

Topographical Description of the Ganga River and its Tributaries

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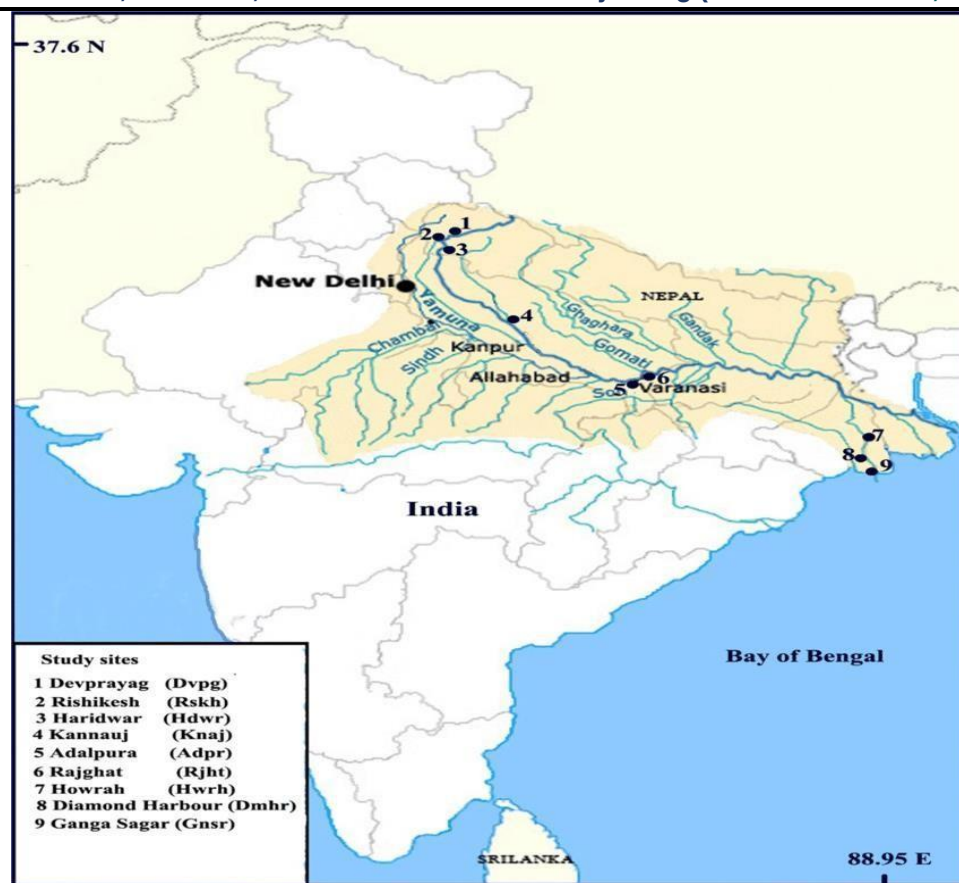
Abstract: The Ganges is a trans-boundary river of Asia which flows through India and Bangladesh. The 3,000 km (1,900 mi) river rises in the western Himalayas in the Indian state of Uttarakhand. It flows south and east through the Gangetic plain of North India, receiving the right-bank tributary, the Yamuna, which also rises in the western Indian Himalayas, and several left-bank tributaries from Nepal that account for the bulk of its flow. In West Bengal state, India, a feeder canal taking off from its right bank diverts 50% of its flow southwards, artificially connecting it to the Hooghly river. The Ganges continues into Bangladesh, its name changing to the Padma. It is then joined by the Jamuna, the lower stream of the Brahmaputra, and eventually the Meghna, forming the major estuary of the Ganges Delta, and emptying into the Bay of Bengal. The Ganges-Brahmaputra-Meghna system is the second largest river on earth by discharge. The main stem of the Ganges begins at the town of Devprayag, at the confluence of the Alaknanda, which is the source stream in hydrology on account of its greater length, and the Bhagirathi, which is considered the source stream in Hindu mythology. The Ganges is a lifeline to millions of people who live in its basin and depend on it for their daily needs. It has been important historically, with many former provincial or imperial capitals such as Pataliputra, Kannauj, Kara, Munger, Kashi, Patna, Hajipur, Delhi, Bhagalpur, Murshidabad, Baharampur, Kampilya, and Kolkata located on its banks or the banks of tributaries and connected waterways. The river is home to approximately 140 species of fish, 90 species of amphibians, and also reptiles and mammals, including critically endangered species such as the gharial and South Asian river dolphin. The Ganges is the most sacred river to Hindus. It is worshipped as the goddess Ganga in Hinduism.

Key Words: Gomukh, western Himalayas, Uttarakhand, Devprayag, Bay of Bengal, Malda town, Allahabad, GBM Delta, Shivalik range,

Objectives:

- To document the Ganga river and its tributaries
- To assess the Topographical features of rivers
- To analyse the significance of rivers in relation to Indian civilization
- To provide information for further research

A. Introduction: The Ganges (Ganga) River runs through northern India and is sacred to those who follow Hinduism. More than four hundred million people in India live in the area that feeds the river, known as the Ganges River Basin. A river basin is a region that is drained by a river, such as the Ganges, and any of its tributaries. This means that surface water and rainwater in the basin area flow into the nearby rivers. The Ganges River originates in the Himalaya Mountains at Gomukh, the terminus of the Gangotri Glacier. When the ice of this glacier melts, it forms the clear waters of the Bhagirathi River. As the Bhagirathi River flows down the Himalayas, it joins the Alaknanda River, officially forming the Ganges River. The Ganges River Basin is sometimes considered part of a larger river basin consisting of the nearby Brahmaputra and Meghna rivers. Known as the Ganges-Brahmaputra-Meghna (GBM) River Basin, it is one of the largest river systems in the world. The melting water from the Himalayas, as well as water from tributaries and rainfall, all feed the sacred river. The Ganges flows south and east from the Himalayas, forming a canyon as it leaves the mountain. It winds its way through northern India, eventually emptying into the Bay of Bengal. The Ganges' many tributaries originate from the nearby countries of Nepal, Bangladesh, and China (in an autonomous region called Tibet). The Ganges River carries nutrient rich sediment as it flows, depositing fertile soil along its shores. This has allowed civilizations to develop and thrive along the waterway for centuries. Today, the Ganga River



Source: ResearchGate

river flows through well-populated regions of India, providing freshwater to the millions of people living in these regions. The river is also used for fishing, irrigation, and bathing, and it is worshiped in the Hindu religion as the Mother Ganga. As the river empties into the Bay of Bengal, the mouth forms the Ganges River Delta, the largest river delta in the world. The Ganges River is a vital resource to Asia, but it faces many threats. Human and industrial pollutants fill the river in some areas, making it unsafe even for swimming. As the population in regions surrounding the river swells, water demands for agriculture increases, straining water levels. Adding further stress to the situation, scientists have concluded that climate change has led to a decrease in glacial ice in the Himalayas, the source of the Ganges, and theorize this will result in further decreased water levels in the river over time. The Ganga then flows across the broad plains of north India (called the Gangetic Plains) and forms the major river basin of that vast region. Its tributaries include the Kosi, the Gomti, the Sone, and above all, the Yamuna. The Yamuna River — a major river in its own right, and nearly as endowed with the sanctity of religious tradition and legend as the Ganga, is in fact a tributary of the Ganga; their confluence marks the site of the pilgrim town of Prayag, now known as Allahabad. Not only sites of religious significance, but also many of the most populous industrial cities of northern India, lie on the banks of the Ganga, including Kanpur, Allahabad, Varanasi and Patna.

B. Book Review: Documenting the Ganga's 2,525-kilometre journey from Gaumukh to Gangasagar, Chanchal Kumar Ghosh, in his book "Ganga: An Endless Journey" witnesses the spirit of the country. "For Indians Ganga is not simply a river," he states as he delves into the origins and folklores associated with the river and its tributaries. Where after all, beloved Ganga Ma is the ecological, economic, cultural and spiritual lifeline of India. The book is a harsh reality check of the horrendous repercussions of unwarranted human actions that jeopardise the natural route of the river. Ghosh describes Ganga as his childhood crush; conceptualised as a goddess, the stories of Ganga can be found in the Puranas. Offering an insight into the spiritual foundations of the country, Ghosh's monumental endeavour to traverse the length of this sacred river results in a narrative that captures the essence of Indian culture. He begins chronicling his journey from Gaumukh, the cave from which the Ganga emerges, covering innumerable cities along the way including the sacred sites of Gangotri, Uttarkashi, Deoprayag, Rishikesh, Haridwar, Kanpur, Allahabad (now Prayagraj), and Kolkata, encapsulating not only the multifaceted temperament of the Ganga but also the benevolence and generosity of the locals who live around and nearby. The visual references to the ghats that Ghosh touches upon add on to this riveting read. Incorporating paintings of Raja Ravi Verma, Ghosh tries to take his readers on a visually resplendent journey. The well- curated images exhibit the humane side of the river. The numerous photographs that he took capture the diversity that he witnessed throughout his expedition. From visuals depicting pilgrims from Bihar at Gangotri to those showing the

confluence of Ganga and Kedar Ganga at Suryakund, the book is filled with graphic marvels. It is also an anecdotal recounting of events from a pilgrim's point of view. Under the section, 'From a Pilgrim's Diary,' the author not only shares his personal experiences but also recounts events revolving around the river, as narrated to him by his paternal grandmother. Originally written in Bengali and translated into English by Sarbani Putatunda, the book is a reflection of the author's fascination with the river and the readers who can vicariously live through the same on each page. (Book review by Roshini Subramanyam, Outlook Traveller, 20-02-2020)

C. Origin: The Ganges River originates in the Himalaya Mountains at Gomukh, the terminus of the Gangotri Glacier. When the ice of this glacier melts, it forms the clear waters of the Bhagirathi River. As the Bhagirathi River flows down the Himalayas, it joins the Alaknanda River, officially forming the Ganges River. The Ganges River Basin is sometimes considered part of a larger river basin consisting of the nearby Brahmaputra and Meghna rivers. Known as the Ganges-Brahmaputra-Meghna (GBM) River Basin, it is one of the largest river systems in the world. The melting water from the Himalayas, as well as water from tributaries and rainfall, all feed the sacred river. The Ganges flows south and east from the Himalayas, forming a canyon as it leaves the mountain. It winds its way through northern India, eventually emptying into the Bay of Bengal. The Ganges many tributaries originate from the nearby countries of Nepal, Bangladesh, and China (in an autonomous region called Tibet). The Ganges River carries nutrient rich sediment as it flows, depositing fertile soil along its shores. This has allowed civilizations to develop and thrive along the waterway for centuries. Today, the river flows through well-populated regions of India, providing freshwater to the millions of people living in these regions. The river is also used for fishing, irrigation, and bathing, and it is worshiped in the Hindu religion as the Mother Ganga. As the river empties into the Bay of Bengal, the mouth forms the Ganges River Delta, the largest river delta in the world. The Ganges River is a vital resource to Asia, but it faces many threats. Human and industrial pollutants fill the river in some areas, making it unsafe even for swimming. As the population in regions surrounding the river swells, water demands for agriculture increases, straining water levels. Adding further stress to the situation, scientists have concluded that climate change has led to a decrease in glacial ice in the Himalayas, the source of the Ganges, and theorize this will result in further decreased water levels in the river over time.

D. Mythology: In a country where practically everything in nature is venerated, the Ganges is most holy. Considering the magnitude of her life-sustaining force, it's no wonder: her mighty course from the mountains to the sea creates a river basin 200 to 400 miles wide that supports nearly half a billion people. According to Hindu mythology, the Ganges was once a river of heaven that flowed across the sky. Long ago, she agreed to fall to earth to aid a king named Bhagiratha, whose ancestors had been burned to ash by the angry gaze of an ascetic they had disturbed during meditation. Only the purifying waters of Ganges, flowing over their ashes, could free them from the earth and raise them up to live in peace in heaven. So that the earth would not be shattered by the impact of her descent, Lord Shiva caught Ganges in his hair as she cascaded down from heaven to the Himalayas. Ganges then followed Bhagiratha out of the mountains, across the plains to the sea, where she restored his dead ancestors and lifted them to paradise. As the Ganges brought to life the ashes of Bhagiratha's ancestors, so all Hindus believe that if the ashes of their dead are deposited in the river, they will be ensured a smooth transition to the next life, or freed from the cycle of death and rebirth. Hindus may travel great distances to scatter the ashes of loved ones in the Ganges. Hindus also believe that the Ganges' divine waters purify those who immerse themselves in her. It is even said that a single drop of Ganges water, carried by the wind over a great distance, can cleanse a lifetime of sins. In cities along the river, daily dips are an important ritual among the faithful. Many cities are considered sacred and serve as pilgrimage sites: Gangotri, where the river originates from a glacial cave; Sagar Island, where the Ganges drains into the sea and once restored the ancestors of Bhagiratha; Varanasi, the holiest of cities along the river's course and the most auspicious place to die; and Allahabad, the site of the most important festival in the Hindu religious calendar, Kumbh Mela. In 2001, some 20 million people bathed in the Ganges at Allahabad at the most auspicious moment of this festival. 30 million bathed in the Ganges at Kumbh Mela in 2013.

E. Course of the river: Bhagirathi is the source stream of Ganga. It emanates from Gangotri Glacier at Gaumukh at an elevation of 3,892 m (12,770 feet). Many small streams comprise the headwaters of Ganga. The important among these are Alaknanda, Dhauliganga, Pindar, Mandakini and Bhilangana. At Devprayag, where Alaknanda joins Bhagirathi, the river acquires the name Ganga. It traverses a course of 2525 km before flowing into the Bay of Bengal. It has a large number of tributaries joining it during this journey. In Uttarakhand, Tehri dam has been built on Bhagirathi for hydropower generation resulting in regulated additional water discharge during the dry months. At Haridwar, Ganga opens to the Gangetic Plains, where a barrage diverts a large quantity of its waters into the Upper Ganga Canal, to provide water for irrigation. At Bijnore, another barrage diverts water into the Madhya Ganga Canal but only during monsoon months. At Narora, there is further diversion of water into the Lower Ganga Canal. Further down, River Ramganga joins Ganga near Kannauj, adding additional water to the river. Yamuna confluences Ganga at the Sangam in Allahabad, making a major contribution to the river flow. Beyond Allahabad, Ganga is joined by several

tributaries, most of which are from the north and a few from the south. In the stretch between Allahabad in U.P. and Malda in West Bengal, Ganga, therefore, has considerable flow. The Farakka barrage in West Bengal regulates the flow of the river, diverting some of the water into a feeder canal linking Hooghly to keep it relatively silt-free. Downstream of this barrage, River Ganga splits into two, Bhagirathi (Hooghly) on the right and Padma on the left. Bhagirathi (Hooghly) meets the Bay of Bengal about 150 km downstream of Kolkata. Padma enters Bangladesh and meets river Brahmaputra and Meghna before finally joining the Bay of Bengal. (nmcg.nic.in)

F. Hydrology: Rainfall, subsurface flows and snow melt from glaciers are the main sources of water in river Ganga. Surface water resources of Ganga have been assessed at 525 billion cubic meter (BCM). Out of its 17 main tributaries Yamuna, Sone, Ghagra and Kosi contribute over half of the annual water yield of the Ganga. These tributaries meet the Ganga at Allahabad and further downstream. The river has a problem of low flows between the Haridwar-Allahabad stretch. December to May are the months of lean flow in the Ganga. On an average, each square km of the Ganga basin receives a million cubic meter (MCM) of water as rainfall. 30% of this is lost as evaporation, 20% seeps to the subsurface and the remaining 50% is available as surface runoff. The deep channel of the river bounded by high banks facilitates the passage of ground water as base flow. Annual flooding is the characteristic of all rivers in the Ganga basin. The Ganga rises during the monsoon but the high banks restrict the flood water from spreading. The floodplain is usually

0.5 to 2 km wide. This active flood plain is flooded every year. In addition to this the existing structures on the Ganga Basin also affect its discharge. (nmcg.nic.in)

G. River Basin: The Ganges basin encompasses some 419,300 square miles (1,086,000 square km) and contains the largest river system on the subcontinent. The water supply depends partly on the rains brought by the southwesterly monsoon winds from July to October as well as on the flow from melting Himalayan snows in the hot season from April to June. Precipitation in the river basin accompanies the southwest monsoon winds, but it also comes with tropical cyclones that originate in the Bay of Bengal between June and October. Only a small amount of rainfall occurs in December and January. The average annual rainfall varies from 30 inches (760 mm) at the western end of the basin to more than 90 inches (2,290 mm) at the eastern end. (In the upper Gangetic Plain in Uttar Pradesh, rainfall averages about 30–40 inches [760–1,020 mm]; in the Middle Ganges Plain of Bihar, from 40 to 60 inches [1,020 to 1,520 mm]; and in the delta region, between 60 and 100 inches [1,520 and 2,540 mm].) The delta region experiences strong cyclonic storms both before the commencement of the monsoon season, from March to May, and at the end of it, from September to October. Some of those storms result in much loss of life and the destruction of homes, crops, and livestock. One such storm, which occurred in November 1970, was of catastrophic proportions, resulting in deaths of at least 200,000 and possibly as many as 500,000 people; another, in April 1991, killed some 140,000. Since there is little variation in relief over the entire surface of the Gangetic Plain, the river's rate of flow is slow. Between the Yamuna River at Delhi and the Bay of Bengal, a distance of nearly 1,000 miles (1,600 km), the elevation drops only some 700 feet (210 metres). Altogether the Ganges-Brahmaputra plains extend over an area of 300,000 square miles (800,000 square km). The alluvial mantle of the plain, which in some places is more than 6,000 feet (1,800 metres) thick, is possibly not more than 10,000 years old.

The Ganges Basin is a part of the Ganges-Brahmaputra-Meghna (GBM) basin draining 1,999,000 square kilometres in Tibet, Nepal, India and Bangladesh. To the north, the Himalaya or lower parallel ranges beyond form the Ganges-Brahmaputra divide. On the west the Ganges Basin borders the Indus basin and then the Aravalli ridge. Southern limits are the Vindhya and Chota Nagpur Plateau. On the east the Ganges merges with the Brahmaputra through a complex system of common distributaries into the Bay of Bengal. Its catchment lies in the states of Uttar Pradesh (294,364 km²), Madhya Pradesh (198,962 km²), Bihar (143,961 km²), Rajasthan (112,490 km²), West Bengal (71,485 km²), Haryana (34,341 km²), Himachal Pradesh (4,317 km²), Delhi, Arunachal Pradesh (1,484 km²), the whole of Bangladesh, Nepal and Bhutan. Several tributaries rise inside Tibet before flowing south through Nepal. The basin has a population of more than 500 million, making it the most populated river basin in the world. The Ganges (Ganga) River runs through northern India and is sacred to those who follow Hinduism. More than four hundred million people in India live in the area that feeds the river, known as the Ganges River Basin. A river basin is a region that is drained by a river, such as the Ganges, and any of its tributaries. This means that surface water and rainwater in the basin area flow into the nearby rivers. The basin comprises semi-arid valleys in the rain shadow north of the Himalaya, densely forested mountains south of the highest ranges, the scrubby Shivalik foothills and the fertile Gangetic Plains. Central highlands south of the Gangetic Plain have plateaus, hills and mountains intersected by valleys and river plains. The important soil types found in the basin are sand, loam, clay and their combinations such as sandy loam, silty clay etc. The annual surface water potential of the basin has been assessed as 525 km³ in India, out of which 250 km³ is utilizable water. There is about 580,000 km² of arable land; 29.5% of the cultivable area of India. Water-related issues of the basin are

due to both high and low flows. In India, the states of Uttarakhand, Uttar Pradesh, Bihar and West Bengal are affected by floods. Bangladesh – at the confluence of Brahmaputra River and Ganges River – suffers from severe floods almost every year. Northern Ganges tributaries such as Kosi, Gandak and Mahananda are the most flood-prone, but southern tributaries also contribute. Low flows are caused by scarcity of rainfall outside the summer Monsoon, and sometimes by failure of this monsoon to develop to its normal extent. The Ganges is joined by Kosi, Ghaghra, Gandak from the Himalayas and by Chambal, Betwa, Son from the peninsular region.

Swollen by the waters of a wide basin that draws from watersheds as diverse as the Himalayas and the Aravallis, the Ganga forms a formidable current in the stretch between Allahabad and Malda, and thereafter, a large delta. Near the town of Malda in West Bengal, it undergoes its first attrition with the branching away of the Hooghly, its first distributary. The city of Kolkata (previously Calcutta) stands on the banks of the Hooghly. The main stream of the river (known as the Padma River) then enters Bangladesh. Here, it unites with the Jamuna branch of the even larger Brahmaputra river. The combined stream then joins with the Meghna River before flowing out to sea. In the flat plains of Bangladesh, the Ganges splits almost immediately into a dense network of distributaries, all of which finally empty into the Bay of Bengal. The region encompassing the delta near the Bay of Bengal coast is known as The Sundarbans (Beautiful Forests) — a region of thick mangrove forests and one of the major habitats of the Royal Bengal Tiger. Two species of dolphin can be found in the Ganges, the Ganges River Dolphin and the Irrawaddy Dolphin. The Ganges is also notable in that it contains a rare species of freshwater shark, *Glyphis gangeticus*, about which little is known. Bhagirathi is the source stream of Ganga. It emanates from Gangotri Glacier at Gaumukh at an elevation of 3,892 m (12,770 feet). Many small streams comprise the headwaters of Ganga. The important among these are Alaknanda, Dhauliganga, Pindar, Mandakini and Bhilangana. At Devprayag, where Alaknanda joins Bhagirathi, the river acquires the name Ganga. It traverses a course of 2525 km before flowing into the Bay of Bengal. It has a large number of tributaries joining it during this journey.

H. Delta: The Ganges Delta (also known as the Sundarbans Delta or the Bengal Delta) is a river delta in the Bengal region of South Asia, consisting of Bangladesh and the Indian state of West Bengal. It is the world's largest river delta and it empties into the Bay of Bengal with the combined waters of several river systems, mainly those of the Brahmaputra river and the Ganges river. It is also one of the most fertile regions in the world, thus earning the nickname the Green Delta. The delta stretches from the Hooghly River east as far as the Meghna River. The Ganges Delta has the shape of a triangle and is considered to be an "arcuate" (arc-shaped) delta. It covers more than 105,000 km² (41,000 sq mi) and lies mostly in Bangladesh and India, with rivers from Bhutan, Tibet, and Nepal draining into it from the north. Most of the delta is composed of alluvial soils made up by small sediment particles that finally settle down as river currents slow down in the estuary. Rivers carry these fine particles with them, even from their sources at glaciers as fluvio-glacial. Red and red-yellow laterite soils are found as one heads farther east. The soil has large amounts of minerals and nutrients, which is good for agriculture. It is composed of a labyrinth of channels, swamps, lakes, and floodplain sediments (chars). The Gorai-Madhumati River, one of the distributaries of the Ganges, divides the Ganges Delta into two parts: the geologically young, active, eastern delta, and the older, less active, western delta.

In Uttarakhand, Tehri dam has been built on Bhagirathi for hydropower generation resulting in regulated additional water discharge during the dry months. At Haridwar, Ganga opens to the Gangetic Plains, where a barrage diverts a large quantity of its waters into the Upper Ganga Canal, to provide water for irrigation. At Bijnore, another barrage diverts water into the Madhya Ganga Canal but only during monsoon months. At Narora, there is further diversion of water into the Lower Ganga Canal. Further down, River Ramganga joins Ganga near Kannauj, adding additional water to the river. Yamuna confluences Ganga at the Sangam in Allahabad, making a major contribution to the river flow. Beyond Allahabad, Ganga is joined by several tributaries, most of which are from the north and a few from the south. In the stretch between Allahabad in U.P. and Malda in West Bengal, Ganga, therefore, has considerable flow. The Farakka barrage in West Bengal regulates the flow of the river, diverting some of the water into a feeder canal linking Hooghly to keep it relatively silt-free. Downstream of this barrage, River Ganga splits into two, Bhagirathi (Hooghly) on the right and Padma on the left. Bhagirathi (Hooghly) meets the Bay of Bengal about 150 km downstream of Kolkata. Padma enters Bangladesh and meets river Brahmaputra and Meghna before finally joining the Bay of Bengal. For India, the Ganga is more than just a river. It is a vast waterway that originates in the Himalayan mountains and winds through thousands of kilometres of rural terrain before emptying into the Bay of Bengal; it is a lifeline for millions of people. Hindus also regard the river as a sacred body. The river travels almost 2,500 kilometres to the Bay of Bengal, joining with other rivers along the way swollen by monsoon rain and melted glaciers. In the foothills of the Himalayas, the Alaknanda and Bhagirathi rivers converge in the small hill town of Devprayag. This is where the Ganges begins. Pristine waters soon become a distant memory as the 2,525 km-long Ganges snakes its way down to the densely populated plains of north India, eventually forming a huge delta with the Brahmaputra River and emptying into the Bay of Bengal. The river and its tributaries are a vital water source for hundreds of millions of people, who rely on it to

drink, bathe, and irrigate the land. At other points along the river, industrial waste and sewage pour in from open drains, turning the river red in some places, while clouds of toxic foam float on the surface in others. The holy Ganga begins as a crystal clear river high in the icy Himalayas, but pollution and excessive usage transform it into toxic sludge in places on its journey through burgeoning cities, industrial hubs, and past millions of devotees.

I. Tributaries of Ganga The important tributaries of Ganga are the Ramganga, the Gomati, the Ghaghara, the Gandak, the Kosi and the Mahanada. The river finally discharges itself into the Bay of Bengal near the Sagar Island.

1. Alakananda river: The Ganges rises in the southern Great Himalayas on the Indian side of the border with the Tibet Autonomous Region of China. Its five headstreams—the Bhagirathi, the Alaknanda, the Mandakini, the Dhauliganga, and the Pindar—all rise in the mountainous region of northern Uttarakhand state. Of those, the two main headstreams are the Alaknanda (the longer of the two), which rises about 30 miles (50 km) north of the Himalayan peak of Nanda Devi, and the Bhagirathi, which originates at about 10,000 feet (3,000 metres) above sea level in a subglacial meltwater cave at the base of the Himalayan glacier known as Gangotri. Gangotri itself is a sacred place for Hindu pilgrimage. The true source of the Ganges, however, is considered to be at Gaumukh, about 13 miles (21 km) southeast of Gangotri. The Alaknanda and Bhagirathi rivers unite at Devprayag to form the mainstream known as the Ganga, which cuts southwestward through the Siwalik Range (Outer Himalayas) at the northern edge of the Indo-Gangetic Plain to emerge from the mountains at Rishikesh. It then flows onto the plain at Haridwar, another place held sacred by Hindus.

2. Bhagirathi river: The Bhagirathi River originates from Gaumukh Glacier and flows about 193 kms before merging with Alaknanda to form River Ganga at Devprayag. It lies in Garhwal region and is 205 km long. It flows for about 193 km before merging with the Alaknanda at Deoprayag. The basin area is about 6,921 sq.km. The Headwaters of Bhagirathi river are formed at Gaumukh, perched at an elevation of 3892m above sea level, at the foot of Gangotri glacier and Khatling glaciers in the Garhwal, Himalaya. Various tributaries joining Bhagirathi are Kedar Ganga at Gangotri, Jadh Ganga at Bhaironghati, kakora Gad and Jalandhari Gad near Harshil, Siyan Gad near Jhala, Asi Ganga near Uttarkashi and Bhilangna River near Old Tehri. The Bhilangna itself rises at the foot of the Khatling Glacier (elevation 3,717 m) approximately 50 km south of Gaumukh. The highest point of Bhagirathi basin is Chaukhamba I. The famous Tehri Dam lies at the confluence of Bhagirathi and Bhilangna River near Tehri Garhwal. Other operational projects in the basin include Koteshwar, Maneri and Joshiyara. Other than these, many more have been planned and are being constructed like

Kotli Bhel, Loharinag, Bhilangna dam etc.

3. Barakar river: Once known as the ‘sorrow of Bengal’, the Damodar has been now tamed by the Damodar Valley Corporation, a multipurpose project. The Barakar River is the main tributary of the Damodar River in eastern India. Originating near Padma in Hazaribagh district of Jharkhand it flows for 225 kilometers (140 mi) across the northern part of the Chota Nagpur Plateau, mostly in a west to east direction, before joining the Damodar near Dishergarh in Asansol, Bardhaman district of West Bengal. It has a catchment area of 6,159 square kilometers (2,378 sq mi). The main tributaries, Barsoti and Usri, flow in from the south and north respectively. Apart from the two main tributaries some fifteen medium or small streams join it. The Barakar skirts the northern portion of Parasnath Hills, 1,350 metres (4,430 ft) above sea level, the highest hill in the region, located in Giridih district of Jharkhand and a centre of Jain pilgrimage. Barakar River is the primary tributary of Damodar River situated in the eastern part Jharkhand, India. Primarily Damodar River is recognised as the River of Sorrow due to its nature of devastating deluges in the valleys of West Bengal. Due to major construction of the dam in the area of Damodar River, the tributaries are under control. Usri River and Barsotti River are the chief tributaries of Barakar River that runs down from south towards north correspondingly. Other than these two rivers Usri River and Barsotti River, there are 15 other small tributaries of Barakar River which forms into watercourses.

4. Chambal river: The 1,024 kilometres (636 mi) long Chambal River originates from the Bhadakla Falls in Janapav Hills on the northern slopes of the Vindhyan escarpment near Mandav, 67.5 kilometres (41.9 mi) South-West of Mhow in Indore District, Madhya Pradesh state, at an elevation of about 843 metres (2,766 ft). The river flows first in a northerly direction through Madhya Pradesh (M.P.) for about 376 kilometres (234 mi) and then in a generally north-easterly direction for 249 kilometres (155 mi) through Rajasthan. The Chambal flows for another 216 kilometres (134 mi) between M.P. and Rajasthan and a further 150 kilometres (93 mi) between M.P. and Uttar Pradesh (U.P.). It enters U.P. and flows for about 33 kilometres (21 mi) before joining the Yamuna River in Jalaun District at an elevation of 123 metres (404 ft), to form a part of the greater Gangetic drainage system.[7] From its source down to its junction with the Yamuna, the Chambal has a fall of about 747.25 metres (2,451.6 ft). Of this, around 305 metres (1,001 ft) is within the first 26 kilometres (16 mi) reach from its source. It falls for another 195 metres (640 ft) in the next 312 kilometres (194 mi), where it enters the gorge past the Chaurasigarh Fort. During the next 157 kilometres (98 mi) of its run from the Chaurasigarh Fort to Kota city, the bed falls by another 91 metres (299 ft). For the rest of its 529 kilometres (329

mi) run, the river passes through the flat terrain of the Malwa Plateau and later the Gangetic Plain with an average gradient of 0.21 m/km.[7] The Chambal River is a tributary of the Yamuna River in Central and Northern India, and thus forms part of the drainage system of the Ganges.[2] The river flows north-northeast through Madhya Pradesh, running for a time through Rajasthan then forming the boundary between Rajasthan and Madhya Pradesh before turning southeast to join the Yamuna in Uttar Pradesh state.[3] It is a legendary river and finds mention in ancient scriptures. The perennial Chambal originates at Janapav, south of Mhow town, near Manpur, Indore, on the south slope of the Vindhya Range in Madhya Pradesh. The Chambal and its tributaries drain the Malwa region of northwestern Madhya Pradesh, while its tributary, the Banas, which rises in the Aravalli Range, drains southeastern Rajasthan. It ends a confluence of five rivers, including the Chambal, Kwari, Yamuna, Sind, Pahuj, at Pachnada near Bhareh in Uttar Pradesh state, at the border of Bhind and Etawah districts. The Chambal rises near Mhow in the Malwa plateau of Madhya Pradesh and flows northwards through a gorge up wards of Kotain Rajasthan, where the Gandhisagar dam has been constructed. From Kota, it traverses down to Bundi, Sawai Madhopur and Dholpur, and finally joins the Yamuna. The Chambal is famous for its badlands topography called the Chambal ravines.

5. Damodar river: The Damodar river occupies the eastern margins of the Chotanagpur Plateau where it flows through a rift valley and finally joins the Hugli. Damodar River, river in northeastern India, rising with its many tributaries, notably the Bokaro and Konar, in the Chota Nagpur plateau of south-central Bihar state. It follows a generally eastward course for 368 miles (592 km) through West Bengal to join the Hugli (Hooghly) River southwest of Kolkata (Calcutta). The Damodar valley along the Bihar–West Bengal border includes India's most important coal- and mica-mining fields and has long been an area of active industrial development. The major coalfields (Jharia, Raniganj, and Giridih) are mostly open-pit and are easily mined. The Damodar Valley Corporation, which began work in 1948, constructed four

multipurpose dams to form a series of reservoirs—Tilaiya, Maithon, Konar, and Panchet Hill. Also included is the Durgapur diversionary barrage (dam) and an 80-mile (130-km) navigation canal linking the coalfields with the Hugli-Kolkata industrial complex. The project provides for flood control, hydroelectricity, coal-fired thermal power plants, irrigation of about 950,000 acres (385,000 hectares) chiefly in West Bengal, afforestation, fish breeding, recreation, and the general development of agriculture and industry throughout the valley, which experienced a great influx of people during the 20th century. Numerous towns, including Dhanbad, Jharia, and Sindri, are connected by a dense rail and road network. The Damodar River rises in the Palamau hills of Chota Nagpur at an elevation of about 609.75 m. It flows in a south-easterly direction entering the deltaic plains below Raniganj. Near Burdwan, the river abruptly changes its course to a southerly direction and joins Hooghly about 48.27 km below Calcutta. Its slope during the first 241.35 km is about 1.89 m/km, during the next 160.9 km about 0.568 m/km and during the last 144.8 km about 0.189 m/km. The total length of the river is nearly 547 km and a total drainage area is 22,005 sq. km. The principal tributary Barkar joins the Damodar after traveling for about 241 km. The catchment area of the river above the confluence is fan shaped and as such is susceptible to the concentration of flood flows but the catchment below the confluence is narrow and has an average width of 16.09 km. The upper catchment is rough hilly areas denuded of forest and vegetal cover and is subject to erosion while the lower catchment is silt covered and fertile. There are no irrigation facilities in the upper catchment and the cultivation is solely dependent on monsoon rains. However the lower portion had irrigation from the Anderson Weir situated at Rhondia on the Damodar nearly 19 km below the Durgapur Barrage. The tributaries and subtributaries of the Damodar include Konar, Barakar, Haharo, Bokaro, Ghari, Jamunia, Khadia, Guaia and Bhera. The biggest tributary of the Damodar River is the Barakar. The source of Barakar is located in the vicinity of Padma in Hazaribagh district. Subsequently, the river runs through Jharkhand prior to joining the Damodar close to Dishergarh in West Bengal. The Barakar and the Damodar get the Chota Nagpur flat terrain divided into three parts. The rivers flow through mountainous regions with enormous might, overwhelming anything that comes in their way.

6. Gandak river: The Gandak comprises two streams, namely Kaligandak and Trishulganga. It rises in the Nepal Himalayas between the Dhaulagiri and Mount Everest and drains the central part of Nepal. It enters the Ganga plain in Champaran district of Bihar and joins the Ganga at Sonpur near Patna. The Ghaghara originates in the glaciers of Mapchachungo. After collecting the waters of its tributaries – Tila, Seti and Beri, it comes out of the mountain, cutting a deep gorge at Shishapani. The river Sarda (Kali or Kali Ganga) joins it in the plain before it finally meets the Ganga at Chhapra. Gandak River, also called Narayani River, river in central Nepal and northern India. It is formed by the union of the Kali and Trisuli rivers, which rise in the Great Himalaya Range in Nepal; from this junction to the Indian border the river is called the Narayani. It flows southwest into India and then turns southeast along the Uttar Pradesh–Bihar state border and across the Indo-Gangetic Plain. It enters the Ganges (Ganga) River opposite Patna after a winding course of 475 miles (765 km). The Burhi (“Old”) Gandak flows parallel to and east of the Gandak River in an old channel. It joins the Ganges northeast of Munger. The river flows across the Gangetic plain of Bihar state and eventually merges with the Ganga near Hajipur or Patna. The entry point of the river at the Indo-Nepal border is at the convergence

of Gandak, known as Triveni. Here, the rivers meet with Pachnad and Sonha also sliding into India from Nepal. Pandai River flows into the Indian state of Bihar from Nepal in the eastern end of the Valmiki Sanctuary and finally meets Masan. The drainage area of this river in India is 7620 sq km. After the river enters India at Triveni, it flows for an extended length of 300 km and then joins the Ganga. Before merging with the river Ganga near Patna, it flows through the districts of Champaran, Sarang and Muzaffarpur. The total length of the Gandak River is 630 km out of which 330 km flows in Nepal and Tibet. The important towns along the river are considered to have mythological importance. The major towns and cities located along the banks of the Gandak River are Lo Manthang, Jomsom, Devghat, Beni, Kusma, Baglung, Narayangarh, Ridi, Valmikinagar and Triveni. The river also forms the western border of the popular Chitwan National Park. Gorkha is an important town in the Trisuli river basin. Kali Gandaki is a well-known whitewater adventure spot. Chitwan National Park of Nepal and Valmiki National Park of India are located just beside each other in the area of Valmikinagar around the Gandak Barrage. The park encompasses an area of 932 km² and is the oldest national park of Nepal established in 1973.

7. Kosi river: The Kosi is an antecedent river with its source to the north of Mount Everest in Tibet, where its main stream Arun rises. After crossing the Central Himalayas in Nepal, it is joined by the Son Kosi from the West and the Tamur Kosi from the east. It forms Saptakoshi after uniting with the river Arun. The Koshi or Kosi River drains the northern slopes of the Himalayas in the Tibet Autonomous Region and the southern slopes in Nepal. From a major confluence of tributaries north of the Chatra Gorge onwards, the Koshi River is also known as Saptakoshi for its seven upper tributaries. These include the Tamur Koshi originating from the Kanchenjunga area in the east, Arun River from Tibet and Sun Koshi from the Gosainthan area farther west. The Sun Koshi's tributaries from east to west are Dudh Koshi, Bhote Koshi, Tamba Koshi and Indravati Koshi. The Saptakoshi crosses into northern Bihar where it branches into distributaries before joining the Ganges near Kursela in Katihar district. The Koshi is 720 km (450 mi) long and drains an area of about 74,500 km² (28,800 sq mi) in Tibet, Nepal and Bihar. In the past, several authors proposed that the river has shifted its course for more than 133 km (83 mi) from east to west during the last 200 years. But a review of 28 historical maps dating 1760 to 1960 revealed a slight eastward shift for a long duration, and that the shifting was random

and oscillating in nature. The river basin is surrounded by ridges which separate it from the Yarlung Tsangpo River in the north, the Gandaki in the west and the Mahananda in the east. The river is joined by major tributaries in the Mahabharat Range approximately 48 km (30 mi) north of the Indo-Nepal border. Below the Siwaliks, the river has built up a megafan some 15,000 km² (5,800 sq mi) in extent, breaking into more than twelve distinct channels, all with shifting courses due to flooding. Kamalā, Bāgmati (Kareh) and Budhi Gandak are major tributaries of Koshi in India, besides minor tributaries such as Bhutahi Balān. The Kosi alluvial fan is one of the largest in the world covering northeast Bihar and eastern Mithila to the Ganges, 180 km (110 mi) long and 150 km (93 mi) wide. It shows evidence of lateral channel shifting exceeding 120 km (75 mi) during the past 250 years, via at least twelve major channels. The river, which flowed near Purnea in the 18th century, now flows west of Saharsa. A satellite image shows old channels with a confluence before 1731 with the Mahananda River north of Lava.

8. Mahananda river: is another important tributary of the Ganga rising in the Darjeeling hills. It joins the Ganga as its last left bank tributary in West Bengal. Mahananda River, river in northern India and Bangladesh. It rises in the Darjiling Hills in extreme northern West Bengal state. The river flows south through a rich agricultural area in Bihar state, enters West Bengal state, flows past Ingraj Bazar, and then continues southeastward into Bangladesh to join the Ganges River at Godagari Ghat after a 225-mile (360-km) course. The Mahananda forms in its upper course an important eastward linguistic boundary between the Bengali- and Hindi-speaking areas. The Mahananda river system consists of two streams- one is locally known as Fulahar river and the other Mahananda. Fulahar originates from the mountainous region of Himalayas in Nepal and traverses through the Indian state of Bihar and merges with Ganges on the left opposite to Rajmahal. The Mahananda originates in the Himalayas: Paglajhora Falls on Mahaldiram Hill near Chimli, east of Kurseong in Darjeeling district at an elevation of 2,100 metres (6,900 ft). It flows through Mahananda Wildlife Sanctuary and descends to the plains near Siliguri. It touches Jalpaiguri district. It enters Bangladesh near Tentulia in Panchagarh District, flows for 3 kilometres (1.9 mi) after Tentulia and returns to India. After flowing through Uttar Dinajpur district in West Bengal and Kishanganj, Purnia and Katihar districts in Bihar, it enters Malda district in West Bengal. The Mahananda divides the district into two regions — the eastern region, consisting mainly of old alluvial and relatively infertile soil is commonly known as Barind (Borendrovomee), and the western region, which is further subdivided by the river Kalindri into two areas, the northern area is known as "Tal". It is low-lying and vulnerable to inundation during the rainy season; the southern area consists of very fertile land and is thickly populated, being commonly known as "Diara". The main tributaries of the Mahananda are Balason, Mechi, Kankai and River Kalindri. At the East of the confluence of the Kalindri and the Mahananda lies the Old Malda town. In the Siliguri area it has three tributaries called the Trinai, Ranochondi and the pair of Chokor and Dauk taken as a single tributary.

9. Ramaganga river: The Ramganga is comparatively a small river rising in the Garhwal hills near Gairsain. It changes its course to the southwest direction after crossing the Shiwalik and enters into the plains of Uttar Pradesh near Najibabad. Finally, it joins the Ganga near Kannauj. The geographical extent of the Ramganga sub-basin lies between $78^{\circ} 14'$ to $80^{\circ} 8'$ east longitudes and $27^{\circ} 7'$ to $30^{\circ} 6'$ north latitudes of the country. The Ramganga is the first major tributary joining the Ganga. It rises at an altitude of about 3,110 m in the lower Himalayas near the Lohba village in the Garhwal district of Uttarakhand. The length of the Ramganga river from the source to the confluence with the Ganga is 596 km. During its course, the river flows through mountainous terrain and has a number of falls and rapids. The river enters the plains at Kalagarh near the border of the Garhwal district, where the famous Ramganga dam has been constructed. Beyond Kalagarh, the river flows in a southeasterly direction and finally joins the Ganga on its left bank near Kanauj in the Fategarh district. The river flows entirely in the states of Uttarakhand and Uttar Pradesh. The catchment area of the sub-basin is about 32,493 Sq.km. Ramganga flows by the Corbett National Park near Ramnagar of Nainital district from where it descends upon the plains. Moradabad, Bareilly, Badaun, Shahjahanpur and Hardoi cities of Uttar Pradesh are situated on its banks. The Ramganga Dam crosses the river at Kalagarh for irrigation and hydroelectric generation. The important tributaries that join the Ramganga river are the Ban, the Khoh, the Gangan, the Gagas, the Aril, the Kosi, the Haldgadi Rao and the Deoha. There are 93 towns in Ramganga Basin, out of which, 72 are Statutory Towns and 21 are Census Towns. There are five towns having a population between 1 to 10 lakhs viz. Bareilly, Moradabad, Pilibhit, Rampur and Shahjahanpur. The climate of Ramganga Basin is subtropical, monsoonal. Winters (October to February) are cool and dry with occasional fogs and light showers, summers (March to early June) are hot and dry, and the monsoon season (middle June to September) is warm and humid, with frequent heavy rainfall. Diverse climate conditions are observed because of the large variation in the altitude of the catchment area. The lower valley is usually hot. The average annual rainfall varies from 2200 mm in the north to 800 mm near the Ramganga confluence with Ganga at Hardoi. In Uttar Pradesh rainfall varies from 700 to 1000 mm. The temperature in the Ramganga plains varies from 5° to 25°C in winter and from 20°C to more than 40°C during summer. The annual average pan evaporation rate for Ramganga Basin is 4.88 mm/day.

10. Sarda river: The Sarda or Saryu River rises in the Milan glacier in the Nepal Himalayas where it is known as the Goriganga. Along the Indo-Nepal border, it is called Kali or Chauk, where it joins the Ghaghara. The Sarayu is a river that flows through the Indian states of Uttarakhand and Uttar Pradesh. This river is of ancient significance, finding mentions in the Vedas and the Ramayana. The Sarayu river forms at the confluence of the Karnali (or Ghaghara) and Mahakali (or Sharda) in Bahraich District. The Mahakali or Sharda forms the western Indo-Nepal border. Ayodhya is situated on the banks of river Sarayu. Some mapmakers consider the Sarayu to be just a section of the lower Ghaghara River. The Sarayu rises at Sarmul (or Sarmool), which is located in the extreme north of the district Bageshwar of Uttarakhand on the southern slope of a ridge of the Nanda Kot. It flows through the Kumaon Himalayas, and passes by the towns of Kapkot, Bageshwar and Seraghat before flowing into the Mahakali at Pancheshwar. The river is mentioned three times in the Rigveda. The banks of the Sarayu are the location of the slaying of two Aryas at the hands of Indra in RV 4.30.18. It is listed together with western tributaries to the Indus: Rasā, Anitabha, Kubha, Krumu and the Sindhu itself as obstacles crossed by the Maruts in RV 5.53.9. In this verse, Purisini appears as its epithet. At this stage of the earlier Rigveda, it apparently was a river west of the Indus system that corresponds to Iranian Harayu (Avestan acc. Harōiium, Old Persian Haraiva, modern Harē or Harī), the Hari River. It is invoked together with Sindhu and Sarasvati (two of the most prominent Rigvedic rivers) in the late hymn RV 10.64. According to the regional versions of the Ramayana written in different Indian languages, especially in Ram Charit Manas by Goswami Tulsi Das 1.5.6, the Sarayu flowed beside the ancient city of Ayodhya, which is in modern day Uttar Pradesh. It is a tributary of the Ghaghara. This Sarayu played a vital role in the city and life of Ayodhya, and according to the Ram Charit Manas, Rama, the seventh Avatar of Vishnu immersed himself in the river to return to his eternal Mahavishnu form, after he retired from the throne of Kosala. His brothers Bharata and Shatrughna also joined him, as did many devout followers. The Sarayu is also the river on whose banks King Rama was born. The Sarayu is a river that originates at a ridge south of Nanda Kot mountain in Bageshwar district in Uttarakhand, India. It flows through Kapkot, Bageshwar, and Seraghat towns before discharging into the Sharda River at Pancheshwar at the India—Nepal border. Sharda river (also known as Kali river) then flows into Ghaghara river in Sitapur District, Uttar Pradesh, India. Lower Ghaghara is also popularly known as Sarayu in India. Especially while it flows through the city of Ayodhya, the birthplace of the Hindu deity Rama. The river is mentioned various times in the ancient Indian epic of Ramayana.

11. Son river: The Son is a major right bank tributary of Ganga River. It is a large south bank tributary of the Ganga, originating in the Amarkantak plateau. After forming a series of waterfalls at the edge of the plateau, it reaches Arrah, west of Patna, to join the Ganga. Son River, Son also spelled Sone, principal southern tributary of the Ganges River, rising in Madhya Pradesh state, central India. It flows north past Manpur and then turns northeast. The river cuts

through the Kaimur Range and joins the Ganges above Patna, after a 487-mile (784-km) course. The Son valley is geologically almost a continuation of that of the Narmada River to the southwest. It is largely forested and sparsely populated. The valley is bordered by the Kaimur Range to the north and the Chota Nagpur plateau to the south. The river's flow is seasonal, and the Son is unimportant for navigation. Dams have been constructed on some of its tributaries. At Dehri, in Bihar state, are the headworks of the Son canal system and a rare instance of an Indian river having masculine name, Damodar and Brahmaputra also have masculine names. The Sone originates near Pendra in Chhattisgarh, just east of the headwater of the Narmada River, and flows north-northwest through Shahdol district in Madhya Pradesh state before turning sharply eastward where it encounters the southwest-northeast-Kaimur Range. The Sone parallels the Kaimur hills, flowing east-northeast through Uttar Pradesh, Jharkhand and Bihar states to join the Ganges just west of Patna. Geologically, the lower valley of the Son is an extension of the Narmada Valley, and the Kaimur Range an extension of the Vindhya Range. Arwal, Daudnagar, Deori, Rohtasgarh, Dehri, Sonbhadra and Bihta are some of the major cities situated on Sone River. The Sone river which is 784 kilometres (487 mi) long, is one of the longest Indian rivers. Its chief tributaries are the Rihand, Kanhar and the North Koel. The Son has a steep gradient (35–55 cm per km) with quick run-off and ephemeral regimes, becoming a roaring river with the rain-waters in the catchment area but turning quickly into a fordable stream. The Son, being wide and shallow, leaves disconnected pools of water in the remaining parts of the year. The channel of the Son is very wide (about 5 km at Dehri) but the floodplain is narrow, only 3 to 5 kilometres (2 to 3 mi) wide. The meeting point with North Koel the width of Sone River is 5 to 8 kilometres (3 to 5 mi). In the past, the Son has been notorious for changing course. As it is traceable from several old beds near its east bank, the river changed its course more than 5 times. In modern times this tendency has been checked with the anicut at Dehri, and now more so with the Indrapuri Barrage.

12. Yamuna river, the western most and the longest tributary of the Ganga, has its source in the Yamunotri glacier on the western slopes of Bandarpunch range (6,316 km). It joins the Ganga at Prayag (Allahabad). It is joined by the Chambal, the Sind, the Betwa and the Ken on its right bank which originates from the Peninsular plateau while the Hindan, the Rind, the Sengar, the Varuna, etc. join it on its left bank. Much of its water feeds the western and eastern Yamuna and the Agra canals for irrigation purposes. Yamuna River (also known as Jumna), is the major tributary of the Ganges River. The 1,376 km long Yamuna flows solely through India, crossing three states: Uttarakhand, Uttar Pradesh and Haryana. The Yamuna also flows part of the border between the states of Himachal Pradesh and Uttarakhand and later on its course between the states of Haryana and Uttar Pradesh. The Yamuna rises in the high Himalaya, in the Yamunotri Glacier, at the height of 4,421 meters. It then flows onto the North Indian Plain, describing a broad arc convex to the southwest along its course. The Yamuna joins the Ganges in Triveni Sangam, a sacred Hindu site. Yamuna River has many tributaries over its 1,376 km course. Near Dehradun, the capital city of Uttarakhand, the Yamuna is joined by its biggest tributary, the Tons River. The Chambal River is Yamuna's biggest tributary on the right. Other important tributaries of the Yamuna include the Hindon, Sarda and Giri river on the right and Betwa and Sindh on the left. Just like the Ganga, the Yamuna is also highly venerated in Hinduism and treated as a goddess. It is known as Yami in early texts, while in literature of the later periods, she is called Kalindi. In Hindu scriptures, she is worshipped as the daughter of the sun god, Surya, and his wife Saranyu or Sanjana, the cloud goddess. Other texts, however, say she was the daughter of Brahma. The twin sister of Yama, the god of death, Yamuna is also associated with the god Krishna, and is mentioned as one of his ashtabharya, his eight consorts. As a river, it plays an important role, both in his early life and youth. Bathing or drinking in Yamuna's waters is believed to wash away all sins. Her other siblings include Vaivasvata Manu, the first man, and the twin Ashvins, divine doctors, and the planet Saturn (shani). She is often portrayed as Surya's favourite child, which is evident from her other names – Suryatanaya, Suryaja and Ravinandini.

The Ganges Delta (also known as the Sundarbans Delta or the Bengal Delta) is a river delta in the Bengal region of South Asia, consisting of Bangladesh and the Indian state of West Bengal. It is the world's largest river delta and it empties into the Bay of Bengal with the combined waters of several river systems, mainly those of the Brahmaputra river and the Ganges river. It is also one of the most fertile regions in the world, thus earning the nickname the Green Delta. The delta stretches from the Hooghly River east as far as the Meghna River. The Ganges Delta has the shape of a triangle and is considered to be an "arcuate" (arc-shaped) delta. It covers more than 105,000 km² (41,000 sq mi) and lies mostly in Bangladesh and India, with rivers from Bhutan, Tibet, and Nepal draining into it from the north. Most of the delta is composed of alluvial soils made up by small sediment particles that finally settle down as river currents slow down in the estuary. Rivers carry these fine particles with them, even from their sources at glaciers as fluvio-glacial. Red and red- yellow laterite soils are found as one heads farther east. The soil has large amounts of minerals and nutrients, which is good for agriculture. It is composed of a labyrinth of channels, swamps, lakes, and floodplain sediments (chars). The Gorai-Madhumati River, one of the distributaries of the Ganges, divides the Ganges Delta into two parts: the geologically young, active, eastern delta, and the older, less active, western delta.

The Ganges River runs through northern India and is sacred to those who follow Hinduism. More than four hundred million people in India live in the area that feeds the river, known as the Ganges River Basin. A river basin is a region that is drained by a river, such as the Ganges, and any of its tributaries. This means that surface water and rainwater in the basin area flow into the nearby rivers. The Ganges River originates in the Himalaya Mountains at Gomukh, the terminus of the Gangotri Glacier. When the ice of this glacier melts, it forms the clear waters of the Bhagirathi River. As the Bhagirathi River flows down the Himalayas, it joins the Alaknanda River, officially forming the Ganges River. The Ganges River Basin is sometimes considered part of a larger river basin consisting of the nearby Brahmaputra and Meghna rivers. Known as the Ganges-Brahmaputra-Meghna (GBM) River Basin, it is one of the largest river systems in the world. The melting water from the Himalayas, as well as water from tributaries and rainfall, all feed the sacred river. The Ganges flows south and east from the Himalayas, forming a canyon as it leaves the mountain. It winds its way through northern India, eventually emptying into the Bay of Bengal. The Ganges' many tributaries originate from the nearby countries of Nepal, Bangladesh, and China (in an autonomous region called Tibet). The Ganges River carries nutrient rich sediment as it flows, depositing fertile soil along its shores. This has allowed civilizations to develop and thrive along the waterway for centuries. Today, the river flows through well-populated regions of India, providing freshwater to the millions of people living in these regions. The river is also used for fishing, irrigation, and bathing, and it is worshiped in the Hindu religion as the Mother Ganga. As the river empties into the Bay of Bengal, the mouth forms the Ganges River Delta, the largest river delta in the world. The Ganges River is a vital resource to Asia, but it faces many threats. Human and industrial pollutants fill the river in some areas, making it unsafe even for swimming. As the population in regions surrounding the river swells, water demands for agriculture increases, straining water levels. Adding further stress to the situation, scientists have concluded that climate change has led to a decrease in glacial ice in the Himalayas, the source of the Ganges, and theorize this will result in further decreased water levels in the river over time. (National Geographic, Online edition)

On August 12, 2011, the National Mission for Clean Ganga (NMCG) was listed as a society under the Societies Registration Act, 1860. The consortium acts as the implementation arm of the National Ganga River Basin Authority (NGRBA), which was constituted under provisions of the Environment Protection Act (EPA), 1986, and was established to address pollution challenges in the Ganga river. The operational area of this project comprises the Ganges Basin and all states through which the river flows, including Delhi. The objective of the National Mission for Clean Ganga is to reduce pollution and ensure rejuvenation of the Ganga river. This can be achieved by promoting intersectoral coordination for comprehensive planning & management and maintaining minimum ecological flow in the river, with the aim of ensuring water quality and environmentally sustainable development.

J. Drainage area: The drainage area of this basin is constituted of many sub-basins namely The Yamuna river, passing through the states of Uttarakhand, Himachal Pradesh, Haryana and Uttar Pradesh and Delhi. Its main tributaries are Tons and Chambal, followed by Sindh, the Betwa, and Ken which drain parts of Rajasthan and Madhya Pradesh states; The Gomti river, passing through the Uttar Pradesh; The Ghaghara river, which originates from Tibetan plateau and

crosses Nepal before passing through Uttar Pradesh and Bihar. It is the largest tributary of the Ganga by volume of water contributed; The Gandak river, passing through Nepal and Uttar Pradesh and Bihar; The Kosi river, passing through Nepal and Bihar; The Son river, passing through Madhya Pradesh, Uttar Pradesh, Jharkhand and Bihar; The Punpun river, passing through Jharkhand and Bihar; The Damodar river, passing through West Bengal and Jharkhand. (Sciencedirect.com)

The Ganga is the most important river of India both from the point of view of its basin and cultural significance. It rises from the Gangotri glacier near Gaumukh (3,900 m) in the Uttarkashi district of Uttarakhand. Here, it is known as the Bhagirathi. The important tributaries of Ganga are the Ramganga, the Gomati, the Ghaghara, the Gandak, the Kosi and the Mahanada. The river finally discharges itself into the Bay of Bengal near the Sagar Island. The Ganga is the most important river of India both from the point of view of its basin and cultural significance. It rises from the Gangotri glacier near Gaumukh (3,900 m) in the Uttarkashi district of Uttarakhand. Here, it is known as the Bhagirathi. It cuts through the Central and the Lesser Himalayas in narrow gorges. At Devprayag, the Bhagirathi meets the Alaknanda; then after, it is known as the Ganga. The Alaknanda has its source in the Satopanth glacier above Badrinath. The Alaknanda consists of the Dhaulī and the Vishnu Ganga which meet at Joshimath or Vishnu Prayag. The other tributaries of Alaknanda such as the Pindar join it at Karna Prayag while Mandakini or Kali Ganga meets it at Rudra Prayag. The Ganga enters the plains at Haridwar. From Haridwar, it flows first to the south, then to the south-east and east before splitting into two distributaries, namely the Bhagirathi and the Hugli. The river has a length of 2,525 km. It is shared by Uttarakhand (110 km) and Uttar Pradesh (1,450 km), Bihar (445 km) and West Bengal (520 km). The Ganga basin covers about 8.6 lakh sq. km area in India alone. The Ganga river system is the largest in India having a number of perennial and non-perennial rivers originating in the Himalayas in the north and the Peninsula in the south,

respectively. Hindus also call the river Ganga as Maa Ganga in Hinduisim, and it is considered a symbol of purity.

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