CHAPTER - VI

CANALISATION OF THE PUNJAB

Punjab a land locked state, falls in the semi-arid to arid climatic zone, with the exception of areas situated in the Himalayas. Though its southern boundaries are more than 1700 km North of the geographical equator, several parts of its plain segment virtually become the ‘thermal equator’ in hot and dry months when the mean monthly maximum temperature rises to more than 45°C (Trevaskis 1928, p. 353). Summers become hot enough and succeed in giving a feel of the Sahara or quasi-Sahara climate in places. With some exceptions, summers are hot and dry while winters are cold and dry. The resultant scenario generates a volume of aridity.

With the exception of montane and sub-mountain regions lying in the North, the scanty rainfall, and exceptionally high evapotranspiration have necessitated the use of irrigation to grow crops. Luckily, the presence of perennial rivers of the Indus-basin were available to be exploited for this purpose.

In order to mitigate the horror of drought and famines, to help the Punjab farmers and general populace and to create a source of raw materials for its industry, irrigation was developed by the British. It was a unique and grand experiment in the world of the later half of nineteenth and the first half of the twentieth century. As a result, millions of acres of waste land were canalised in the West and South-West of the province. The easy availability of loans from the London money market, monetary help provided by the Native states of Punjab in anticipation of high returns from canal revenue, availability of canal engineers, and the large cheap and forced labour (begar) strength helped the British execute the grand ambitious canal projects.
Canal System in Punjab: A Historical View

The development of canal irrigation in Punjab dates back to the rise of the Indus-Valley civilization, when groups of people started raising crops along the banks of the rivers from sailaba irrigation (flood irrigation). The sailaba irrigation covered only small bands or strips along the river banks. Later on some pioneers hit upon the brilliant idea of carrying the river water for considerably large distances through already existing creeks of some of the abandoned rivers (Uppal 1978, pp. 18, 19).

The idea of canalisation was not entirely new to India and Punjab. Western Yamuna canal, one of the oldest canals of the province, was constructed in A.D. 1356 during the reign of Sultan Firoz Tughluq. The water of the Choutang torrent was diverted and utilised to irrigate lands in Hisar and Hansi, region in the South-East of the Province.

One of the inundation canals which needs to be mentioned was the Hansli canal carved out of the Ravi during the time of Emperor Jehangir. It took the water a distance of about 80 kilometers to irrigate the royal garden of the emperor near Sheikhpura at Hiran Minar. Another was the Shah Nehar canal taken off from the left bank of river Beas about 20 km away from Mukerian. There are many such examples.

It must be admitted, nevertheless, that the greatest achievement of the British rule was the magnificent system of irrigation canals which it gave to the Province of Punjab. The vast Punjab plains traversed by large perennial rivers of Punjab drawing an unfailing river water supply from Himalayan snows provided an ideal field for experimentation to the European canal engineers. The vast arid areas without irrigation yielded some millets and pulses only. The canalisation proved to be highly beneficial for the people of the Province. A brief description of the canal system of Punjab prior to or during the British rule is given below:

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Table 6.1
Colonial Punjab: Canals, 1945

<table>
<thead>
<tr>
<th>Canal system</th>
<th>Length of mainline (kms)</th>
<th>Length of distributaries (kms)</th>
<th>Culturable area commanded (000, acres)</th>
<th>Average area irrigated (000, acres)</th>
<th>Year of first irrigation</th>
<th>Date of completion of construction</th>
<th>Date of commencement of construction</th>
</tr>
</thead>
<tbody>
<tr>
<td>Average Yamuna</td>
<td>539</td>
<td>3845</td>
<td>2305</td>
<td>877</td>
<td>1828-39</td>
<td>1891-92</td>
<td>1886-87</td>
</tr>
<tr>
<td>North canal</td>
<td>564</td>
<td>5546</td>
<td>2093</td>
<td>1774</td>
<td>1883-84</td>
<td>1886-87</td>
<td>1867-68</td>
</tr>
<tr>
<td>Upper Baniyan Canal</td>
<td>505</td>
<td>2476</td>
<td>1452</td>
<td>1304</td>
<td>1886-81</td>
<td>1878-79</td>
<td>1840-50</td>
</tr>
<tr>
<td>Lower Baniyan Canal</td>
<td>212</td>
<td>2002</td>
<td>1532</td>
<td>1181</td>
<td>1913-14</td>
<td>31.3.1917</td>
<td>1906</td>
</tr>
<tr>
<td>Upper Chenab Canal</td>
<td>278</td>
<td>2012</td>
<td>1453</td>
<td>569</td>
<td>1912-13</td>
<td>31.3.1917</td>
<td>1905</td>
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<tr>
<td>Lower Chenab Canal</td>
<td>758</td>
<td>4059</td>
<td>2724</td>
<td>2530</td>
<td>1892</td>
<td>1889-1900</td>
<td>1890</td>
</tr>
<tr>
<td>Lower Jhelum Canal</td>
<td>200</td>
<td>978</td>
<td>545</td>
<td>332</td>
<td>1915-16</td>
<td>31.3.1917</td>
<td>1905</td>
</tr>
<tr>
<td>Upper Jhelum Canal</td>
<td>292</td>
<td>1627</td>
<td>1240</td>
<td>876</td>
<td>1901</td>
<td>31.3.1917</td>
<td>1897</td>
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<tr>
<td>South Canal</td>
<td>108</td>
<td>407</td>
<td>390</td>
<td>299</td>
<td>1886</td>
<td>1886-84</td>
<td>1883-84</td>
</tr>
<tr>
<td>Pakpatan Canal</td>
<td>322</td>
<td>1569</td>
<td>1103</td>
<td>276</td>
<td>1926-27</td>
<td>31.3.1932</td>
<td>1923-24</td>
</tr>
<tr>
<td>Dipalpur Canal</td>
<td>253</td>
<td>1394</td>
<td>888</td>
<td>391</td>
<td>1927-28</td>
<td>31.3.1932</td>
<td>1924-25</td>
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<tr>
<td>Eastern Canal</td>
<td>127</td>
<td>667</td>
<td>423</td>
<td>137</td>
<td>1927-28</td>
<td>31.3.1932</td>
<td>1924-25</td>
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<tr>
<td>Maila Canal</td>
<td>237</td>
<td>1035</td>
<td>739</td>
<td>239</td>
<td>1927-28</td>
<td>31.3.1932</td>
<td>1925-26</td>
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<td>Hassanwala Canal</td>
<td>103</td>
<td>502</td>
<td>226</td>
<td>353</td>
<td>1853-54</td>
<td>1853-54</td>
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<tr>
<td>Panjnad Canal</td>
<td>151</td>
<td>--</td>
<td>1246</td>
<td>--</td>
<td>1932</td>
<td>1927-28</td>
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<tr>
<td>Harappa Canal</td>
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<tr>
<td>Haveli Canal</td>
<td>40</td>
<td>--</td>
<td>--</td>
<td>--</td>
<td>1939</td>
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</tr>
<tr>
<td>Jhel Canal</td>
<td>--</td>
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<td>--</td>
<td>--</td>
<td>1944-45</td>
<td>1942</td>
<td></td>
</tr>
</tbody>
</table>

Source: (a) Census of India Report-Punjab 1931, p. 39
(b) Uppal, Hydrological Balance Of The Indus Basin 1978, pp. 28-29.
(c) Tilton 1992, p.
(d) Imperial Gazetteer of India, Punjab 1908, p. 217.

Note: The average area shown in column 6 is for the last 10 years from 1921-22 to 1930-31.
Information on other canals such as Khinki Extension Canal, Eastern Sadiqia, Fordwah, Bahuwal Canal, Abassia Canal, Bahuwalpur Canal, Manika Canal was not available.
Perennial Canals

Western Yamuna Canal: An important perennial irrigation system, this canal was taken off the West bank of river Yamuna (Table 6.1 and Map 26). It irrigated the districts along Yamuna in the South-eastern region. Beside these British districts of the province, this canal system irrigated areas of Native states of Patiala and Jind previously it was got dug in A.D. 1356 by Sultan Firoze Tughluq. The canal initially was utilized to irrigate the royal gardens of Hansi and Hisar of the Hariana tract (Imperial Gazetteer of India, Punjab, 1908 p. 202). Due to poor upkeep it did not go beyond Kaithal area but emperor Akbar got it dug afresh in A.D. 1568 and brought the waters of the Yamuna upto the required point.

Fourteen years after assumption of power the British authority in Delhi took up the work of restoration of the old canal from Yamuna in 1817. The work of restoring and realigning it was entrusted to G.R. Blone who took three years to complete it. The Delhi branch of this canal was opened in 1819 and the Hansi branch was completed in 1825.

After the famine of 1832-33, enlargement and modification of this canal was again taken up and it irrigated about 400,000 acres in 1837-38 (Douie 1916, p. 135). The financial returns from the canal water revenue in 1847 were about 13 per cent of the total investment in this project (Dhillon 1992, p. 7). At the same time, the problem of waterlogging caused by defective alignment, blocked the natural drainage of the region. Therefore, further modification and remodelling schemes were taken up during 1872-82. A permanent weir was built at Tajewala and cross-drainage works were constructed at Datarpur over Pathrala stream between 1875-79. Sirsa branch of this canal system was constructed between 1889 and 1895. The subsequent extensions largely increased its irrigation capacity. This branch
alone irrigated nearly 200,000 acres (Imperial Gazetteer of India 1908, vol. 1, p. 203).

The head of the canal at Tajewala in Ambala district was about 2.4 kms from the point where the Yamuna leaves the Shivaliks (30°17'N and 77°37'E) and had a length of 1700 feet (518.3 mts).

The course of the canal for the first 22.5 km ran in the old abandoned bed on the right bank of Yamuna where it made a junction with Somb Nadi, where a masonry dam was built, which forced the discharge of combined streams into the canal at village Dadupur. At this place, Sirsa branch had a length of 185 km where it took off from the left bank of the main branch. It irrigated the areas of Karnal and Hisar districts and, Patiala state in the arid region. Further 50 km south, Hansi branch with a length of 76 kms took off from the right bank. It was made navigable upto Hansi railway station and was mainly used to raft the timber. The Butana canal took off from Sirsa branch West of the main branch near Indri and from here upto the point of Okhla navigation channel the course of the main branch was 119 km. The total length of the main canal and the branches was 552 km and length of its distributories was 2892 km. The total area commanded by the canal was about 10,000 sq. kms and the average area of the crops irrigated during the 20 years ending 1894-95 was 8223 km (Imperial Gazetteer of India – Punjab 1928 Vol. I, p. 204).

The canal was again remodelled in 1940-43 in order to extend the irrigation further. In 1947, the canal carried full supply discharge of 8000 cusecs during kharif season and 6784 cusecs during rabi season. It irrigated areas of the districts of Karnal, Rohtak, and Hisar and gross commanded area was 3.2 million acres, out of which culturable command area was 2.6 million acres.

**The Sirhind Canal:** Taking off from Satluj river at Ropar, this perennial canal irrigated the waste tract of the highland between the river Satluj on the
North-West and Patiali Rao and Ghaggar streams on the South-East, extending as far south as the borders of Rajputana and Bahawalpur states.

The impetus for the construction of this canal was provided by a famine which ravaged Punjab, Central Provinces, and Upper Provinces in which about a million people died. The preliminary survey was begun in 1867 and the canal project was undertaken in 1873. The canal was opened for irrigation in 1882, but actual irrigation did not commence until 1883 (Table 6.1). The project was financed from public loans and funds and it was constructed solely by the government agency to irrigate areas lying in British Punjab as well as the Native states of Patiala, Nabha, Jind, Faridkot, Malerkotla, and Kalsian. The cost of the work and annual maintenance and supplies available were shared by the British and Native states in the ratio of 64:36 (Randhawa 1983, p. 198). The original headworks of the canal at Ropar consisted of a weir 2370 feet (722.4 m) along with 12 under sluices each of 20 feet (6.1 m) span on the left of the weir and a head regulator of the canal with 13 bays each 21 feet (6.4 m) wide. It is very interesting to note that to carry out the scheme as finally approved in 1879, 1800 convicts and multitudes of free labourers including 15,000 famine affected relief workers from Sirsa and Bikaner were lodged in moveable camps at different points along the line. It was the first experiment of employing convict labour on public works on a large scale. ‘Their services were of great value, and their presence ensured the placing of a large body of men on any urgent work. The jails having the convicts proved to be a valuable source and contributed significantly to the completion of the canal’ (Thorburn 1970, p. 266).

The cost of the construction of the canal upto its opening in November 1882 was huge (40.7 million rupees) and it was opened with great ceremony by the Viceroy Lord Rippon in the presence of the chiefs of Native states who had largely contributed to the cost of the undertaking (Randhawa 1983, pp.
The area commanded by this canal in the first decade of the twentieth century was 21,466 km², of which 10,390 km² was the British territory and the rest of the area was in the Native states.

The length of the main canal is 63 km with the bed width of 200 feet (61 mts.) and the depth of 11.5 feet (3.5 m). It could carry 800 cubic feet of water (38.83 m³) per second. At the 63 km point at Doraha in the South of Ludhiana, it was divided into four large branches, i.e., combined branch on the West and the Patiala feeder on the East. The former, which had a bed width of 136 feet (41.5 m) and a capacity of 5,200 cubic feet per second, was soon divided again into two branches. The northern canal, i.e., Abohar branch ran parallel to the Satluj through Ludhiana and Firozpur districts and terminated after a course of 303 km at the town of Gobindgarh in Firozpur district. The southern canal (the Bathinda branch) ran through Ludhiana district and Patiala territory with a length of 161 km (Punjab State Gazetteer 1908, p. 105). The irrigation from these two branches was mainly in the British territory, and its administration was entirely under the British government which retained all the revenue derived from them. The British territory received 64 per cent of the supply of the main line. The Patiala feeder, the eastern part of the two large branches after bifurcation from the main line, made its way to Patiala with a bed width of 75 feet (22.9 m) and a capacity of 3,000 cubic feet per (145.3 m³) second. On its way, it moved South in three Native states branches, the Kotla 151.3 km long, the Ghaggar 87 km long and the Choa 40 km long. These three branches irrigated almost exclusively the non-British territory. The distributaries and the irrigation arrangements were under the erstwhile Phulkian states, which received the entire canal revenue. The Patiala feeder and its branches, however, were maintained by an officer of the Canal Department as an agent for the state who distributed the water according to a fixed allotment – Patiala taking 83 per cent, Nabha 9 per cent, and Jind 8 per cent.
The main line (the combined branch) and 77 km of the Abohar branch were provided with locks at the falls; from the 77 km point of the Abohar branch, a special navigation canal to the Satluj 76 km long near Firozpur, was constructed. The Patiala feeder was also made navigable along with other branches, though the main line from Ropar to the North-western railway headquarter at Firozpur was used to bring down a considerable amount of timber from the hills. Twenty five flour mills (gharats) were also constructed at different falls along the branches. The greater part of the mainline and branches was bordered by rows of trees, and the strips of land (reserved for the soil or burrow pits) were generally covered with plantation. A telegraph line was extended from the main line to the Patiala feeder, and parts of the longer Native states Bhatinda and Kotla branches. This canal system irrigated 5526 sq. kilometer area during 1899-1900, of which 3746 km² (60%) was in British territory. Of the total cost accrued on headworks and mainline the government paid 64 per cent and the rest of it was contributed by the Phulkian states. The government undertook the maintenance of the British and the Native states canals and the total charges were shared in the same way (Punjab State Gazetteer 1908, Vol. I, p. 217).

The gross revenue of the British branches averaged about Rs. 28 lakh, and the net revenue was 20 lakhs. On the Native states branches, the gross revenue averaged about 12.5 lakhs and the net revenue was about 7 lakhs. The return on the British capital outlay was as high as 10.8 per cent in 1897-98 and averaged 8 per cent during the years 1897-1903. Of the Native states capital outlay, the return for the same period (1897-1903) averaged 5.3 per cent. This canal was then not only a successful commercial scheme yielding a handsome profit, but also a useful source leading to incalculable advantages in years of drought. It saved a large tract of Punjab from famine and also provided food for export. This tract of irrigated country was
traversed in all directions by railway lines, some of which would not have been required if no canal existed.

Upper Bari doab Canal: The Bari doab canal was a perennial irrigation canal of Punjab, taking off from the left bank of the Ravi. It watered the districts of Gurdaspur, Amritsar, and Lahore in the Bari doab between the Beas and Ravi. This canal system originated as a project for the improvement of an older work, the Hasli canal, constructed in about 1633 by Ali Mardan Khan, the famous engineer of Emperor Shah Jehan (Gazetteer of Gurdaspur district 1914, p. 16). After resuming the regency power in 1846, Major Napier carried out the necessary surveys.

The progress of work was interrupted by the outbreak of the Second Anglo-Sikh War. After annexation of the province in 1849, the work was pressed on to provide employment for the disbanded Sikh soldiers who, otherwise had little motivation to turn to agriculture. The alignment of the Hasli canal proved, on examination, to be so defective that the officers in charge decided upon the adoption of an entirely independent line in which only parts of the original channel were utilized as distributaries.

Irrigation began in 1860-61 but the then permanent weir and other regulating headworks were not completed till after 1875. The headworks were at the village of Madhopur in Gurdaspur district where the river was crossed by a weir of 2700 feet (823.17 m) long. The canal was capable of carrying 6,500 cubic feet (314.85 m³) of water per second. The highest average supply in the hot season was 4,860 feet (234.93 m³), while in the cold season it varied from 1,270 to 2,170 cubic feet per second (62.52 to 105.1 m³). Its main line terminated at its 50th kilometer, separating Kasur and the main branch.

The Kasur branch after 11 kilometers gave off the Sabraon branch, and the main branch after 40.3 km gave off the Lahore branch. The four branches following the crest of the ridge into which the tract was divided by the
natural drainage. The total length of the main and branch canals was 594 km, and there were 2562 km of distributories from which water was brought upon the field by means of water-courses constructed and maintained by the cultivators. The canal was not navigable. Rainfall was the highest in the upper part of the system which had necessitated adoption of a special system of irrigation in Gurdaspur district and in a portion of Amritsar district, of the North-Western Railway on the Kasur and Sabraon branches (Punjab Administration Report 1887-88, pp. 122-23).

In this tract, the distributories were closed during winter season after a watering had been given for sowing the spring crop. The winter rains with some help from wells were sufficient to mature the rabi crops. The water thus saved was utilized in extending irrigation in the dry part of the Lahore district bordering on Montgomery – a tract for which it would otherwise had been impossible to provide a perennial supply. The gross area commanded by this canal was 64.72 km² in the middle Bari doab districts (Gurdaspur, Amritsar, and Lahore).

The lower portion of the doab in Montgomery and Multan district was not irrigable because there was no sufficient water available in the Ravi during the winter. The area irrigated was 766 km² in 1860, which thus increased to 3742 km² in 1903-04. The total capital expenditure (exclusive of interest) upto the end of 1903-04 was 197 lakhs. The gross income for the year was about 33 lakh rupees, inclusive of the increase in land revenue due to irrigation credited to the canal, amounted to rupees 36 lakhs. The working expenses amounted to 11 lakhs rupees leaving a net profit of rupees 25 lakhs which was 12.7 per cent, of the capital outlay (Punjab Administration Report 1897-98, p. 225).

**Bist doab Canal**: The Jalandhar doab had only one canal system, the Bist doab Canal, which was constructed in 1853-54, four years after the
annexation of Punjab. It was taken off from the right bank of the Satluj near Ropar which irrigated the districts of Jalandhar, Hoshiarpur and some parts of Kapurthala state. The main branch moving in a westerly direction for about 30 km bifurcated into Nakodar and Jalandhar branches. The first branch (Nakodar) ran parallel to the Satluj in the South, whereas the second branch (Jalandhar) went in a North-westerly direction till Jalandhar was reached, from where it took the southerly direction. It irrigated parts of Hoshiarpur in the South of Jalandhar and Kapurthala state in the North. Its capacity at the time of designing was 1601 cusecs, command area was 502055 acres and it irrigated 225951 acres in 1921-22. The length of this canal system was only 103 km.

**Lower Chenab Canal:** The Lower Chenab canal was a perennial canal in Punjab taking off from the left bank of the Chenab river and watering the tract between it and the Ravi. The canal was one of the greatest irrigation works in the world. The area commanded was 3.33 million acres, the average discharge was 4-5 times higher than that of the Thames, the largest river of Great Britain at Teddington. Its average irrigated area was 2.25 million acres (Douie 1916, p. 136). The average revenue earned by this canal between 1907-08 and 1911-12 was 28 per cent (of the investment). The money spent on this canal system was equivalent to £ 2,000,000. The interest charges of the amount spent on this canal were cleared in 1894 and double the amount of capital investment was paid by 1911-12. A large part of this area before the introduction of irrigation was a desolate region, unpopulated except for a race of pastoral nomade known as janglis. The land for the most part of it was ‘government waste land’ and was thus adopted for colonisation on a large scale. The original work was designed as a small inundation canal and opened as such in 1887, but in 1889 it was decided to convert it into a perennial canal of the first magnitude (Punjab Administration Report 1901-02, p. 132).
The headworks of the canal were at Khinki, a village in Gujranwala district 13 km before Wazirabad. There was a weir across the river at this place by which the supply to the canal was regulated and controlled. The main line of the canal had a bed width of 250 feet (76.2 m) and had been run with a depth of about 11 feet (3.35 m) and a discharge of 11,000 cubic feet (532.8 m) per second. This weir was commenced in 1890 and completed in 1892 (Table 6.1). The largest branch of the canal, the Gugera carrying about the total supply, taking off from the left bank of the mainline at the 45th km. It had a length of 88.6 km and then bifurcated into two subsidiary branches, Gugaira lower and the Buralla with a length of 124 and 72.5 kms respectively.

On the right bank, not far from the same, the Kot Nikka branch has a length of 29 km. The length of the mainline was 69.4 km and it then divided into the Jhang and Mian Ali branches. The Jhang was the second largest branch of the system carrying out 3,000 cubic feet water per second (145.3 m$^3$/s). Its length was about 100 km, before it bifurcated into Jhang lower (61.27 km) and Bhowana (12 km). The lengths of the Rakh and Mian Ali were 28.6 and 43.5 km, respectively. The total length of the main channels was 758 km for the distribution of the water supply from the branches to the water courses, which directly irrigated the land there at the end of 1903-04. Total length of distributaries of this canal was 4059 kms (Census of India Report - Punjab 1931, p. 39) while total length of the water courses nearly two times that of the length of the tributaries. In 1930-31 the cultivable command area of this canal rose to 27,24,000 acres and the average irrigated area (1921-22 to 1930-31) was 2.5 million acres (see Table 6.1).

The total area commanded by the canal in Gujranwala, Lahore, Jhang, and Montgomery districts at the end of 1902-03 was 13,557 sq. km. of which 7993 sq. kms were irrigated. The total area of government waste in Rechna doab was about 5143 sq. km of which 4553 sq. km land was commanded by
the canal by the end of 1903-04 (District Gazetteer of Gujranwala, 1935, pp. 117-18). By the year 1930-31 culturable command area of this canal system increased to 4256 sq.km. and the average irrigated area (1921-22 and 1930-31) was 3953 sq. km.

**Lower Jhelum Canal:** The Lower Jhelum canal was also a perennial irrigation work in Punjab which was executed at the cost of Rs. 18.2 million (Uppal 1978, p. 22). It was opened on October 30, 1901. It was taken off from the left bank of the Jhelum and supplied perennial irrigation to whole of the area lying between the Jhelum and the Chenab rivers. West of a line joining the town of Maini on the Jhelum with Pindi Bhattian on the Chenab. The head of the canal was near the village of Mong Rasul in Gujarat district. The river was dammed by a weir 12.50 metres (4063 feet) long and a regulator across the head of the canal took the form of a bridge comprising 8 spans of 7.5 metres each. In the year 1930-31 the bed width of this canal was 140 feet (43.7 mts). In the same year the length was 292 km and about 1011 miles (1627 km). The distributing of the canal were constructed in 1892-93 (Census of India Report - Punjab 1930-31, p. 39).

The canal protected an area of 2,400 sq. miles (6192 km²) and irrigated annually about 1200 sq. miles (2096 km²). Out of the protected area, about 850 sq. miles (2380 km²) were government waste, which was turned into an immense horse breeding colony for the supply of mounts to the Indian army.

**Upper Jhelum Canal:** This was the first canal of the triple canal Project and was opened in 1915. A dam was constructed at Mangla on river Jhelum in Kashmir territory about 24 km from the town of Jhelum. From here, the canal followed the left bank of the river upto Rasul in the territory of Gujarat district. From here, the main Branch poured 249 cusecs of Jhelum water into the Chenab at about seven kilometres, North-East of the Khinki Head Works. From Khinki, the Lower Chenab Canal carried the Jhelum waters
into the canal colonies of Rachna doab. The second branch, which departed from a place near Rasul Headworks, joined southern branch of Lower Jhelum Canal near Bhabra in Shahpur district. This canal was designed with a full supply discharge of 256 cumeecs (8960 cusecs) which was subsequently raised to 340 cumeecs. This canal on its way to Chenab irrigated about 3,80,000 acres in Gujarat district. The length of canal and distributary canals was 171 kms (Uppal 1978, pp. 24-25).

**Upper Chenab Canal:** Upper Chenab Canal was constructed in 1912. It took off from the left bank of the Chenab from Marala Head Works in Sialkot district. It was a much larger canal than Upper Jhelum Canal in terms of its water carrying capacity, irrigated area, and the length of channels. Upto Daska, it had a single channel from where Raya branch bifurcated and irrigated the areas of Sialkot district. The main line flowing towards Gujranwala irrigated the areas of Gujranwala and Sheikhupura districts. The main line poured its water into the Ravi at Bulloki. The total length of the channels of the canal was 3285 km which irrigated about 6,55,000 acres in 1921-22. The designed capacity of the canal was 11,742 cusecs (Uppal 1978, p. 25).

**Lower Bari doab Canal:** Lower Bari doab Canal (LBDC) played the most important role in the development of Montgomery Canal Colony as well as the Multan Canal Colony. It was completed in 1913. It took off from Bulloke Head Works about 60 km South-West of Lahore. The Ravi which was tapped at Madhopur for feeding UBDC did not have adequate amount of water to feed the LBDC; therefore, provision was made through a unique engineering feat by bringing the excess water of the Chenab to the Ravi through Upper Chenab Canal at Bulloke. This was done by constructing a 503 metre crossing barrage and was flung across the Ravi to feed the LBDC (Randhawa 1983, p. 232).
After a distance of about 18 km from Bulloke to Halla, its northern branch (Gugera branch) ran almost parallel to the Ravi and after covering about 100 kms, it terminated 15 km North-West of Montgomery. The main LBDC flowing South of Gugera branch ran parallel to Lahore-Multan railway line from Renala Khurd to Chichawatni. On its way towards the South-West, two distributories took off at Usafwala and Dadfatriana and the remaining two took off near Iqbalnagar. The total length of the main branch was 216 kms and the length of the distributories was 3154 kms (Uppal 1978, p. 25). The designed capacity of this canal at first was 6750 cusecs (191 m$^3$/sec.) and its maximum capacity in 1921-22 was 200 m$^3$/sec. In the same year, the command area of this canal was 233743 acres and the area irrigated was 162704 acres.

**Satluj Valley Project Canal:** The Satluj Valley canal project, comprising the canals taking off from Hussainiwala, Sulemanki, Pallah (Islam), and Panjnad Head Works on the Satluj river, was commissioned in 1921. The Bikaner canal, the Eastern canal and the Dipalpur canals were taken off from Hussainiwala Head Works near Firozpur. The Sadiquia, the Bahawalpur, the Fordwah and the Pak Pattan canals took off from Sulemanki head works. The Bahawalpur and the Mailsi canals took off from Pallah Headworks. The Panjnad and the Abbasia canals took off from Panjnad head works.

**Inundation Canals**

To irrigate the interior valley lands, where the flood spills could not reach, shallow cuts were made in the banks of the river and the water was drawn through these channels when the river level was high. This system of open cuts and channels is known as inundation canals. A large number of inundation canals were taken off from the Indus, the Jhelum, the Chenab and the Satluj. These were several hundred kilometres long, hundred metres wide and carrying heavy discharges during the monsoon season. The Indus, above
its confluence with the Satluj and other four rivers had dozens of canals taking off from right and left banks. But for these canals, extremely arid regions of South-West Punjab would have remained barren and uninhabited land. The important inundation canals were Kutab, Dhuni, Nur, Dhanoi, Sohan, Chibri, Ghuman and Bamihan on the right bank. There were numerous such canals on the left bank which received supplies from the perennial canals Magassan and Ghattu (Map 27).

The Satluj, by capturing the Beas in 1790 made the entire course of the Beas river below Harike dry. This necessitated the supply of water to this desiccated valley. For the supply of water to this land, inundation canals, such as Khanwah, Upper Sohag, Lower Sohag, and Para canals taking off from the Satluj were built. There were a number of small and large inundation canals on right and left banks of the Chenab and Satluj rivers, which were a source of irrigation especially during the summer floods. Major canals taken off from the left bank of Chenab were Nikki and Sukhrarawah in Montgomery district. Rest of the canals, namely, Abdul Hakim, Khadar, Durana, Nugana, Mohammadwah, Sikandrawah, Gajjuliatta, Bilochan and Sikandra were secondary inundation canals taken off from the left bank of river Chenab in Multan district. Sidhani canal also was previously an inundation canal but in 1886, it was made a perennial canal.

A brief description of the important inundation canals of the Satluj valley system is given below. After 1902-03 many canals were amalgamated with other large canal systems, which became perennial after 1902-03.

**The Katora Canal:** It takes off from the river Satluj at Kassoki village in the Kasur tehsil about 15 km above the Kaiser-i-Hind railway bridge (Hussainiwala dismantled railway bridge) over the river Satluj. Before 1903-04, it irrigated an area of 5000-8000 acres of 49 villages of Kasur tehsil and it reached only upto Khudian in Chunian tehsil of Lahore (Imperial
At the time of its construction in 1870-71, the width of the canal was 16.8 m and its authorised discharge was 13.18 m³/second. Its length at that time was about 34 km and it followed the dry bed nalla of Beas.

**The Khanwah Canal:** The date of its construction is not known; however, the records of Emperor Akbar's reign maintained that this canal was improved by Akbar's minister Mirza Khan. It was neglected by his successors and was repaired by one Radha Ram, an official of Maharaja Ranjit Singh and it flowed until 1823. It was again neglected till it was brought into working condition in 1841 under the order of Ranjit Singh's son Maharaja Sher Singh. When the British annexed Punjab, the canal was in working condition.

**Upper Sohag Canal:** It appears to have been constructed in 1827 and worked until 1840. Nothing was done until 1850 when it was taken over by the Irrigation Department of the British government. Then it was put into working order. At this time, the width of the channel was 18.3 m and the authorised discharge of the canal was 74.6 m³/second (Imperial Gazetteer of India - Punjab 1908, p. 214).

**Lower Sohag and Para Canals:** The Lower Sohag canal had a bed width of 27.4 m and an authorised discharge of 88.79 m³/second. It is said to date back to 1816 when the first attempt to irrigate the area was made by means of a dam across the Sohag Nalla which caused it to overflow its banks. In 1831, another dam was made and the water was lead to Dipalpur to the lands of Jawand Singh (an official of Lahore Durbar) who was said to have obtained a large return from the water levy. Para canal was a small distributary of the Lower Sohag Canal.
Grey Canals: It was a system of inundation canals in Punjab and these canals took off from the South bank of the Satluj and irrigated the low-lying tracts of Firozpur and Ludhiana districts. These canals took their name from Colonel L.J.H. Grey, under whose order as Deputy Commissioner of Firozpur, these were constructed. The work on these canals began in 1875-76 when eleven canals were made; the number was increased to 13 in 1883; and in 1885 after the incorporation of Fazilka tehsil in Firozpur district, two of the canals were remodelled and extended so as to irrigate this tehsil also.

Lower Satluj Inundation Canals: It was an imperial system of inundation canals in the Punjab, which took off from the right bank of the Satluj and irrigated parts of Multan district. These were for most of the part constructed in the middle of the eighteenth century by Daduputras of the Bahawalpur state. One of the largest canals, the Diwanwah was excavated in 1831 by Diwan Sawan Mal, who also enlarged and improved several others. Excluding the Hajiwah canal, there were 19 canals in 1850. These canals, however, had been gradually amalgamated into three canals, Mohamadwah, Sardarwah, and Bahawalpur in 1903. The Lodhran canal was amalgamated into the Mailsi canal. The gross cultivated area commanded by these canals was 3680 sq. km of which about 1100 sq. km was irrigated.

Muzaffargarh Inundation Canal: This imperial system of inundation canals took off from the left bank of Indus and the right bank of the Chenab which irrigated the areas of Muzaffargarh district. These were for most of the part constructed by the native rulers of the district and improved by Sawan Mal, Governor of Ranjit Singh. After annexation of Punjab, the canal remained for many years under the management of the Deputy
Commissioner of Muzaffargarh district and were transferred to the Canals Department as minor works in 1880. The Indus series consisted of eight canals with an aggregate length of 1832 km (main branch and the distributaries). There were five canals in the Chenab series with a total length of 372 kms (Imperial Gazetteer of India - Punjab 1908, p. 218).

**Chenab Inundation Canal:** It was a system of inundation canals in the Punjab which took off from the left bank of Chenab below its confluence with the Ravi and the irrigated parts of Multan and its Shujabad tehsil. These were constructed by the Pathan rulers of Multan and Shujabad and were 13 in number, but by amalgamation their number was reduced to four. These were Mattithal, Wali Mohammad, Sikandrabad and Sikandarwah canals, into which small canal systems were amalgamated.

**Jhelum Inundation Canal:** It was a system of inundation canals fed by the Jhelum river and were mainly situated in Shahpur district about 16 of them were owned by private persons and six by the government. The latter three were classed as imperial canals and the remaining two canals as provincial, Pind Dadankhan canal in Jhelum district was made over to the Municipal Committee of Pind Dadankhan for management. The three imperial canals served the Shahpur tehsil and were improved in 1864 by Sir William Davies. The imperial canals commanded an area of 272 sq. km and they irrigated 130 sq. km per year on an average.

**Ghaggar Inundation Canal:** The Ghaggar canals were minor canals of the imperial system of the Ghaggar region. Due to stagnated water of lakes and swamps of the Ghaggar, the sanitary condition of the low lying area of the Ghaggar valley was very bad South-West of Sirsa town in Hisar district. In order to make use of these swamps and lakes, the British government and the state of Bikaner agreed that Dhanur lake about 13 km South-West of
Sirsa should be converted into a reservoir. A masonry weir was built at Otu and two canals, northern and southern with a combined capacity of 48.4 m$^2$/second were constructed at each end of the weir. These canals were constructed by engaging the famine labour of surrounding regions in 1896-97 and irrigation was started in the monsoon season of 1897.

**Bhupindra or Devigarh Khands**: The khands or inundation canals from Bhupindra Regulator at Devigarh in Patiala state were built by Maharaja Bhupinder Singh in 1932. These canals, four in number, were Haripur Khand, Addliwala Khand, Dudhan Khand, and Ghuram Khand. This regulator was located on the river Ghaggar at the crossing of Patiala-Pehowa road about 20 km South-West of Patiala.

**Banur Canal System**: These inundation canals were taken off from the West bank of river Ghaggar from a place near Chhatbir and these canals worked with varied efficiency till 1947 and served the area of Patiala state.

**Conclusion**

Canalisation of Punjab has been quite an old phenomenon. Some of the canal irrigation works date back to very early times. The present perennial canal system was, however, initiated and completed by the British Government. These works covering a span of about one hundred years had no parallel anywhere in the world, neither in their grandeur nor the scale on which these were executed.

Most of the Punjab plains had deficient rainfall, which was highly variable and ill distributed. Agriculture, being the staple economy, was dependent on irrigation. Without artificial irrigation Punjab would have been as barren as the Thar.
In the eastern plains the three major canal systems – western Yamuna, Sirhind and Upper Bari were constructed or remodelled between 1870 and 1895. The British districts and Native states in this part of Punjab did have irrigation by wells but it was the canal irrigation which changed the face of the land. It improved the agricultural economy, in particular.

Lower Jhelum, Lower Chenab and Lower Bari Canals constructed between 1900 and 1917 changed the landscape of the western and South-western Punjab. Prior to the construction of these canal systems, the interfluves of the various doabs were almost unpopulated and desolate upto hundreds of miles comparable with Thar or any other desert. Cultivation in these doabs was earlier confined mainly to hithars (flood plains).

The major canal systems executed in whole of the Punjab included Western Yamuna canal, Sirhind canal, Upper Bari doab canal, Lower Chenab canal, Lower Jhelum canal and Upper Jhelum and Upper Chenab canals. In addition to these canal works in the Punjab proper, there were other large irrigation works operating in the state of Bahawalpur. One should not have any hesitation in appreciating the great achievements of British rule in the Punjab for magnificent systems of irrigation canals which they had given to the province.

On the whole canalisation of the province lead to an associated development of roads, canal and river navigation, industry, trade and communication. Consequently new infrastructure was also augmented. This way conditions were created for the development of various canal colonies which turned the Punjab into a granary of British India. In 1936-37 total irrigated area from all sources was 15.60 million acres, of which 10.83 million acres were irrigated by government canals. This accounted for more than one-third of the total irrigated area of British India.
Three considerations influenced the British to carry on and complete these canal projects. The first was to solve the problem of famines, the second was to provide immediate employment to the disbanded Sikh army after annexation and the third was to colonise many million acres of unappropriated wasteland lying in the bar areas of west and South-western Punjab.