

Public Works (1900) Department.

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[Despatch Abstract.]

Review of Irrigation in India in 1898-99 - Endorsement by the Govt of India forwarding copy of it - Communicated to officers concerned.

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SUBJECT.

Review of Irrigation in
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GOVERNMENT OF INDIA.
PUBLIC WORKS DEPARTMENT.
CIVIL WORKS.

Irrigation.

Simla, the 26th October 1900.

Review of Irrigation in India in 1898-99.

Read—

Note by A. R. Becher, Esq., Accountant General, Public Works Department, upon the accounts of Revenue and Expenditure of Irrigation Works in India for 1902.

Provincial Revenue Reports of Irrigation Works for 1898-99.

OBSERVATIONS.—The Irrigation Works in India are divided into two classes, Major Works and Minor Works. Major Works are subdivided

— the World, the capital of which provided from borrowed

(b) Protective Works, designed as a protection against famine, the capital of which is provided from the Famine

Capital and Revenue Accounts are kept for all Major Works.

Minor Works are constructed from funds provided out of the General Revenues of India and are subdivided into—

- (a) Works for which both Capital and Revenue Accounts are kept.
- (b) Works for which only Revenue Accounts are kept.
- (c) Works for which neither Capital nor Revenue Accounts are kept.

PRODUCTIVE WORKS.

2. Productive Works are those which are expected to yield sufficient revenue to pay their working expenses and the interest on the outlay incurred in their construction, reckoned at 4 per cent. No project is now sanctioned as a Productive work unless it can be shown beyond reasonable doubt that the irrigation when fully developed will at least fulfil those conditions. But in former years before rules to this effect were definitely laid down several large irrigation works were constructed from borrowed money which would not now be admitted to the Productive class.

There are 11 of these works, *viz.*, the Orissa, Sone, and Midnapur Irrigation Canals, and the Hijili Tidal (Navigation) Canal, in Bengal, and seven irrigation works in the Deccan and Gujarat. They are still retained on the list of Productive Works, but they are never likely to be remunerative and current expenditure against their capital account is now charged against the general revenues of India. In addition to these 11 works there are two projects in Madras, the Karnul Canal and the Barur Tank, which have proved financial failures. In the table below the financial results attained on these thirteen works, which are Productive only in name, are exhibited separately from those which are actually, or are expected shortly to be, remunerative. Of the latter there are twenty-one projects in operation and seven under construction. The financial results of Productive Works in operation during and up to the end of 1898-99 may therefore be stated as follows:—

Productive Works.	Number of works.	Capital outlay to end of 1898-99.	Net revenue in 1898-99.	Return on Capital Outlay.	Accumulated net revenue up to end of 1898-99.	Accumulated interest charges on Capital Outlay to end of 1898-99.	Surplus Revenue up to end of 1898-99.
		Rs.	Rs.	Per cent.	Rs.	Rs.	Rs.
Works sanctioned as productive but not productive according to definition now in force.	13	9,73,14,110	6,91,730	0.71	31,37,980	8,36,80,850	8,05,42,870
Works which are actually productive or are expected to be so.	21	21,83,88,660	2,10,10,220	9.62	33,59,75,500	...	15,04,...
Total	34	31,57,02,770	2,17,01,950	6.87	33,91,13,880	26,92,25,010	6,98,88,870

The total loss on the 13 works which, as has been stated above, are never likely to be remunerative, has amounted to 8 crores of rupees, a loss that will necessarily increase. But though these works have proved a failure as financial investments, they have been indirectly of great benefit to the tracts of country which they irrigate, by securing large areas of cultivation against the vicissitudes of the seasons. The area irrigated by them during the year under review amounted to nearly 800,000 acres.

The 21 works which are considered to fulfil the conditions of a Productive Work, paid collectively 9.62 per cent. on their capital outlay during the year, while the surplus revenue, after paying interest charges, which they had contributed to the general revenues of the country up to the end of 1898-99, exceeded 15 crores of rupees. The least remunerative is the Periyar project, which paid only 1.7 per cent. on its capital cost. Irrigation from this work did not commence until 1896-97, and is not yet fully developed.

3. Taken collectively by Provinces the Productive Works in operation gave the following results during the year:—

Provinces.	Number of works.	Area irrigated.	VALUE OF CROPS IRRIGATED.		Assessed revenue per acre irrigated.	Capital outlay to end of 1898-99.	Net revenue in 1898-99.	Percentage of net revenue on capital outlay.		
			Total.	Per acre.						
<i>Irrigation.</i>			Acres.	Rs.	Rs.	Rs.	Rs.			
Punjab	{ Imperial ... Native States }	{ 6 {	3,320,000	9,81,78,654	29.57	3.73	8,51,87,334	85,08,862	9.99	
			412,742	1,05,59,071	25.58	3.79	1,51,78,384	8,02,594	5.28	
North-Western Provinces	4	2,112,778	6,97,02,351	32.99	3.94	7,87,85,640	57,30,456	7.27		
Madras ...	9	2,692,817	7,07,91,236	26.29	2.89	6,66,60,849	58,89,493	8.84		
Andhra ...	4	688,651	1,00,94,753	14.66	1.90	99,04,377	9,33,307	9.42		
Bombay ...	7	27,389	20,66,933	75.46	8.67	1,09,50,247	2,27,346	2.08		
Bengal ...	3	710,544	2,22,04,753	31.25	1.86	6,15,99,076	3,88,528			
Total Irrigation	{ Imperial ... Native States }	{ 33 {	9,552,179	27,30,38,680	28.58	2.24	31,30,87,523	2,16,77,662	6.92	
			412,742	1,05,59,071	25.58	3.79	1,51,78,384	8,02,594		
GRAND TOTAL—Irrigation, Imperial and Native States.			33	9,964,921	28,35,97,751	28.46	2.30	32,82,65,907	2,24,80,256	6.85
<i>Navigation.</i>										
Hijili Tidal Canal, Bengal	1	...	...	...	...	26,15,242	24,277	0.93		

The total area irrigated fell short of the areas for the years 1896-97 and 1897-98, which, owing to the intense demand due to famine and drought, were the highest on record, by 340,459 and 375,655 acres only. The Punjab Canals irrigated a larger area and paid a higher percentage on capital outlay than canals of this class in any other province. The Lower Sohag and Para Canal cleared its debt of interest during the year and paid a return (the highest on record) of 11.54 per cent. on its capital outlay. The results recorded of the working of the Chenab Canal, which paid a return of 8.14 per cent. on its capital outlay, were again very striking. Although its system of distributaries is still incomplete it irrigated no less than 957,705 acres, an area 24 per cent. in excess of the area irrigated in the previous year and exceeding by 174,975 acres the area in British territory irrigated by the Sirhind Canal, the largest of the old Punjab Canals. At the end of 1897-98 the interest debt stood at Rs. 7,47,556. This was completely cleared off during the year, at the end of which the revenue account of the canal showed a surplus of Rs. 3,09,538. The Government of India take this opportunity of congratulating

the Punjab Irrigation Engineers upon the rapid development and successful working of this, their last completed, canal.

In the North-Western Provinces there was a slight falling off in the returns paid by all the four canals in operation as compared with the returns paid in 1897-98, in which year, however, the irrigation was abnormal on account of the drought.

In Madras the Productive Works irrigated a larger area and paid collectively a slightly higher return on capital outlay than in 1897-98. The financial results in this Presidency are seriously affected by the dead weight of the Karnul-Cuddapah canal, the capital cost of which is Rs. 2,17,24,490, while the area irrigated during the year did not exceed 49,000 acres and the net revenue amounted to Rs. 44,390 only. Excluding this canal the net revenue derived from the Productive Works in Madras, including the Barur Tank and Periyar Project, was equivalent to a return of 13 per cent. on the capital outlay—a result which has not yet been attained or approached in any other Province.

In Sind the area of irrigation was less by 65,171 acres than the area, 753,842 acres, irrigated in 1897-98, while the return on capital outlay fell only from 9.54 to 9.42 per cent. These results are satisfactory. The Sind Canals are entirely dependent upon the height and duration of the floods in the Indus during the irrigation season. In 1897-98 the floods were high and long sustained: in 1898-99 they were below the average in height and not above the average in duration and on the whole were not very favourable. In connection with the Sind Canals the Government of India consider the suggestions made by Mr. James in his memorandum deserve the careful attention of the Sind Engineers, and note with satisfaction the terms of high commendation in which the services of these officers have been referred to by the Commissioner and the Government of Bombay.

In the Bombay Deccan and Gujarat, though the area irrigated was less than in the previous year, there was an increase in the net revenue, and the return on capital outlay was 2.08 per cent. against 1.28 per cent. in 1897-98—a result which was due to a reduction in the working expenses.

In Bengal the area irrigated was 710,544 acres as compared with 701,253 acres in 1897-98 and 620,489 acres, the average of the five previous years. The Government of India agree with the Government of Bengal in regarding these figures as a satisfactory indication that the value of irrigation as an insurance against disaster in years of failing rainfall is becoming more fully realized by cultivators. The statement made in the Resolution of the Local Government that in the famine year of 1896-97 the rice crop alone, which the Sone Canals saved from destruction, was valued at a sum more than half the entire capital cost of those canals, is a sufficient indication of the great protective value of this work. The Sone Canals covered their working expenses, the net revenue amounting to Rs. 4,63,167 equivalent to a return of 1.73 per cent. on the capital outlay. On the Orissa Canals the receipts fell short of the working expenses by Rs. 19,721 and on the Midnapore Canal by Rs. 45,248.

The Government of India note with great satisfaction the high standard which has now been attained in the work of collection on the Sone and Orissa

Canals on both of which the outstanding demands at the end of the year were nil, while there was a notable reduction in the number of certificates issued. These results reflect great credit on all the officers concerned.

The gross revenue derived from the Productive Irrigation Works in operation in India in 1898-99 amounted to 317.60 lakhs of rupees or Rs. 3.2 per acre irrigated.

There are also in course of construction seven new projects which have been sanctioned as Productive Works. They are—

- (i) The Mandalay Canal in Upper Burma, a perennial canal designed to irrigate 72,000 acres in the "dry zone" of Burma. The work was started in 1896-97 and is being vigorously pushed on.
- (ii) The Fatehpur Branch of the Lower Ganges Canal in the North-Western Provinces. This is an extension, 106 miles in length, of the Ganges Canal from Cawnpore into the Allahabad District. A portion of the work has already been opened and irrigation from it begun. The whole project will soon be completed and will be capable of irrigating 116,000 acres.
- (iii) The Jhelum Canal in the Punjab. This important project will bring a large desert tract under cultivation and is estimated to irrigate about 600,000 acres. Work was started during the year and is now in active progress.
- (iv) The Jamrao Canal in Sind. This large canal is designed to supply water to 260,000 acres in a comparatively rainless tract in Sind. Work was started in 1895-96. The head-works are completed and the canal was opened in November 1899.
- (v) The Dad Canal, (vi) The Naulakhi Canal, (vii) The Nasrat Canal.

These are projects for improving and extending existing canals in Sind, so as to bring an additional area of 277,563 acres under irrigation. Work on the Dad Canal was begun in 1896-97 and is in full progress. On the Naulakhi and Nasrat Canals preliminary works only have as yet been commenced.

PROTECTIVE WORKS.

4. There are only five works of the protective class in operation in India. They gave the results shown below during the year under review:—

Province.	Area irrigated.	Capital outlay to end of 1898-99.	Net revenue in 1898-99.	Percentage of net revenue on capital outlay.
	Acres.	Rs.	Rs.	
Swat River Canal (Punjab)	139,759	40,29,300	3,46,731	8.60
Betwa Canal (North-Western Provinces)	39,560	43,01,490	480	0.01
Rushikulya Project (Madras)	82,965	46,99,230	43,750	0.93
Mhasvad Tank	6,101	20,74,650	7,710	0.37
Nira Canal	34,360	56,82,990	78,560	1.38
Total	302,745	2,07,87,660	4,77,230	2.30

The most prominent of the results tabulated in the statement above are those of the Swat River Canal in the Punjab. This work though sanctioned as a Protective work might well have been included in the Productive class. It paid a return of no less than 8·6 per cent. during the year on its capital outlay, the net revenue exceeding the interest charges of the year by 124 per cent., while the outstanding debt of interest has been reduced from Rs. 5,58,153 to Rs. 3,66,207, a comparatively small balance that will soon be paid off.

5. The major works which paid over 4 per cent. on the capital outlay are as follows:—

	PERCENTAGES PAID IN			Capital outlay to end of 1898-99.	Area irrigated during 1898-99.
	1896-97.	1897-98.	1898-99.		
				Rs.	Acres.
1. Cauvery Delta system	45·86	44·87	41·56	21,12,340	994,118
2. Eastern Jumna Canal	26·77	34·04	28·13	38,67,420	297,072
3. Begari Canal	15·40	17·78	19·22	17,06,800	254,729
4. Godavari Delta system	16·41	19·15	18·42	1,30,65,510	776,493
5. Kistna Delta system	10·50	13·18	15·03	1,33,96,630	566,277
6. Unharwah Project	17·14	17·47	14·80	6,26,880	72,805
7. Bari Doab Canal	11·89	13·66	13·17	1,52,070	771,451
8. Sidhna Canal	17·37	20·33	12·31	11,98,000	84,306
9. Lower Sohag and Para Canal	4·89	5·92	11·54	7,19,910	74,660
10. Western Jumna Canal	11·29	10·34	11·31	1,66,19,400	649,148
11. Ganges Canal	9·55	10·68	9·29	2,99,63,830	901,002
12. Swat River Canal (Protective)	6·52	7·38	8·60	40,29,300	139,759
13. Sirhind Canal	8·59	10·83	8·38	2,42,55,840	782,730
14. Penner Anicut	6·87	7·59	8·23	18,99,190	72,192
15. Chenab Canal	6·75	7·34	8·14	2,42,41,130	957,705
16. Desert Canal	2·91	6·30	7·25	12,92,090	104,827
17. Eastern Nara works	6·21	7·18	6·64	62,78,610	256,290
18. Srivaikuntham Anicut system	2·20	5·45	5·54	14,77,430	42,740
19. Agra Canal	6·02	7·67	4·50	95,53,400	209,966
20. Krishna Canal	2·92	5·24	4·14	8,64,890	3,970
21. Lower Ganges Canal	4·74	6·25	4·04	3,54,00,990	704,138
22. Sangam Anicut system	3·96	3·68	4·03	38,78,610	78,261

Sixteen of the large irrigation systems have paid off the accumulated interest on the capital invested in them and several more are shortly expected to do so. The total surplus which the 16 works have contributed amounts to nearly 16½ crores of rupees, a sum which exceeds the capital invested in them by 2½ crores.

The following statement gives the cost of maintenance and considered with reference to the area irrigated and to the gross revenue.

Province.	Working expenses per acre irrigated.	Per cent. of working expenses to gross revenue.
Bombay—Sind	Rs. 0·5	27·9
Madras	0·9	19·9
Punjab	1·0	28·6
North-Western Provinces	1·4	34·1
Bengal	1·9	77·6
Bombay—Deccan and Gujarat	3·5	42·7

The Sind Canals cost least to work per acre while the Madras works were worked for the smallest share of working expenses to gross revenue. The high ratio of owner's rates and to the fact that the high rate per acre in the Deccan and Gujarat is due to special causes. The high rate per acre in the Deccan and Gujarat is due to special causes. The high rate per acre in the Deccan and Gujarat is due to special causes.

MINOR WORKS FOR WHICH CAPITAL AND REVENUE ACCOUNTS ARE KEPT.
6. Taken collectively by Provinces these works gave the following results the year:—

Province.	Number of works.	Area irrigated.	Capital outlay 1898-99.	Net revenue in 1898-99.	Percentage of net revenue on capital outlay.
<i>Irrigation.</i>					
Sind	7	Acres. 981,019	Rs. 39,23,870	Rs. 7,31,080	18·71
Punjab	5	664,213	21,68,820	5,32,670	24·56
Madras	23	560,497	91,80,710	7,66,310	8·35
North-Western Provinces	4	101,464	28,17,620	1,45,680	5·17
Bombay	27	37,205	70,71,230	46,370	0·65
Rajputana	3	25,592	24,67,180	66,040	2·68
Baluchistan	2	5,653	16,12,780	33,220	2·06
Bengal	1	* ...	7,21,590	3,730	0·52
Burma (embankments)	...	† 453,317	33,70,010	6,50,560	19·30
Total Irrigation	72	2,831,990	3,33,33,810	29,78,660	8·93
<i>Navigation.</i>					
Madras	4	...	92,82,160	—12,370	...
Bengal	2	...	1,09,93,660	1,19,410	1·09
Total Navigation	6	...	2,02,75,820	1,07,040	0·52

* There was no irrigation from the Saran Canals, the net revenue of Rs. 3,730 comprising principally unrealized water-rates of the previous year collected during 1898-99.
† These figures represent the area the cultivation of which depends upon the protection afforded by the embankments.

The results of Irrigation Works in India as they affect the general taxpayer may be stated as follows:—

The most important of the irrigation works of this class are the Inundation Canals in Sind and the Punjab. In Sind the area irrigated amounted to 981,049 acres as compared with 849,123 acres in the previous year. The return on capital outlay however decreased from 26½ to 18½ per cent., this decrease being due to an unusually large outlay on the Fuleli Canals. In the Punjab, on the other hand, the return on capital outlay of 24½ per cent. slightly exceeded that of 1897-98 though the area irrigated, 664,213 acres, was less than the area of that year by 152,193 acres.

In Burma these works consist of embankments which, by the protection they afford against floods, enable large tracts to be brought under cultivation. The area protected, which varies very little from year to year, amounted in 1898-99 to 453,317 acres and the return on capital outlay to 19·3 per cent. The total area irrigated by this class of minor works was 2,831,990 acres as compared with 2,915,560 acres in 1897-98 and value of the crops raised is estimated at 6·51 crores of rupees.

The navigation works consist of the Buckingham Canal and three other smaller canals in Madras, and the Calcutta and Eastern Canals and the Orissa Coast Canal in Bengal.

The traffic on the Buckingham Canal is less than usual and the main- Coast Canal in Bengal. normal exceeded the receipts by		Bengal the total receipts amounted in the previous year, the falling and the plague scare. The	
1. Begari Canal	45·86	26·77	34 and 28·15
2. Godavari Delta system	15·40	17·78	19·32
3. Kistna	16·41	18·42	15·03
Rs. 8,706			

On the Circular and Eastern Canals in Bd480 6,26,880 72,805
to Rs. 4,09,281 as compared with Rs. 4,26,203 13·17 1,21,52,070 771,451
off being attributed to general dulness in trade in these years.
working expenses were higher than usual and the return on capital outlay was only 2 per cent. as compared with 3·1 per cent., the average of the five previous years.

On the Orissa Coast Canal the working expenses exceeded the receipts by Rs. 9,194. The opening of the Bengal-Nagpur Railway is said to have affected the revenue of this canal and to be likely to continue to do so.

MINOR WORKS FOR WHICH ONLY REVENUE ACCOUNTS ARE KEPT.

7. The results obtained from these works during the year were as follows:

Area irrigated	...	...	...	1,772,174 acres.
Gross receipts	...	...	...	Rs. 48,70,460
Expenditure	...	...	...	23,46,210
Net revenue	...	...	...	25,24,250

The expenditure includes not only working expenses, but also the cost of extensions and improvements, which, in the case of works for which capital accounts are kept, would be charged against capital. The net revenue of 25½ lakhs may, therefore, be said to represent the actual gain to the revenues of the country derived from these works.

FINANCIAL RESULTS OF IRRIGATION WORKS IN INDIA.

8. The statement in paragraph 2 of this review shows the surplus revenue derived from Productive Works after deducting interest at 4 per cent. on the total direct capital outlay. But though, for purposes of account, interest on the full capital outlay is charged against each work, it is not actually payable upon any portion of the outlay not met from borrowed money.

	During 1898-99.	To end of 1898-99.
MAJOR WORKS.		
	Rs.	Rs.
PRODUCTIVE WORKS—		
Total direct Capital outlay from borrowed money	65,35,480	25,06,72,970
Interest on borrowed capital	98,96,210	17,47,27,270
Direct Capital outlay charged against revenue	1,43,520	6,05,67,850
Indirect charges	8,84,150	2,89,53,780
Working expenses (direct charges)	90,99,480	18,96,38,990
Total charges on taxpayer	2,00,23,360	48,39,37,890
Total revenue	*3,14,12,430	54,21,71,260
Surplus revenue	1,13,89,070	8,82,33,370
PROTECTIVE WORKS—		
Direct Capital outlay (charged against revenue)	1,16,690	2,19,52,900
Indirect charges	28,010	14,34,660
Working expenses (direct charges)	3,04,450	3,15,020
Total charges on taxpayer	4,49,150	2,67,02,580
Total revenue	*8,04,460	55,88,740
Surplus revenue	+3,55,310	—2,11,63,840
MINOR WORKS.		
WORKS FOR WHICH CAPITAL AND REVENUE ACCOUNTS ARE KEPT.		
Direct Capital outlay (charged against revenue)	6,39,970	5,10,77,360
Indirect charges	1,43,260	55,42,120
Working expenses (direct charges)	22,00,690	5,95,42,020
Total charges on taxpayer	29,83,920	11,61,61,500
Total revenue	*53,52,890	13,62,35,090
Surplus revenue	23,68,970	2,00,73,590
WORKS FOR WHICH ONLY REVENUE ACCOUNTS ARE KEPT.		
Total expenditure	23,46,210	4,16,02,680
Total revenue	*48,70,460	8,39,70,450
Surplus revenue	25,24,250	4,23,67,770
Total surplus revenue, Major and Minor Works	1,66,37,600	12,95,10,890

* These figures represent the gross revenue due to the expenditure of Government capital less collection charges.

The results shown above do not include those due to Minor Works for which neither Capital nor Revenue Accounts are kept. A large amount of land revenue depends upon the efficient maintenance of these works, but it is not possible to determine how much of it is directly due to the expenditure incurred upon them by Government. In Madras, however, where this class of works is most largely represented, the expenditure on them in 1898-99 is stated to have been Rs. 20,13,671, while the gross revenue dependent on their maintenance is estimated at Rs. 89,98,980.

9. The total area irrigated by all classes of irrigation works in India in 1898-99 was 18½ million acres and the value of the crops raised by means of this irrigation is estimated at 39½ crores of rupees.

ORDER.—Ordered, that this Review, with a copy of the note by the Accountant General, Public Works Department, be forwarded to the Finance and Commerce and Revenue and Agricultural Departments, and to the Local Governments and Administrations in the Public Works Department, noted on the margin, for information.

Ordered also, that the Review be published in Part I of the Gazette of India, and the note in the Supplement thereto.

Ordered further, that a copy of the Review and note be forwarded to Her Majesty's Secretary of State for India for information.

7 W. J. W. Secy. to the Govt. of India.

Document accompanying.

Note by the Accountant General, Public Works Department, dated 26th March 1900.

To, The Secretary to the Govt. of Madras, P.W. Department

Accompaniment to P. W. D. No. 1203 C. W.—I., dated 26th October 1900.

Note by A. R. Becher, Esq., Accountant General, Public Works Department, upon the accounts of Revenue and Expenditure of Irrigation Works in India for 1898-99.

The figures in the accounts attached to this note are those of the Finance and Revenue accounts of the Government of India, but certain additional figures taken from the Administrative accounts of the Public Works Department, Irrigation Branch, the Revenue Reports of Irrigation Works and the Annual Statement of the Financial Results of Irrigation Operations in India are also dealt with in various portions of the note.

2. The irrigation works in India are divided into two main classes, viz., Major Works and Minor Works.

Major Works are sub-divided into—

- (a) Productive Works the Capital of which has been provided from borrowed money; and
- (b) Protective Works, the Capital of which has been provided out of the general revenues of India.

Minor Works are for the purpose of this note sub-divided into—

- (a) Works for which Capital and Revenue accounts are kept; and
- (b) Works for which Capital accounts are not kept.

Capital and Revenue accounts are kept for all Major Works.

3. There are 50 projects classed as Major Works, of which one, viz., the Hijili Canal in Bengal, is purely navigation canal.

Of these, 41 were sanctioned as works expected to be remunerative, i.e., estimated to pay the cost of up-keep as well as interest on Capital outlay. Some of these works having failed to realise these expectations, the current Capital outlay is being met from the general revenues as explained in para. 22. The rest of these works are being carried out from funds provided from sources outside the general revenues. The remaining nine projects* were sanctioned as works of protection against famine, and the cost of their construction has been, or is being, paid for out of annual grants made from general revenues under the head of "Famine Relief and Insurance."

* Now classed as a Minor Work and combined with the Gokak Storage Works.

4. The works classed as Minor Works are numerous. Capital and Revenue accounts are kept for 80 separate projects of this class; for the others only one account of receipts and charges for each work or group of works is kept. Of the 80 projects for which Capital and Revenue accounts are kept, 6 are purely navigation canals, of which 2 are in Bengal and 4 in Madras.

5. The receipts from the Irrigation Works in India during the years 1896-97 and 1897-98 were very high, as the unusually dry nature of the seasons led to a greater demand, than usual, for canal water. The receipts for 1898-99, in spite of more seasonable rainfall, were also very favourable. After allowing for the increase due to the opening of additional lengths of canal and to the improved supply from canals already in operation, it appears that one of the effects of the drought of the two previous years has been to stimulate the use of canal water, and it may reasonably be expected that the advantages of irrigation will continue to be fully appreciated in future.

6. The general financial results of all works for which Capital and Revenue accounts are kept are as follows:—

	Major Works.	Minor Works.	TOTAL.
	Rx.	Rx.	Rx.
<i>Capital Outlay.</i>			
During 1898-99	707,184	68,516	775,700
To end of 1898-99	34,834,616	5,360,963	40,195,579
<i>Revenue Account, 1898-99.</i>			
Gross Revenue	3,265,099	584,431	3,849,530
Maintenance and Working	1,047,402	275,861	1,323,263
Net Revenue	2,217,697	308,570	2,526,267
Interest	1,312,695	...	...
Net profit after paying interest on Capital	905,002	...	...
Percentage of net Revenue of the year on the Capital outlay to end of the year	6.37	5.75	6.28
Against in 1897-98	7.00	6.60	6.95
" " 1896-97	6.03	6.14	6.04

7. The net revenue derived from Major Works was less than that of the previous year by Rx. 171,737. The revenue during 1897-98 was abnormally large on account of drought. The net profit to the State after paying interest on Capital amounted to Rx. 905,002 against Rx. 1,105,184 in 1897-98. The increase of revenue due to the development of irrigation from the Chenab Canal in the Punjab, and the Kistna Delta System and Periyar Project in Madras, helped to make the net result as favourable as it was.

8. The net profit of Rx. 905,002 from Major Works is made up of a surplus revenue of Rx. 938,368 from Productive Works and of a deficit of Rx. 33,366 on Protective Works. The seven projects noted in the margin were not in operation during 1898-99. There are also certain works in Bengal and the Deccan and the Kurnool Canal and Barun

Branch of Canal
Lower Ganges Canal.
Jhelum Canal.

Jamrao Canal.
Dad Canal.
Naolakhli Canal.

expected to pay the interest on the capital invested; omitting the expenditure on all these works, the return on capital attributable to really productive works is 9.62 per cent.

9. The total expenditure up to 31st March 1899 on the seven productive Irrigation Works, which were not in operation during 1898-99, amounted to Rx. 1,112,133, and the interest charged to this expenditure was Rx. 35,844; omitting these figures from the total expenditure, the net profit derived from the works in operation during 1898-99 was Rx. 974,433, giving a return of 6.87 on capital outlay as shown below:—

	Number of works.	Net revenue, 1898-99.	Percentage on Capital outlay.	Interest charges, 1898-99.	Surplus revenue, 1898-99.
		Rx.		Rx.	Rx.
<i>Productive Works.</i>					
Works which are actually remunerative, or are likely to become so	21	2,101,022	9.62	815,751	1,285,271
Works which are not expected to repay the interest charges on the Capital invested in them	13	69,173	71	380,011	-310,838
	34	2,170,195	6.87	1,195,762	974,433
Works not yet in operation	7	-221	...	35,844	-36,065
Total Productive Works	41	2,169,974	6.64	1,231,606	938,368
PROTECTIVE WORKS	9	47,723	2.22	81,089	-33,366
GRAND TOTAL	50	2,217,697	6.37	1,312,695	905,002

10. The net revenue from Minor Works was less than that of the previous year by Rx. 40,611. The important variations in the revenue from this class of works are explained in para. 39 below.

11. The receipts and charges of the year 1898-99 on Revenue account, exclusive of the figures relating to Minor Works for which only one general account is kept, are detailed in the following statement by funds and provinces.

	PROVINCIAL.					TOTAL.				
	Main-tenance and working.	Net revenue.	Interest.	Net profit.	Gross revenue.	Main-tenance and working.	Net revenue.	Interest.	Net profit.	Gross revenue.
	Rx.	Rx.	Rx.	Rx.	Rx.	Rx.	Rx.	Rx.	Rx.	Rx.
MAJOR WORKS.										
<i>Productive.</i>										
Irrigation.										
Burma	10,977	11,025	16,833	-16,935	176,534	187,743	38,820	288,535	-199,935	176,534
N.W. P. and Oudh	10,792	45,465	15,478	19,193	176,534	285,471	455,327	313,082	142,245	176,534
Punjab	4,407	8,782	17,127	-19,752	74,938	...	...	...	...	74,938
Madras	7,732	16,359	32,151	-23,324	...	...	...	...	...	...
Bombay	38,908	81,631	31,089	-33,366	...	...	...	...	...	...
TOTAL PRODUCTIVE	619,185	2,340,307	753,916	987,206	974,433	2,217,697	2,217,697	1,312,695	905,002	2,217,697
<i>Protective.</i>										
Irrigation.										
N.W. P. and Oudh	10,977	11,025	16,833	-16,935	176,534	187,743	38,820	288,535	-199,935	176,534
Punjab	10,792	45,465	15,478	19,193	176,534	285,471	455,327	313,082	142,245	176,534
Madras	4,407	8,782	17,127	-19,752	74,938	...	...	...	...	74,938
Bombay	7,732	16,359	32,151	-23,324	...	...	...	...	...	...
TOTAL PROTECTIVE	38,908	81,631	31,089	-33,366	...	...	...	...	...	...
MINOR WORKS.										
<i>Irrigation.</i>										
Rajputana	5,304	11,908	6,604	6,604	...	...	...	...	...	...
Baluchistan	2,084	5,406	3,322	3,322	...	...	...	...	...	...
Burma	136	136	...	...	...	...	...	...	...	...
Bengal	18,233	88,529	88,529	65,056	...	...	...	...	...	...
N.W. P. and Oudh	103,235	156,502	103,235	14,568	...	...	...	...	...	...
Punjab	47,948	122,634	75,586	53,267	...	...	...	...	...	...
Madras	157,071	296,450	138,779	138,779	...	...	...	...	...	...
Bombay	157,071	296,450	138,779	138,779	...	...	...	...	...	...
TOTAL	157,071	296,450	138,779	138,779	...	...	...	...	...	...
<i>Navigation.</i>										
Bengal	11,941	48,238	11,941	11,941	...	...	...	...	...	...
Madras	11,941	48,238	11,941	11,941	...	...	...	...	...	...
TOTAL	11,941	48,238	11,941	11,941	...	...	...	...	...	...
GRAND TOTAL										
TOTAL MAJOR WORKS	619,185	2,340,307	753,916	987,206	974,433	2,217,697	2,217,697	1,312,695	905,002	2,217,697
TOTAL MINOR WORKS	11,941	48,238	11,941	11,941	...	...	...	...	...	...
GRAND TOTAL	631,126	2,388,545	765,857	1,005,147	986,373	2,229,634	2,229,634	1,324,636	916,943	2,229,634

12. The foregoing table shows that after paying interest on money expended in the construction of works classed as Productive Public Works, the net profits were, as in the previous two years, highest in the Punjab, and that Madras, the North-Western Provinces, and Bombay follow in the order named. In Bengal the loss was, as explained in the previous years' reports, due to the permanent settlement which renders enhancement of land revenue impracticable. The only work in Burma constructed from borrowed money is the Mandalay Canal, which was not in operation during 1898-99.

13. The net revenue derived from Protective Works fell short of the interest on the Capital expended on them by Rx. 33,366, against a deficiency of Rx. 40,272 in 1897-98. The improvement in 1898-99 was mainly due to the expansion of irrigation from the Swat River Canal and the Rushikulya project. The only project under this class which has paid off the interest on the Capital expenditure is the Swat River Canal in the Punjab.

Major Works.

14. The following statement shows in detail the financial results of individual Major Irrigation Works during, and to the end of, 1898-99:—

Major Works.	CAPITAL OUTLAY TO END OF 1898-99.				REVENUE ACCOUNT FOR 1898-99.				Percentage of net revenue on the Capital outlay.	Gross revenue.	Maintenance and working.	Net revenue.	Interest.	Net profit.
	Direct.	Indirect.	Total.	Rx.	Maintenance and working.	Net revenue.	Interest.	Net profit.						
Productive.	Rx.	Rx.	Rx.	Rx.	Rx.	Rx.	Rx.	Rx.	Rx.	Rx.	Rx.	Rx.	Rx.	Rx.
BURMA.														
Mandalay Canal	151,896	3,041	154,937	...	...	...	...	-4,344	...	...	...	...	5,881	-5,881
BENGAL.														
Irrigation.														
Orissa Project	2,578,898	58,477	2,637,375	...	40,521	2,972	...	-105,990	...	716,402	1,058,117	-841,715	2,379,719	-2,721,434
Midnapore Canal	828,077	18,466	846,543	...	27,398	-2,972	...	-37,600	...	613,739	579,952	33,787	872,429	-838,642
Sone Project	2,554,300	91,750	2,646,050	...	60,824	4,525	...	-57,118	1.73	1,739,547	1,351,844	387,703	2,384,366	-1,906,663
Navigation.														
Hijli Tidal Canal	5,991,215	168,693	6,159,908	...	137,743	88,820	...	-200,766	.63	3,069,688	2,989,913	79,775	5,636,514	-5,556,739
TOTAL BENGAL	6,246,388	175,044	6,421,432	...	142,746	2,428	...	-7,779	.93	142,132	116,253	26,879	224,158	-197,279
N.-W. PROVINCES AND OUDH.														
Irrigation.														
Ganges Canal	2,822,137	174,246	2,996,383	...	113,555	278,322	...	165,496	9.29	8,521,063	3,520,740	5,000,323	4,173,405	826,918
Lower Ganges Canal	3,399,281	240,818	3,640,099	...	105,692	142,912	...	11,873	4.04	4,510,198	1,968,354	2,541,844	2,811,707	-269,863
Agra Canal	886,797	68,543	955,340	...	25,002	43,010	...	7,572	4.50	1,239,336	564,303	675,033	865,397	-190,364
Eastern Jumna Canal	363,572	23,170	386,742	...	41,001	108,802	...	94,279	28.13	3,650,168	1,112,895	2,537,273	507,618	2,022,655
Fatehpur Branch of Lower Ganges Canal	273,711	22,891	296,602	...	221	-221	...	-10,135	...	...	221	-221	21,784	-23,005
TOTAL N.-W. P. & OUDH	7,645,498	529,708	8,175,206	...	285,471	572,895	...	269,085	7.01	17,920,765	7,166,513	10,754,252	8,879,911	2,374,341
PUNJAB.														
Irrigation.														
Western Jumna Canal, including Sirsa Branch	1,585,265	76,675	1,661,940	...	91,304	187,951	...	26,853	11.31	6,928,232	2,242,315	4,685,917	1,262,181	3,423,736
Bari Doab Canal	1,750,411	64,796	1,815,207	...	83,501	239,135	...	39,242	13.17	5,366,574	2,026,211	3,340,363	2,248,786	1,091,547
Sirhind "	2,307,040	118,544	2,425,584	...	71,386	203,371	...	11,273	8.38	2,208,992	806,432	1,397,560	1,839,441	-441,881
Lower Sohan and Para Canal	69,244	2,747	71,991	...	8,314	8,314	...	5,552	11.54	120,222	80,146	40,076	35,873	4,208
Chenab Canal	2,366,414	57,699	2,424,113	...	76,435	197,349	...	105,710	8.14	968,567	388,847	579,720	548,766	30,954
Sidhmali "	116,162	3,786	119,948	...	15,340	14,766	...	10,187	12.32	317,658	118,649	199,009	50,031	148,978
Jhelum "	60,196	3,717	63,913	...	...	...	...	-1,600	...	...	...	...	2,679	-2,679
TOTAL PUNJAB	8,254,732	827,914	9,082,646	...	344,358	850,886	...	525,717	9.91	15,905,245	5,662,630	10,242,615	5,937,757	4,254,858

(a) Excludes revenue due to old irrigation, which is as follows:—

	Gross revenue.	Maintenance and working.	Net revenue.	
			Rx.	Rx.
Godavari Delta System	12,400	850	11,550	
Kistna "	7,100	490	6,610	
Penner Anicut "	11,700	3,000	8,700	
Canvey Delta "	338,601	36,654	301,947	
Srivaikuntham Anicut System	7,800	1,250	6,550	
Sangam Anicut System	13,800	2,500	11,400	
Berrur Tank	200	15	185	
Periyar Project	19,272	1,318	17,954	
	411,078	46,077		364,996

(C) Excludes revenue due to old irrigation, which is as follows:—

[illegible]

15. Taken collectively by provinces the percentages of net revenue on the Capital outlay upon Major Works for the last three years are as follows:—

	1898-99.	1897-98.	1896-97.
1. Punjab	9.35	10.32	9.33
2. Madras	8.32	7.88	6.71
3. North-Western Provinces and Oudh	6.66	8.77	7.27
4. Bombay—Sind	5.88	6.65	6.30
5. Bombay—Deccan and Gujarat	1.60	1.01	.90
6. Bengal	.64	1.14	.83
Total	6.37	7.00	6.03

16. Omitting the figures for the Kurnool Canal which, as explained in para. 22, is not a remunerative work, the percentages in Madras would be—

	Per cent.
1898-99	11.87
1897-98	12.21
1896-97	9.65

The systems which in 1898-99 paid over 4 per cent. are arranged below in order of the rate paid, and are compared with the results of the two previous years:—

	RATE PAID.		
	1898-99.	1897-98.	1896-97.
1. Cauvery Delta System	41.56	44.87	45.86
2. Krishna Delta System	28.13	34.04	45.86
3. Godavari Delta System	18.42	19.15	16.41
4. Godavari Delta System	15.03	13.18	10.50
5. Kistna Delta System	14.80	17.47	17.14
6. Unharwah Project	13.17	13.66	11.89
7. Bari Doab Canal	12.32	20.33	17.37
8. Sidhna Canal	11.54	5.92	4.89
9. Lower Sohag and Para Canal	11.31	10.34	11.29
10. Western Jumna Canal	9.29	10.68	9.55
11. Ganges Canal	8.60	7.38	6.52
12. Swat River Canal	8.38	10.83	8.59
13. Sirhind Canal	8.23	7.59	6.87
14. Penner Anicut	8.14	7.34	6.75
15. Chenab Canal	7.25	6.30	2.91
16. Desert "	6.64	7.18	6.21
17. Eastern Nara Works	5.54	5.45	2.20
18. Srivaikuntham Anicut System	4.50	7.67	6.02
19. Agra Canal	4.14	5.24	2.92
20. Krishna Canal	4.04	6.25	4.74
21. Lower Ganges Canal	4.03	3.68	3.96
22. Saugam Anicut System			

MAJOR WORKS.	CAPITAL OUTLAY TO END OF 1898-99.			REVENUE ACCOUNT TO END OF 1898.					
	Direct.	Indirect.	Total.	Gross revenue.	Maintenance and working.	Net revenue.	Interest.	Net profit.	
	Rx.	Rx.	Rx.	Rx.	Rx.	Rx.	Rx.	Rx.	Rx.
1. N.W. PROVINCES AND OUDH.									
Irrigation.									
Betwa Canal	408,267	21,882	430,149	11,025	10,877	48	16,33	-16,285	-288,224
2. PUNJAB.									
Irrigation.									
Swat River Canal	388,505	14,425	402,930	45,465	10,792	34,673	1	19,195	-36,621
3. MADRAS.									
Irrigation.									
Rushikulya Project	430,857	39,066	469,923	(a) 8,782	4,407	4,375	1	-12,752	-121,820
4. BOMBAY.									
DECCAN AND GUJARAT.									
Irrigation.									
Gokak Canal, 1st Section	40,094	1,173	41,267	(b)	(b)	(b)			
Mhaswad Tank	198,681	8,784	207,465	2,116	1,345	771	21	-1,604	-28,547
Nira Canal	535,550	32,749	568,299	14,243	6,387	7,856	21	-7,172	-131,591
Shetphal Tank	16,407	382	16,789	...	...	...	...	...	-277,565
Chankapur Tank	9,111	407	9,518	...	...	...	...	...	-1,554
Mahadevi Tank	5,571	285	5,856	...	...	...	...	...	-4,957
TOTAL BOMBAY	805,414	43,790	849,204	16,359	7,732	8,627	76	-23,524	-2,267
TOTAL PROTECTIVE	2,033,043	119,163	2,152,206	61,631	33,908	47,723	81	-23,524	-446,481
GRAND TOTAL	33,157,130	1,677,486	34,834,616	8,265,099	1,047,402	2,217,697	1,312,6	-33,366	-893,146
50								905,002	6,020,597

(a) Excludes Rs. 6,360 on account of old irrigation works.
(b) This is now shown as a minor work and combined.

Gokak Storage Works.

Krishna Delta System

22. The undermentioned works, the construction of which from borrowed money was undertaken prior to the introduction of the rules now in force laying down the conditions which must be fulfilled before a work can be classed as Productive, are not expected to repay the accumulated interest charges on the Capital invested in them :—

	Capital outlay to end of 1898-99.	NET GAIN OR LOSS IN WORKING EACH YEAR.				
		1894-95.	1895-96.	1896-97.	1897-98.	1898-99.
	Rx.	Rx.	Rx.	Rx.	Rx.	Rx.
Bengal—						
Orissa Project	2,637,315	—15,097	—5,559	—2,280	1,201	—2,972
Chandrapore Canal	846,543	6,986	—1,248	4,536	3,380	—4,525
Sone Project	2,676,050	12,809	19,088	46,218	63,665	46,317
Hijili Tidal Canal	261,524	1,110	58	5,076	5,204	2,428
Bombay, Deccan and Gujarat—						
Amriti Canal	51,784	499	576	272	592	629
Godavari River Works	46,861	987	1,041	833	902	1,029
17. The systems in the order of the previous years :—	75,030	—465	41	—787	—1,418	—196
	37,189	—1,167	—772	—1,281	—4,409	—1,140
	663,633	15,368	19,886	13,988	15,439	17,146
	134,039	1,682	1,096	229	—1,685	1,690
	81	78	1,852	2,525	4,535	1,488

1. Cauvery Delta

In addition to the above, the Kurnool Canal in Madras, which was purchased from the Madras Irrigation and Canal Company in 1882, is not likely ever to be a financial success, and the Barur Tank also will probably not pay the interest on the Capital outlay. Under the rules contained in Public Works Department Code, Volume II, Chapter V, paragraph 35, clause VIII, the current expenditure on these works is being provided out of the general revenues.

23. The sources from which the revenue of the Major Works was derived during 1898-99 are exhibited in the following statement in comparison with those of the four previous years :—

	Date of Completion.	1894-95.	1895-96.	1896-97.	1897-98.	1898-99.
		Rx.	Rx.	Rx.	Rx.	Rx.
North-Western Provinces and Oudh.						
Lower Ganges Canal	1878	316,845	406,284	370,184	281,736	269,863
Agra Canal	1874	249,285	257,746	235,634	197,935	190,364
Punjab.						
Sirhind Canal	1887	816,591	838,389	722,901	553,154	441,881
Madras.						
Sangam Anicut System	1885	63,523	62,725	60,813	59,189	56,199
TOTAL		1,446,194	1,565,144	1,389,532	1,092,014	958,307

NOTE.—The projects which have not yet been opened for irrigation have been excluded from this statement.

21. It is satisfactory to find that the debit against all these projects is decreasing steadily.

18. The systems that have, up to the end of 1898-99, paid off the accumulated interest on the Capital expended on them are :—

	Surplus.
	Rx.
1. Godavari Delta System	3,709,876
2. Western Jumna Canal, including Sirsa Branch	3,423,736
3. Cauvery Delta System	2,353,832
4. Eastern Jumna Canal	2,029,655
5. Kistna Delta System	2,021,152
6. Bari Doab Canal	1,091,547
7. Ganges Canal	826,918
8. Begari "	291,121
9. Sidhmal "	148,978
10. Penner Anicut System	120,140
11. Desert Canal	64,991
12. Unharwah	45,475
13. Eastern Nara Works	42,229
14. Chenab Canal	30,954
15. Srivaikuntham Anicut System	7,771
16. Lower Sohag and Para Canal	4,203

Assuming that the works are still worth the amount charged in each case to the Capital account, this represents a net profit to the State at the end of 1898-99 on these systems of

The charge to the State on other Major Works is

And this leaves a net profit to date on all Major Works

Net profit of Rx. 16

19. The net profit of Rx. 16 above exceeds the total invested in them irrigation from some of them has not yet been the charge on Protective Works the net profit end of 1898-99 amounted to Rx. 6,913,743, which is equal to 21 per cent. of the Capital invested in them, including indirect charges.

20. The following statement shows the net charge to the State to the end of each year for the last five years on account of further projects, which are expected eventually to pay off the accumulated interest on their Capital cost :—

(7) This row data is a minor work and combined

	IRRIGATION REVENUE.							TOTALS OF PREVIOUS FOUR YEARS.													
	Share of enhanced land revenue due to irrigation works.	Water-rates.		Owners' rates on irrigated lands.	Sale of water.	Water-supply of towns.	Plantations.	Other canal produce.	Water-power.	Navigation.	Rents of buildings.		Fines.		Miscellaneous.		Total.	1897-98.	1896-97.	1895-96.	1894-95.
		Rx.	Rx.								Rx.	Rx.	Rx.	Rx.	Rx.	Rx.					
Bengal	...	129,502	...	157	...	604	360	...	1,616	295	1,455	18	188,994	217,218	190,221	150,773	152,013				
North-Western Provinces and Oudh	117,498	676,770	41,577	601	131	20,134	...	...	3,708	1,489	974	13,987	1,240,709	1,218,842	1,094,445	709,826	685,743				
Punjab	67,897	1,032,178	83,443	5,200	95	3,875	2,683	22,080	...	300	...	...	786,774	740,569	665,438	643,683	596,555				
Madras	751,734	14,930	...	...	388	1,790	2,970	...	...	74	204	2,790	184,801	182,710	154,050	142,654	148,435				
Bombay	113,310	48,438	...	433	12,410	157	1,269	2,803	3,613	2,255	20,955	24,497	3,382,684	2,976,795	2,134,247	2,182,413					
Total for 1898-99	1,055,439	1,901,818	125,120	6,301	13,024	26,620	7,282	28,548	—618	...	...	...	3,382,684	2,976,795	2,134,247	2,182,413					
1897-98	1,009,406	2,064,238	130,752	5,243	11,311	21,232	7,042	31	—23,524	1,02	...	...	2,976,795	2,134,247	2,182,413						
1896-97	911,327	1,783,052	119,317	5,462	12,071	22,909	6,614	2	—33,366	2,22	...	...	2,134,247	2,182,413							
1895-96	859,180	1,064,503	52,284	4,497	11,876	24,390	6,521	25,884	—1,002	6,37	55,8	...	2,182,413								
1894-95	815,910	1,145,084	71,897	4,003	10,708	23,527	6,653	22,764	...	...	...	...	...								

Longe Works.

17. The system in the order of the previous years:—

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