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A DESCRIPTIVE ACCOUNT
OF THE
WORKING OF IRRIGATION WORKS
IN
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General Remarks by the Chief Engineer, Irrigation.

Gujarát.—The small works in Gujarát depend entirely upon local rainfall; the season was distinguished by an excessive fall of rain during a cyclone in July and a failure of rain afterwards; the works were not capable of storing and utilising the cyclonic rainfall, but were damaged by it and the results of the year's working were poor, large remissions were granted on the old irrigation works on the Khári River in Gujarát, and the cultivation under the numerous small tanks suffered equally from the excessive rain of the early part of the season and the deficiency at the end and the season was a poor one.

2. *Khándesh, the Deccan and Kárnátk.*—In the Deccan, there was no cyclone, the rainfall was very deficient, and famine was feared, relief works being opened as a precaution. The irrigation works in the Deccan vary greatly in character; the best have storage Reservoirs on rivers which rise in the Gháts. The Nira Canal with a fine storage Reservoir—lake Whiting—in the Gháts and a tail tank at Shetphal at the end of the canal in the Indápur Táluka, the Mutha Canals with storage at lake Fife in the Gháts, and a tail tank at Mátoba in the Poona District are the largest of these excellent works; these canals are devoted mainly to sugarcane and perennial irrigation, and in a year like the one under reference, when the rain on the Gháts is weak and deficient, must reserve their storage for these valuable crops which require water during the whole of the year. In a famine year, therefore, the area under these canals does not expand so largely as might be expected, but contracts, and is limited for the most part to the area which can be supplied after provision has been made for the perennial crops which cannot be allowed to fail for want of the water, on the faith of receiving which they are reared, and large sums of money are invested in them. This class of irrigation works, however, was so efficient that the resulting revenue is the highest on record. The total area irrigated by this class of canals was 53,247 acres, of which 9,914 acres were perennial crops.

3. The next in order of efficiency are canals drawing their supplies from Ghát-fed rivers, but not provided with storage works, and depending upon the natural flow in the rivers. Having no perennial irrigation to lock up their supply, the area of irrigation under these canals can expand freely during years of bad rainfall in the Deccan, provided that water is available.

In spite of the weak rainfall, the Ojhar Canal on the Pravara River in Ahmednagar irrigated 4,605 acres out of 21,155 commanded, whilst the Krishna Canal in Sátára irrigated 10,107 acres out of 26,453, and the Gokák Canal on the Ghatprabha irrigated 11,084 acres out of 17,627 culturable acres commanded. The very high proportion of land irrigated under these canals shows how excellently this form of irrigation is adapted to the requirements of Deccan cultivators.

It is interesting to note that if the Nira Canal had irrigated the same proportion of land as the Gokák Canal, the area for the Nira would have been 136,602 acres instead of 36,912 acres, of which 5,977 only were sugarcane.

The area irrigated by this class of works was 30,655 acres.

4. A third form of irrigation works are the tanks situated in the district to be irrigated and depending upon the local rain for its supply; when the rain fails, the supply to the tanks also fails, but when the rain is capricious or unseasonable, these tanks prove valuable. For most of these tanks, the supply was limited by the deficient rainfall, but Mhaswa Tank in Khándesh, Bhádalwádi Tank in Poona District, and Maini Tank in Sátára are instances where good to fair supplies were received.

The whole of the water available in this class of tanks was utilised and a total of 20,750 acres irrigated.

5. The old Bandhara irrigation works mainly in Khándesh and Násik drawing their supplies direct from small Ghát streams without storage felt the effects of the drought severely and very large remissions of the water-rate were granted, in proportion greatly exceeding the deficiency of water.

6. The wide-spread system of small tanks in the Karnátak which regulate the supply to the rice crops of Belgaum and Dhárwár suffered severely from the deficient rainfall and large suspensions of revenue were granted.

7. The results of the year's working bring into striking prominence the fact, that the only irrigation works on which the area of irrigation can expand to meet demand in years of scarcity, are canals supplied from Ghát-fed rivers, where the stored water is not locked up and reserved for sugarcane, but is freely issued for Rabi crops; on such canals over 50 per cent. of the culturable area may be expected to be irrigated; indeed the only limit to irrigation on these canals is the area the people can cultivate or the area, the stored water can be distributed over, whichever is the less.

✓ The difficulty, however, in distributing stored water on this principle lies in the uncertainty whether cultivators will take and pay for the water in years of good rainfall. There can be little doubt that even in the very best years cultivators would benefit if they would take canal water, which would be of use during breaks in the monsoon which almost always occur at one time or another either retarding sowings or checking the growth of the young plants. Until recent years cultivators have not understood the importance of insuring their crops by timely irrigation. With the Gokak Canal at least they would appear to have learnt this lesson, and it is hoped they may have learnt it elsewhere. On the extent to which they have learnt it, will depend the mode in which water is distributed from the great storage works in contemplation.

8. The preceding paragraphs have dealt with the operation of existing works during the irrigation season of 1905-06. Of works under construction, the Chankápur masonry dam is the most important; this is in the Kalvan Táluka of the Násik District on the Girna River, one of the strange tributaries of the Tápti River, which, rising in the gháts, flow eastward at first and then turn to the north to join the main Tápti River and flow back westward to the sea. The dam will be a fine one, 100 feet depth of water being stored, but the lake formed will not be large. The water will be used to extend the excellent irrigation from small weirs on bandháras along the course of the stream and to supply a small canal on the left bank of the Girna for the head works of which a weir has been built at Taloda. The borings taken for the foundations of the dam in the river bed indicated rock at a depth of about 15 feet below water level, but when the foundations were pumped out and excavated it was found that the river bed consisted of very large boulders of from 50 to 100 tons in weight, and when these were removed a stratum of hard black clay was revealed. The sides of the river valley were hard rock on both sides sloping at about 45 degrees, and the width of the channel filled with this strange black clay was about 100 feet only, but 25 feet depth of this clay had to be excavated and then between the clay and the rock a stratum one foot thick of gray sand, resembling the wind blown sands of Sind, was found. There is no sand like this to be found in any of the Deccan rivers now, and how this old river gorge in the Deccan was filled up with first, this thin bed of fine gray sand, and then with 25 feet of pure black clay, and finally with big 50 ton boulders and gravel on the top, is a very interesting problem. As they were not suitable for the foundations of a masonry dam they were removed for the width required and the masonry founded on the solid rock of a basalt dyke, 40 feet below the dry weather level of the water in the river. The masonry work was successfully built up above water level in the river bed and commencements made along the whole of the foundations on both banks, and all difficulties surmounted. The construction of the remainder or upper portion of the dam is plain easy work, care being required to keep it excellent.

9. The thorough survey of the Deccan for Protective Irrigation Works was continued and with the labours of previous years has revealed that far

larger areas can be supplied with water from the Western Gháts than was supposed by the Irrigation Commission. The first of the projects prepared from these surveys was the Godáveri Project. It was submitted to the Government of India in the year under reference and has since been sanctioned, funds allotted and work commenced. A description of this Project has already been communicated to the Press. It will consist of a fine storage tank on the Darna River, about 14 miles from Igatpur and close to the small station of Asvali. The whole of this masonry dam and much of the lake will be visible from the Railway line when they are completed. The head works of the canal are at Nandur-Madmeshwar on the main stream of the Godáveri River, a little below Niphád. It was at this place that the Irrigation Surveyors found the remains of an elephant embedded in the clay of the river bank. They were dug out and removed to Calcutta by the Geological Department as the bones are of a type of elephant no longer living. The bed of the river at the Nandur-Madmeshwar Weir has rock visible all across and there is no prospect of other bones being found, or of any interesting difficulties like those of the foundations of the Chankápur Dam. Canals are proposed on both banks of the river from the Nandur-Madmeshwar weir, on the Right Bank a canal 72 miles long and on the left one 48 miles long, and provide means of irrigating 64,000 acres of mixed crops or about a quarter of the area of the land commanded, which is 2,40,000 acres. Provision is made for constructing channels to every field, the land will thus be covered with a network of channels varying in size from the main canal on the Right Bank carrying 386 cubic feet a second, to the small field channel carrying one cubic foot a second, or less. This plan of making channels to every field and bringing the water within the reach of everyone has not yet been practised in the Deccan, but field owners had to construct their own channels, and when their field was at a distance from the nearest Government channel the cost was often prohibitive. The happy experiment of making these channels to every field has led in the canals of Upper India to that rapid development of irrigation which has been so surprising and advantageous to all concerned, and it is anticipated that the convenience will be equally appreciated and used by the Deccan cultivators. A far larger area than 64,000 acres can be irrigated if the cultivators desire a wide distribution for corn crop. The cost of the Godáveri Project as sanctioned, is Rs. 95,61,044 including indirect charges.

10. Good progress was made in Projects for other parts of the Deccan and notably on the Pravára River Project in Ahmednagar, on the Nira Right Bank Canal Project in Sholápur, on the Gokak Canal in Belgaum and Bijapur, and proposals have been since sent up to the Government of India for all these works, but subsequently to the year now under review, and will be dealt with in the next year's review.

A. HILL,
Chief Engineer for Irrigation.

Detailed Reports by Divisions.

NORTHERN DIVISION.

In the year under review the heat in the months of June and July was abnormal, the monsoon late and the rainfall most unfavourable for crops and irrigation purposes. The rainfall during the year exceeded the average, but most of it fell in four days, thereby doing more harm than good. Owing to the abnormal rainfall (32.32 inches being registered at Ahmedabad from the 22nd to 25th July) considerable damage was done to tank bunds and canals, and both old and new tanks were breached. The Khari Cut Canal was breached in several places, as also the Chandola and Vasai Reservoirs, both important irrigation tanks.

2. Many of the old tank bunds were also damaged by the heavy rain. Steps were taken to repair these and the breaches as soon as possible, but as the rainfall was scanty thereafter very little water was stored and, with the exception of one or two tanks, the irrigation possible was inappreciable. Special repairs to 34 tanks were executed at a cost of Rs. 17,200.

3. Good progress was made towards the completion of new tanks in the Kaira and Panch Mahals Districts begun in the famine. Three large tanks with canals were practically finished and two others were approaching completion. The combined protective capacity of these tanks is 7,000 acres and the sum of Rs. 96,660 was expended on them during the year.

The number of acres irrigated was 1,126, yielding a revenue of nearly Rs. 2,500. But for the construction of these tanks there would have been no rice crop in this quarter during the year. The cultivators in these parts are unaccustomed to irrigation, but are learning to appreciate the benefits thereof.

4. The only original work of this nature in progress was the Chekla Drainage Channel in the Ahmedabad Collectorate. The old drains worked most satisfactorily, and had they not been constructed it is probable that the town of Viramgam and many other villages would have been flooded and life and property endangered. A sum of Rs. 12,130 was spent on the construction and repair of drainage channels in the Ahmedabad and Kaira districts.

5. Some 12 villages are served by the Khari Sluices and more than 7,000 acres of the best rice land in Gujarát are irrigated by them. These villages have not had a good crop for the past 7 years owing to bad rainy seasons and their dependence on the precarious discharge of the Khari river, which has ceased to be perennial since 1899. There was very little irrigation during the year on account of the scanty flow in the river in question, and there would have been no rice crop in this area at all if the natural flow of the river had not been supplemented by a part of the water stored in the Bokh Reservoir, which was one of the few storage tanks undamaged by the heavy rain which fell in July and is filled from the Hathmati River. Several storage tanks for the direct protection of the Khari Sluice lands, either have been lately constructed or are still under construction, and it is hoped that in years of short rainfall they will be of much assistance in augmenting the present uncertain and scanty supply of water in this region.

CENTRAL DIVISION.

The works in operation in the Central Division are 20 and are divided into 3 classes as shown below:—

Protective Works.

Poona	{ Nira Canal. Shetphal Tank. Mhaswad Tank.
Sholapur	...	...
	

Productive Works.

Khándesh	... ..	Lower Panjhra Works.
Násik	... Kadwa River Works	{ Palkhed Canal.
		{ Ojhar Tambat Canal.
		{ Wadali Canal.
Ahmednagar .	Pravara River Works.	Lakh Canal.
Poona	... ..	Mutha Canal.
Sholápur	... ..	Ekruk Tank.

Minor Works.

Khándesh	... ..	{ Hartála Tank.
		{ Mhaswa Tank.
		{ Jamda Canals.
Násik	... ..	{ Parsul Tank.
Ahmednagar .	Pravara River Works.	{ Ojhar Canal.
		{ Bhatodi Tank.
		{ Matoba Tank.
Poona	... ..	{ Kasurdi Tank.
		{ Shirsuphal.
		{ Bhadalwádi.
Sholápur	... ..	{ Koregaon.
		{ Ashti Tank.

The capital expenditure incurred during the year both on works in operation and those under construction was as follows:—

				Rs.
Protective Works	... ..	...	...	2,85,494
Productive Works	... ..	...	...	33,082
Minor Works	... ..	...	...	7,860
			Total ...	3,26,436

The area irrigated and the net revenue realised were as under:—

		Area irrigated.	Net Revenue realized.
		Acres.	Rs.
Protective Works	... ..	45,745	96,382
Productive Works	... ..	20,954	3,15,716
Minor Works	... ..	11,524	25,058
Total	... ..	78,223	4,37,156

The year was one of weak and deficient rain. There is a large amount of sugarcane under the Nira Canal, and its tail tank the Shetphal Tank, which is filled by the canal and this was successfully maintained and increased. In the previous year, locusts damaged the sugarcane, but did not appear in the year under reference and a good increase in revenue resulted from the large area under the sugarcane.

These works are provided with a fine storage tank at Bhátghar and lake Whiting in the Gháts and water-supply is safe for the amount that can be stored by the Reservoirs. The cold weather flow in the river below the Reservoir for an area of about 500 square miles is collected by the Vir Weir at the head-works of the canal; this rapidly decreased at the close of the rain and the demands for rabi crops were more than could be supplied.

The Mhaswad Tank is quite different to the above described Protective work and has a Deccan catchment. The rainfall supply was one of the worst recorded, all the water caught by the tank was used and 5,873 acres of crops were grown in spite of the deficient rainfall.

Of the Productive works, the Mutha Canal with its tail tank, the Mátoba Tank, which is classed as a Minor Work but is filled by the Mutha Canal, continued to grow the luxuriant crops of sugarcane for which Poona is famous,

and in spite of the deficient rainfall the area of sugarcane increased by nearly 800 acres, the water for which was supplied from a large Ghát storage Reservoir at Lake Fife. Like the Nira River the Mutha River also had but a small cold weather supply and rabi irrigation was limited by want of water.

The Kadva River system comprising a small storage tank and the small canals the Pálkhed, Ojhar Tambat, and Wadali suffered from the deficient late rains and thus rabi irrigation decreased. The large tanks of Ekruk and Ashti in the Sholápur District had but slight replenishment, but Ekruk was able to irrigate 5,633 acres and Ashti 1,167, for in Ekruk there was fortunately a good balance of water left over owing to the good rain of the preceding year. The observation at this tank indicated that the losses by evaporation and absorption were double the replenishment received during the year. The smaller tanks in Sholápur received very little water.

In the Khándesh Irrigation District the Hartála and Parsul Tanks had but little replenishment, the Mukti Tank about half its full supply, but the Mhaswa Tank filled.

In the Poona District, the small tanks received no replenishment; of the medium-sized tanks Shirsuphal and Bhadalwádi, the former obtained very little water, but the latter had three good replenishments, all of which were secured and used, none being allowed to go to waste.

The works depending on the river supplies only, and without any storage were all short of water in the rabi season and large remissions were granted on, the old works of this class.

SOUTHERN DIVISION.

In the Southern Division there is only one Major Productive Irrigation Work, viz., the Krishna Canal in the Sátára District and 13 Minor Irrigation Works distributed as follows:—

Works in the Southern Division.	Sátára	...	...	Rewári Canal. Chikhli Canal. Yerla River Works. Upper Mán River Works. Maini.
	Bijápur	...	...	Muchkundi.
	Dhárwár	...	...	Dambal. Medleri. Madag. Asundi. Mávinkop.
	Belgaum	...	...	Gokak (Provincial). Gaddikeri.

2. The Krishna Canal is the longest in the Division. It receives its water from the Krishna River, and takes off on the left bank from a masonry weir near Karád. The canal flows through very rich soil. It is 36 miles long and commands 28,327 acres.)

The Gokák Canal is the most important of the other works. It also takes off from a masonry weir, built across the Ghatprabha River, and irrigates rich lands. The main channel is 12 miles long and the command 18,668 acres.

The Rewári and Chikhli Canals are very small works. None of the above possesses Storage Works.

The remainder are storage Reservoirs with canals or distributing channels, but they are all very small works. Dambal, Madag, Asundi and Mávinkop are old works, which have been enlarged and improved; the others are new works constructed by the British Government.

3. The revenue realised from these works in 1905-06 was Rs. 1,30,176. Of this sum, the direct receipts amounted to Rs. 1,25,496 and indirect to Rs. 4,680. After deduct-

ing working expenses, *viz.*, cost of maintenance and repairs, etc., the net revenue amounted to Rs. 73,888 which represents a return of 1.2 per cent. on the capital expenditure.

The above figures are a little higher than the average of the last ten years and practically the same as those of 1904-05, as is also the whole area irrigated, which amounted to 26,429 acres. The kharif crops cover 17,229 acres and the rabi crops 9,200 acres.

4. The whole area of culturable command is 83,968 acres and the irrigated area was nearly 1/3 of the culturable. On the Krishna Canal, there was an increase over the previous year's area of 1,922 acres and on the Gokak Canal of 1,513 acres, distributed over both the kharif and rabi seasons. The increase was due to an extra demand for water owing to the rainfall being unfavourable. Both of the canals are fed from perennial streams from the Gháts, but they are not provided with Storage Works and their usefulness is limited by this fact. A project has been matured and submitted to Government for the extension of the Gokak Canal and the provision of an ample and unfailing Ghát Storage to supply the water required. A similar project for the Krishna Canal is under consideration. The storage of water in this case would be large, but there is great difficulty in using it on account of the high level of the country between Sátára and Bijápur.

5. On the 12 Minor Works the aggregate result of the year's operations was a diminution of the irrigated area by 3,889 acres compared with the previous year. The cause of this decrease also was the scanty rainfall. 10 of the 12 works are dependent upon small Storage Reservoirs and the 2 others upon small streams outside the Ghát area. The local rainfall is the source of supply and this having failed the irrigation suffered accordingly. All tanks and irrigation works beyond the limits of the Ghát area, are liable to failures of this kind. Their general utility really depends upon the utmost use being made of the water available in favourable seasons.

6. The rainfall was unsatisfactory and deficient. In Sátára, Bijápur and Belgaum the total rainfall was generally a good deal less than the average and also less than the previous year's in either one or other of these seasons, but there was a great deal of variation within a small area. On the Rewári Canal, for example, 11 miles north-east of Sátára, the rainfall in both seasons was about 70 per cent. in excess of last year's and on the Maini Tank, 45 miles east of Sátára, it was only half of the previous year's in both seasons. In Dhárwár the deficiency was more marked and uniform, the fall being a good deal less than in the past year and only a little over 1/2 of the average supply. The general deficiency of rain should naturally have led to a large increase of area of irrigation, especially in the rabi season, but, as explained in paragraphs 4 and 5 above, the increase was only possible on two works, because the others are all dependent for the supply upon the local rainfall. It happens that the decrease in area on the latter works was nearly counterbalanced by the increase on the former, and the whole area irrigated was the same as in 1904-05.

7. The working expenses were Rs. 56,288, which is Rs. 7,345 more than last year and 40 per cent. of the assessed revenue. The charges, include the usual administrative and executive establishment, the maintenance and repairs of the works, measurement of crops, and charges for collection of revenue. The increase in expenditure is due to certain special repairs, which were found necessary. The cost of working expenses amounted to Rs. 2½ per acre irrigated.

8. The water-rate varied a good deal on the different works. In the year 1904-05 the lowest was Rs. 2.83 per acre for the Gokak Canal and the highest Rs. 7 per acre on the Krishna Canal, in 1905-06 the corresponding figures were Rs. 4.18 and Rs. 5 and in each case the average came to Rs. 4.6. The variation is, of course, due to the nature of crops grown. In years of poor rainfall there will be always

an increase of low-rated crops, and this explains the reduction on the Krishna Canal. The reduction on the Gokak Canal would naturally be much less marked, because the area of perennial crops is small compared with the whole. The slightly enhanced rates introduced this season on the Gokak Canal did not check the irrigation and water was sought for keenly.

9. There are a large number of 2nd Class irrigation tanks in Kánara, Dhárwár and Belgaum, 16 in Bijápur and 4 in Ratná-giri. These are tanks which have a small fixed area of irrigation under consolidated charges for land revenue and water rates. The repairs to these small tanks are now being vigorously prosecuted in Dhárwár and Belgaum. In Kánara the work has not actually commenced, but some surveys have been carried out. The total expenditure on surveys and repairs and improvements was Rs. 1,29,174. This is a decrease of Rs. 18,156 on the previous year's expenditure. The purpose of the repairs is to make the tanks yield a sufficient supply of water for the lands specially assessed below them. The actual number of tanks repaired in 1905-06 was 220, of which 169 were in Dhárwár.