,278 miles in March 1896 to 8,007 miles at the close of the year under review, the principal additions being 645 miles of new channels from the two recently opened branches of the Chenab Canal, 64 miles of channels on the Western Jumna Canal, and 16 miles on the Shahpur (Imperial) Canals.

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Area Irrigated.

3. The total area irrigated during the year reached the very large total of 4,621,627 acres or 7,221 square miles, of which 456,707 acres or 713½ square miles were in Native States which contributed to the capital cost of the works. This is nearly 22 per cent. in excess of the area irrigated last year, which was the largest on record, and, excluding the area in Native States, is nearly one-fifth of the total cultivated area of the Province as given in the last census report.

The causes which contributed to this gratifying result are stated to be the general scarcity and high prices which prevailed over the greater part of the Province and the scanty rainfall which characterized the seasons. But if, for these reasons, the demand for water was unusually high, the supply of water in the rivers to meet it was unusually low, and the Government of India cannot but regard the success with which the demand was met as affording striking evidence of the high state of efficiency attained in the management of the Punjab Canals. Taking the large canal systems separately, the Sirhind Canal heads the list with an area of 1,338,080 acres, exceeding the previous year's total, which was the highest on record, by 44 per cent. The Western Jumna and Bari Doab Canals come next with 739,752 acres and 731,942 acres, respectively, and are followed by the Chenab Canal, which, though still incomplete, irrigated 520,279 acres, an area 41 per cent. in excess of that irrigated in the previous year and very nearly double the area—272,000 acres—entered in the forecast of 1891 as the probable area the canal would irrigate in 1896-97. The Swat River Canal eclipsed all previous records with an area of 123,087 acres, and the Sidhnai Canal with 149,454 acres nearly reached its 1893-94 record.

The year was not a favourable one for the Inundation canals on account of the early cessation of the rains and the absence of high floods, and consequently the area irrigated from them was not above the normal.

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4. The Government of India regard with satisfaction the highly successful results attained in the irrigation operations in Native States. The area irrigated from the Patiala branches of the Sirhind Canal far exceeded the irrigation effected in 1895-96, which was nearly double that of any previous year. On the Patiala section of the Sirsa branch, the area irrigated was again in excess of the proportion nominally due to the State, while the profit to the Durbar on collections amounted to 15·9 per cent. on the capital cost against 5·3 per cent. in the previous year.

Irrigation Duty.

5. The figures given in the table in paragraph 10 of the Local Government's Resolution afford further testimony to the success of the efforts made to distribute the water to the utmost advantage. Thus on the Western Jumna Canal the areas irrigated per cubic foot of the volume entering the canal were 103 acres in the *kharif* and 152 acres in the *rabi* season, as compared with the average for the previous five years of 71 acres and 82 acres, respectively, while on the Sirhind Canal the areas irrigated per cubic foot of water were 77 acres in the *kharif* and 197 acres in the *rabi* against the average of 38 and 114 acres, respectively.

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6. The total working expenses for the major works (Imperial) amounted to Rs. 30,87,005 as compared with Rs. 28,40,474 in 1895-96, Rs. 26,50,549 in 1894-95, and Rs. 24,45,060 in 1893-94. The growth of expenditure necessarily follows the development of the Chenab Canal project and the extensions of the Western Jumna Canal. The increased expenditure during the year under review was moderate, considering the very large area irrigated, and much of it is stated to have been due to the increase in fees for collection of revenue.

The rate per acre irrigated has fallen steadily from 1·55 in 1894-95 and 1·12 in 1895-96 to 0·96 in the year under review, and the percentage on gross revenue has dropped to 28·2 from 40 in the previous year and 44·4 in 1894-95.

On the minor works the working expenses were less than in either of the two previous years, though the rate per acre is still somewhat above the normal.

The working expenses of both major and minor works together amounted to 33·6 per cent. of the gross revenue of Rs. 1,25,12,321 realized during the year.

The figures given above do not include the cost of maintaining the works by which irrigation in Native States from the Sirsa Branch of the Western Jumna Canal and from the Sirhind Canal is effected. These States pay a share of the maintenance charges of the Head Works and main canals, as well as the entire cost of maintaining, under the agency of the Public Works Department, those Branch canals constructed exclusively for irrigation in their territories. The account of these charges is kept separately, under the head "Contribution Works", from those payable from Imperial Revenues. They amounted during the year under review to Rs. 2,75,713 as compared with Rs. 2,68,917 in 1895-96, Rs. 2,30,640 in 1894-95 and Rs. 1,95,681 in 1893-94. In addition to these charges the Native States pay the cost of maintaining subsidiary works under their own agency which amounted during the year to Rs. 1,80,412. The total working expenses for works for irrigation in Native States therefore amounted to Rs. 4,56,125 during the year.

Financial Results.

7. The financial results of the Punjab Canals in operation during the year may be summarized as follows :—

	Capital outlay to end of year.	Net revenue.	Interest charges.	Return on capital outlay.
Imperial Works.	Rs.	Rs.	Rs.	Per cent.
Major works	8,41,00,265	78,57,443	31,59,651	9·34
Minor works for which Capital and Revenue Accounts are kept	18,27,294	2,66,240	...	14·57
Major and minor works	8,59,27,559	83,04,317	...	9·45*
Works in Native States (Contribution Works)	1,50,65,158	9,92,093	...	6·59

* This percentage is based on a net revenue of Rs 81,23,683 which excludes that derived from the Muzaffargarh and Shahpur (Provincial) canals for which Capital Accounts are not kept.

The net revenue derived from major works amounted to 78½ lakhs, nearly double that collected in any previous year, and represents a return of 9½ per cent. on the capital outlay. After paying all interest charges these canals contributed nearly 47 lakhs, during the year, to the revenues of the country, the total accumulated net profits amounting to 310 lakhs of rupees.

When it is remembered that one of these works, the Swat River Canal, was constructed not as a productive but as a protective work, and that another large project, the Chenab Canal, is still incomplete, these figures must be regarded as highly satisfactory and fully justify the claim of the Punjab Irrigation works to be considered as very profitable investments to Government.

Excluding the two Canals just mentioned the five productive works which are in full operation paid nearly 10½ per cent. on the capital outlay incurred on them.

8. Turning to the individual canals, the Swat River Canal exceeded all previous records with a net revenue of Rs. 2,58,959 and a return of 6¾ per cent. on its capital cost ; but of this about 1½ per cent. is due to arrears of indirect land revenue, amounting to Rs. 58,464, which were credited to the canal for the first time during the year ; excluding this receipt the net return may be taken at 5 per cent. The canal has nearly paid off its interest debt, the balance of which was only Rs. 6,99,337 at the end of the year.

The Western Jumna Canal exhibits a most satisfactory account. Excluding the Sirsa Branch, it yielded a net revenue of 13½ lakhs. This Branch has, however, cleared its interest debt, and shows a return of over 14 per cent. against 1·39 per cent. in the previous year. The canal as a whole, including the Sirsa Branch, paid a dividend of 11·29 per cent. as compared with 3·28 per cent. in 1895-96. Its value to the State may be judged from the fact that after paying interest charges on the capital invested it has altogether contributed a sum of no less than 319 lakhs to the Imperial Revenues. The clear profit during the year, *i.e.*, the excess of net revenue over the interest charges, amounted to nearly 12 lakhs.

The Bari Doab Canal established a record by returning nearly 12 per cent. on the capital invested up to the end of the year, the highest previous dividend being 10·29 in 1895-96. After deducting interest charges, the operations of the year resulted in a clear profit of 14½ lakhs.

On the Sirhind Canal equally favourable results were obtained as compared with the records of previous years, the net revenue amounting to Rs. 20,70,633 equivalent to a return of 8·59 per cent. on the total capital invested as compared with 2·9 per cent. in 1895-96, the clear profit during 1896-97 being 11½ lakhs.

9. But the canal, which exhibits the most interesting results, is the Chenab. Notwithstanding the fact that about half the capital expenditure of the year was on incomplete or undeveloped channels not earning revenue and that the project as a whole is still incomplete, the net revenue during the year amounted to Rs. 13,79,442 equivalent to a profit of 6¾ per cent. on the total capital expenditure (including indirect charges) to the end of the year. The canal has achieved a success far beyond expectations, sanguine as these were. Although the total direct capital expenditure up to the end of the year falls short of that estimated in 1891 by more than 5 lakhs of rupees, the area irrigated has exceeded the area of the forecast by over 91 per cent. The extraordinarily rapid development of the canal is clearly shown by the following comparative statement of the results actually obtained and those forecasted in 1891 :—

	Forecast of 1891.	Actuals.
	Rs.	Rs.
Capital outlay, direct and indirect, up to end of 1896-97	2,11,41,454	2,04,31,137
Net revenue in 1896-97	1,80,448	13,79,442
Percentage of net revenue in 1896-97 on capital outlay (direct and indirect) incurred to end of 1896-97	0·85	6·75
Total net revenue to end of 1896-97 ...	—1,11,741	21,58,088
Total interest charges, less total net revenue at end of 1896-97.	39,78,810	15,71,039
	Acres.	Acres.
Irrigated area in 1896-97	272,000	520,279

The Government of India regard these results with much satisfaction. Not only has the Chenab Canal been of great use in providing the means of sustenance for thousands of cultivators by fertilizing vast tracts of waste land, but it has already yielded a large return on the money invested in its construction, and bids fair to become in the near future a most reliable source of direct revenue.

10. The minor works as a whole did well and irrigated a slightly larger area than in 1895-96, but the net revenue fell from Rs. 5,26,264 in that year to Rs. 4,46,874 in the year under review, for reasons which are explained in the report and referred to in paragraph 3 of this review. The year was a very unfavourable one for the inundation canals.

General Remarks.

11. The benefits conferred on the people by the Punjab Irrigation Works in a year of such general and severe scarcity as that under review can hardly be exaggerated. Rather more than 3¼ million acres of food crops were matured by canal water, the amount of edible produce made available being sufficient, allowing 2 people to the acre, to feed more than a quarter of the entire population of the Punjab for twelve months. The value of these food crops is estimated at 1,173 lakhs of rupees, the wheat crop alone being worth 562 lakhs. The total value of other crops such as cotton, indigo, tobacco, etc., is estimated at 336 lakhs and may be assumed to have afforded the means of subsistence to 1¼ millions of people for twelve months.

The estimated value of all the crops raised by canal water exceeded by 50 per cent. the total amount of capital invested by both the Government of India and Native States in these canals.

12. The report was received by the Government of India on the 8th February 1898, and as usual bears evidence of careful preparation. It gives a clear record of very extensive and important irrigation operations carried on successfully under unusually difficult and trying conditions.

13. The Resolution concludes with a reference to the services rendered during the year by Mr. Higham, who vacated the office of Chief Engineer on his promotion to Inspector General of Irrigation, and by the officers who succeeded him, Lieutenant-Colonel Miller and Mr. Beresford, as well as by the officers of the Department generally, Colonel Jacob being specially mentioned among the latter as discharging his duties with singular devotion and energy. The Government of India concur with the Government of the Punjab in acknowledging the manner in which these officers met the severe strain arising from

a year of drought and famine, and by skill and care in the distribution of water contributed so largely to the excellent results recorded in the body of the report.

ORDER.—Ordered that copies of this Review and of the Report and the Resolution by the Punjab Government be forwarded to the Revenue and Agricultural Department for information.

Ordered, also, that copies of the Review be forwarded to the Government of the Punjab for information and guidance and that copies of the Review and of the Report and Resolution by the Punjab Government be forwarded to the Local Governments and Administrations in the Public Works Department noted on the margin, for information.

The Governments of Madras, Bombay, Bengal, North-Western Provinces and Oudh, and Burma, Public Works Department.
The Chief Commissioners of the Central Provinces and Coorg.
The Residents at Hyderabad and Mysore.
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Ordered, further, that the Review and the Resolution by the Punjab Government be published in the *Gazette of India*, and that copies of the Review and of the Report and Resolution by the Punjab Government be forwarded to Her Majesty's Secretary of State for India.

J. S. BERESFORD,
Offg. Joint Secy. to the Govt. of India.

No 5942 P.W.D. 98
Communicated to the
Chief Engineer for Irrigation.
(Sd). A. S. Russell.
for. Joint. Secry to Govt
I. Branch.

To
Ch. Eng. for I.

G. C. Press, Simla.—No. 371 P. W. D.—17-6-98.—250.

No. 99 I.

GOVERNMENT OF INDIA.

PUBLIC WORKS DEPARTMENT.

CIVIL WORKS.

Irrigation.

Simla, the 16th June 1898.

Review of the Revenue Report of Irrigation Works in the Punjab for 1896-97.

Read—

Letter No. 242 A. I., dated 5th February 1898, from the Government of the Punjab, Public Works Department, forwarding the Revenue Report of Irrigation Works in the Punjab for 1896-97 and the Resolution by that Government reviewing the Report.

CAPITAL OUTLAY.

OBSERVATIONS.—The capital expenditure (exclusive of contributions) incurred on these works during the past financial year amounted to nearly 41½ lakhs of rupees, being nearly 2¾ lakhs in excess of that incurred in 1895-96. Of this sum 2 lakhs were expended on Minor Works and the balance on Major Works; and of the latter 28 lakhs were spent on the new Chenab Canal alone, raising the total outlay on this project to 204 lakhs (exclusive of interest charges) and leaving nearly 61 lakhs still to be spent to complete the works. On the Western Jumna Canal 4¾ lakhs were spent chiefly on the new Nardak and Petwar distributaries and on improving the Hansi Branch. On the Bari Doab Canal 2⅛ lakhs were spent mainly on the construction of new distributaries for the irrigation of Government waste lands in the Lahore District and remodelling the Kasur and Sobraon Branch Canals. Nearly one lakh was spent on the Sirhind Canal, chiefly on the construction of permanent outlets on distributaries. On the Swat River Canal 2 lakhs were spent, chiefly on the Trans-Kalpani distributary which was opened for irrigation in April 1897, and large sums were expended on the Jhelum and Ghaggar Canals which were started during the year as Famine Relief Works, the outlay representing the normal value of the work executed.

The total capital expenditure on Major and Minor Imperial Works to the end of 1896-97 including indirect charges amounted to Rs. 8,61,78,528.

Under "Contribution Works" the capital expenditure during the year was Rs. 54,493 and to the end of the year Rs. 1,50,65,158, this being the share of the capital outlay on the Western Jumna and Sirhind Canal systems contributed by Native States for the irrigation of lands in their territories.

MILEAGE OF CHANNELS.

2. The aggregate length of main and branch canals amounted to 4,153 miles at the close of the year, the addition of 67 miles to the total length during the year being due chiefly to the opening of two branches of the Chenab Canal. There was no increase in the aggregate length of navigable channels which is 386 miles.

The total mileage of distributaries increased from 7,278 miles in March 1896 to 8,007 miles at the close of the year under review, the principal additions being 645 miles of new channels from the two recently opened branches of the Chenab Canal, 64 miles of channels on the Western Jumna Canal, and 16 miles on the Shahpur (Imperial) Canals.

There was no change in the total length—258 miles—of completed canals in Native States, nor was any addition made to the 2,163 miles of distributaries from those canals.

Area Irrigated.

3. The total area irrigated during the year reached the very large total of 4,621,627 acres or 7,221 square miles, of which 456,707 acres or 713½ square miles were in Native States which contributed to the capital cost of the works. This is nearly 22 per cent. in excess of the area irrigated last year, which was the largest on record, and, excluding the area in Native States, is nearly one-fifth of the total cultivated area of the Province as given in the last census report.

The causes which contributed to this gratifying result are stated to be the general scarcity and high prices which prevailed over the greater part of the Province and the scanty rainfall which characterized the seasons. But if, for these reasons, the demand for water was unusually high, the supply of water in the rivers to meet it was unusually low, and the Government of India cannot but regard the success with which the demand was met as affording striking evidence of the high state of efficiency attained in the management of the Punjab Canals. Taking the large canal systems separately, the Sirhind Canal heads the list with an area of 1,338,080 acres, exceeding the previous year's total, which was the highest on record, by 44 per cent. The Western Jumna and Bari Doab Canals come next with 739,752 acres and 731,942 acres, respectively, and are followed by the Chenab Canal, which, though still incomplete, irrigated 520,279 acres, an area 41 per cent. in excess of that irrigated in the previous year and very nearly double the area—272,000 acres—entered in the forecast of 1891 as the probable area the canal would irrigate in 1896-97. The Swat River Canal eclipsed all previous records with an area of 123,087 acres, and the Sidhnai Canal with 149,454 acres nearly reached its 1893-94 record.

The year was not a favourable one for the Inundation canals on account of the early cessation of the rains and the absence of high floods, and consequently the area irrigated from them was not above the normal.

Of the total area, including that in Native States, irrigated from all canals, 1,441,408 acres were under wheat, 210,700 under rice, and 555,008 under other cereals; 357,770 under gram, 276,673 under jowar, 127,017 under sugarcane, 537,247 under cotton, and 137,399 under indigo.

The estimated value of the crops irrigated in both British and Native territory exceeds 15 crores of rupees, the value per acre being Rs. 33. The average rate levied for the use of the water, including owner's rate and indirect revenue, was Rs. 3-4-0 or one-tenth of the value of the crop.

4. The Government of India regard with satisfaction the highly successful results attained in the irrigation operations in Native States. The area irrigated from the Patiala branches of the Sirhind Canal far exceeded the irrigation effected in 1895-96, which was nearly double that of any previous year. On the Patiala section of the Sirsa branch, the area irrigated was again in excess of the proportion nominally due to the State, while the profit to the Durbar on collections amounted to 15·9 per cent. on the capital cost against 5·3 per cent. in the previous year.

Irrigation Duty.

5. The figures given in the table in paragraph 10 of the Local Government's Resolution afford further testimony to the success of the efforts made to distribute the water to the utmost advantage. Thus on the Western Jumna Canal the areas irrigated per cubic foot of the volume entering the canal were 103 acres in the *kharif* and 152 acres in the *rabi* season, as compared with the average for the previous five years of 71 acres and 82 acres, respectively, while on the Sirhind Canal the areas irrigated per cubic foot of water were 77 acres in the *kharif* and 197 acres in the *rabi* against the average of 38 and 114 acres, respectively.

Instructive as are the figures in this table and in the various statements in the Report, giving the duties obtained on individual distributaries of the different canals, the Government of India concur with the remarks made in the latter portion of paragraph 10 of the Resolution regarding the necessity of recording the duties on distributaries more accurately. They also attach much importance to the training of the native revenue establishment in the measurement of distributary discharges and to requiring them to maintain such registers of the volumes of water consumed in their respective sections as will enable these officials to institute a comparison of the quantity of water used with the area of irrigation effected. The Government of India consider that a practical knowledge of the technical points connected with the distribution of canal water should not be confined to the engineering staff. A knowledge of the process of gauging and measuring the flow of water in open channels and through outlets, in a manner sufficiently accurate for practical purposes, is, it is found, readily acquired and applied by the intelligent class of natives composing the canal revenue establishment; and as the first requisite towards a fair distribution of canal water is to have a clear perception of the supply available at any time, it is very desirable to persist in the effective measures already taken in the Punjab to ensure that the establishment in question receive the technical training indicated in the remarks at the end of paragraph 10 of the Local Government's Resolution. With this training they will be much better fitted for the intelligent performance of their duties.

Working Expenses.

6. The total working expenses for the major works (Imperial) amounted to Rs. 30,87,005 as compared with Rs. 28,40,474 in 1895-96, Rs. 26,50,549 in 1894-95, and Rs. 24,45,060 in 1893-94. The growth of expenditure necessarily follows the development of the Chenab Canal project and the extensions of the Western Jumna Canal. The increased expenditure during the year under review was moderate, considering the very large area irrigated, and much of it is stated to have been due to the increase in fees for collection of revenue.

The rate per acre irrigated has fallen steadily from 1·55 in 1894-95 and 1·12 in 1895-96 to 0·96 in the year under review, and the percentage on gross revenue has dropped to 28·2 from 40 in the previous year and 44·4 in 1894-95.

On the minor works the working expenses were less than in either of the two previous years, though the rate per acre is still somewhat above the normal.

The working expenses of both major and minor works together amounted to 33·6 per cent. of the gross revenue of Rs. 1,25,12,321 realized during the year.

The figures given above do not include the cost of maintaining the works by which irrigation in Native States from the Sirsa Branch of the Western Jumna Canal and from the Sirhind Canal is effected. These States pay a share of the maintenance charges of the Head Works and main canals, as well as the entire cost of maintaining, under the agency of the Public Works Department, those Branch canals constructed exclusively for irrigation in their territories. The account of these charges is kept separately, under the head "Contribution Works", from those payable from Imperial Revenues. They amounted during the year under review to Rs. 2,75,713 as compared with Rs. 2,68,917 in 1895-96, Rs. 2,30,640 in 1894-95 and Rs. 1,95,681 in 1893-94. In addition to these charges the Native States pay the cost of maintaining subsidiary works under their own agency which amounted during the year to Rs. 1,80,412. The total working expenses for works for irrigation in Native States therefore amounted to Rs. 4,56,125 during the year.

Financial Results.

7. The financial results of the Punjab Canals in operation during the year may be summarized as follows :—

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J. S. BERESFORD,
Offg. Joint Secy. to the Govt. of India.

No. 5192 dated 7-8-98
Communicated to the
Chief Engineer for Irrigation.
(sd). A. S. Russell
for joint Secretary to Govt
Irrigation Branch

To
Ch. Engr. for I.

G. C. Press, Simla.—No. 371 P. W. D.—17-6-98.—250.

Public Works (1898) Departme

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