

THE STUDY ON WATER QUALITY MANAGEMENT PLAN
FOR GANGA RIVER IN THE REPUBLIC OF INDIA

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Fig.B.2.1 Seasonal Variation of
Temperature, Relative Humidity and
Rainfall (1)

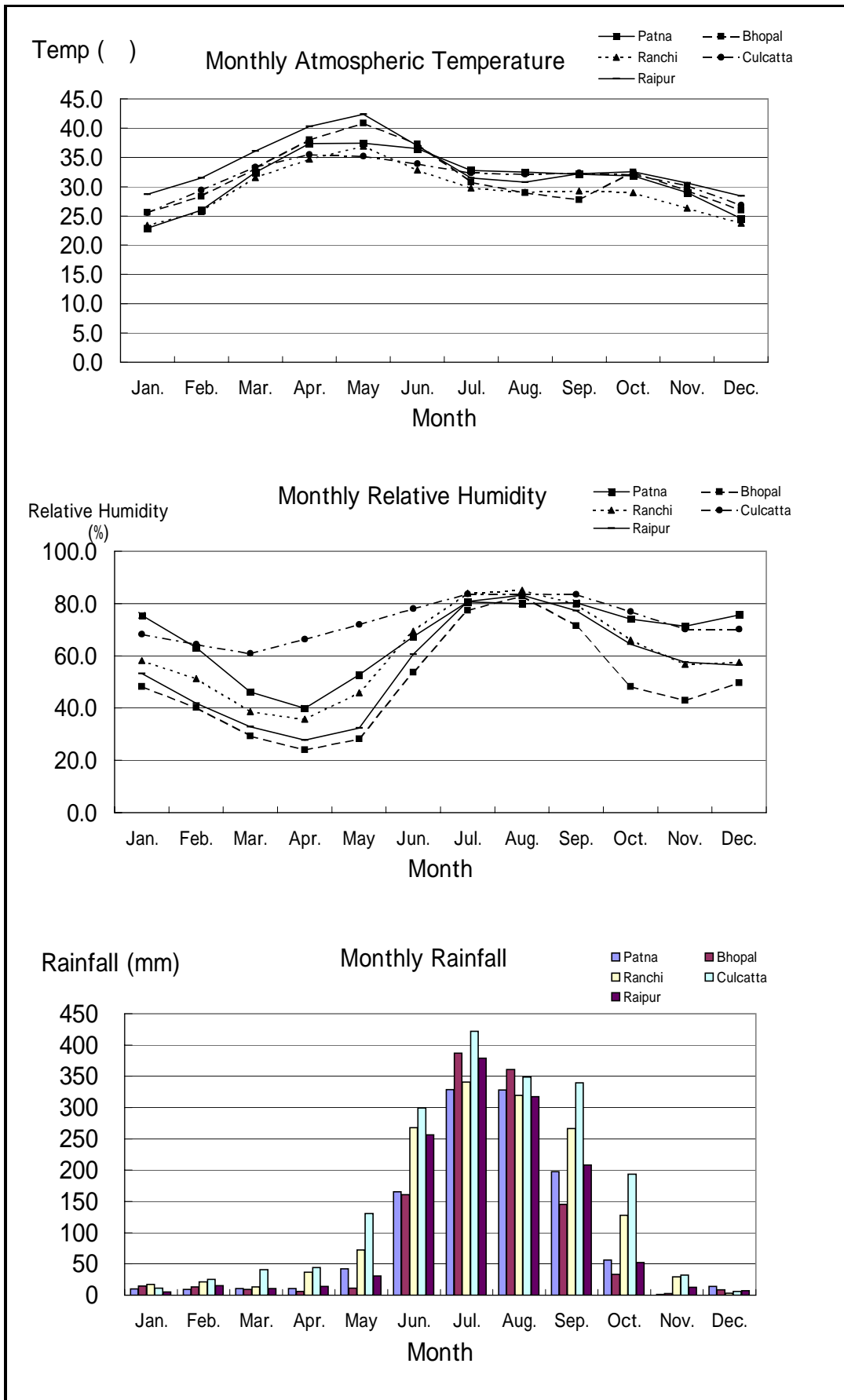
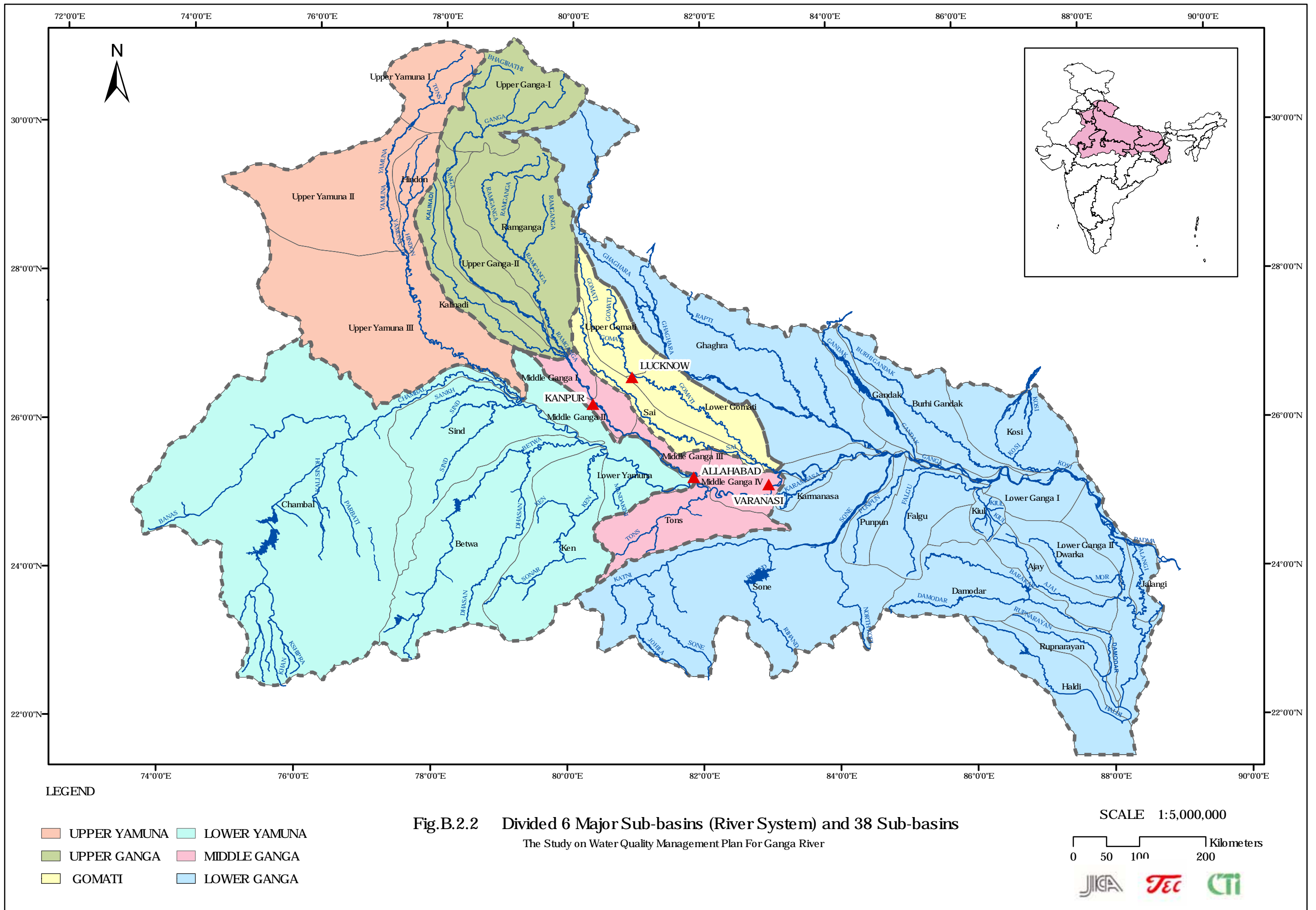
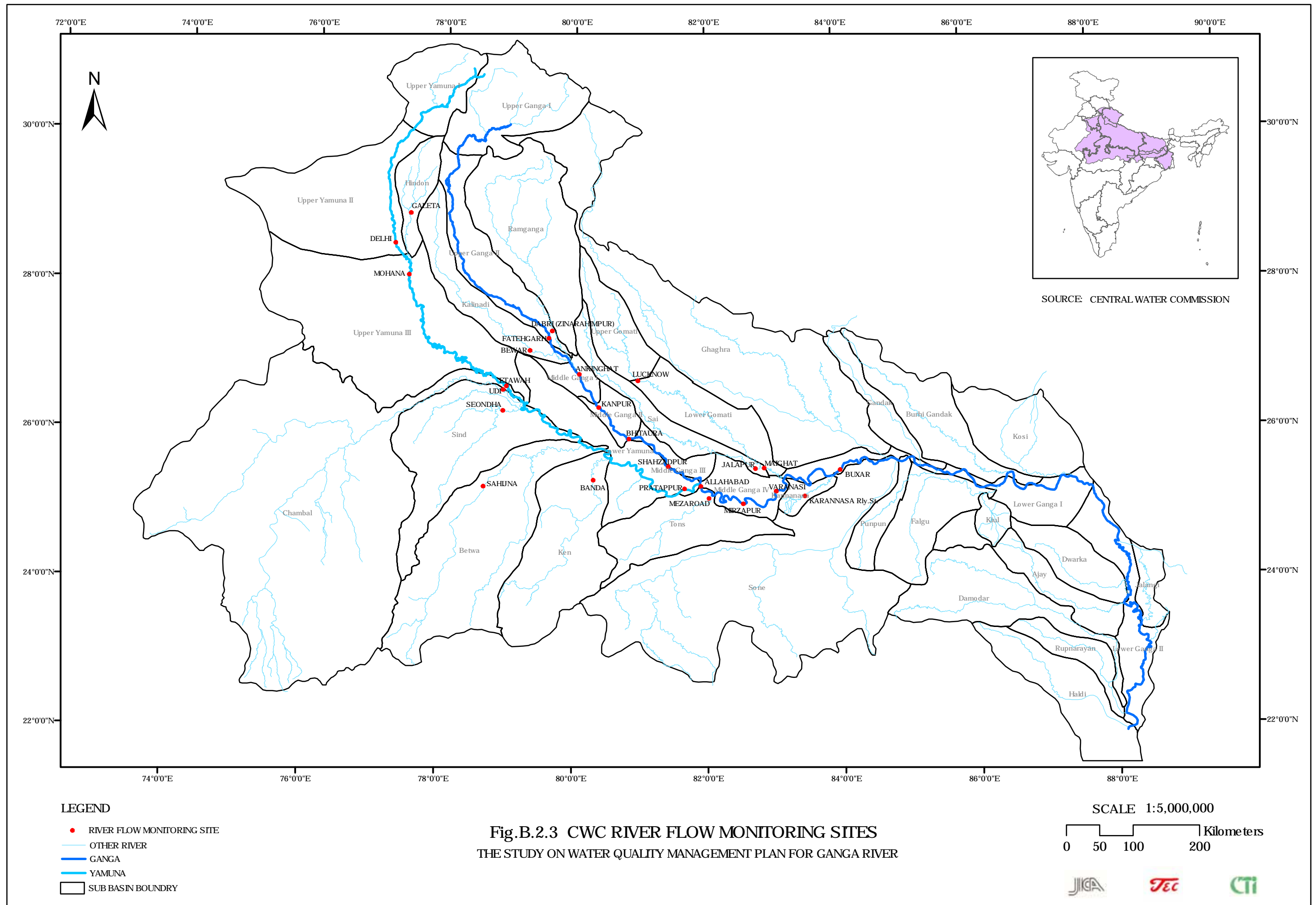
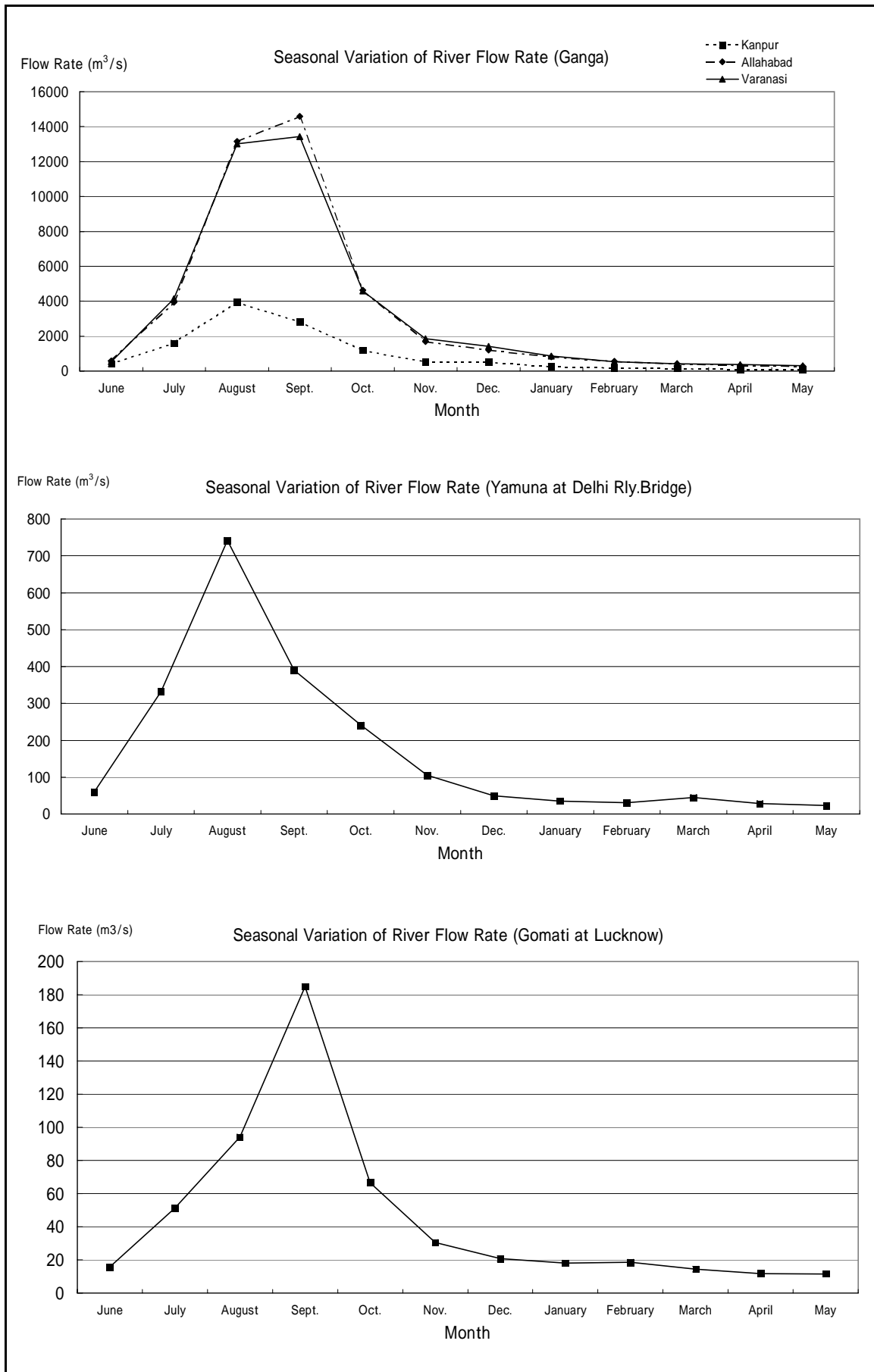


Fig.B.2.1 Seasonal Variation of Temperature, Relative Humidity and Raiffal (2)



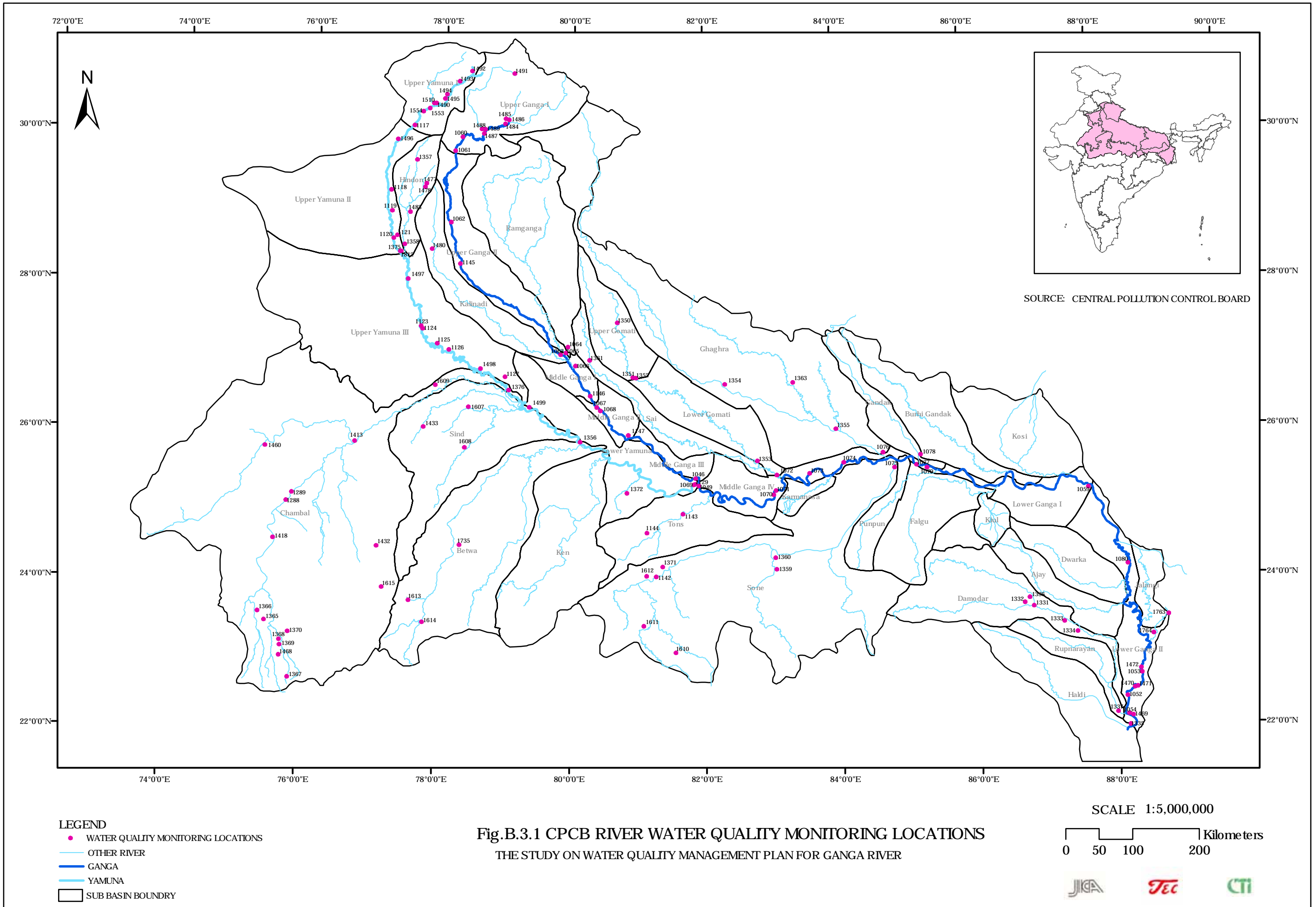


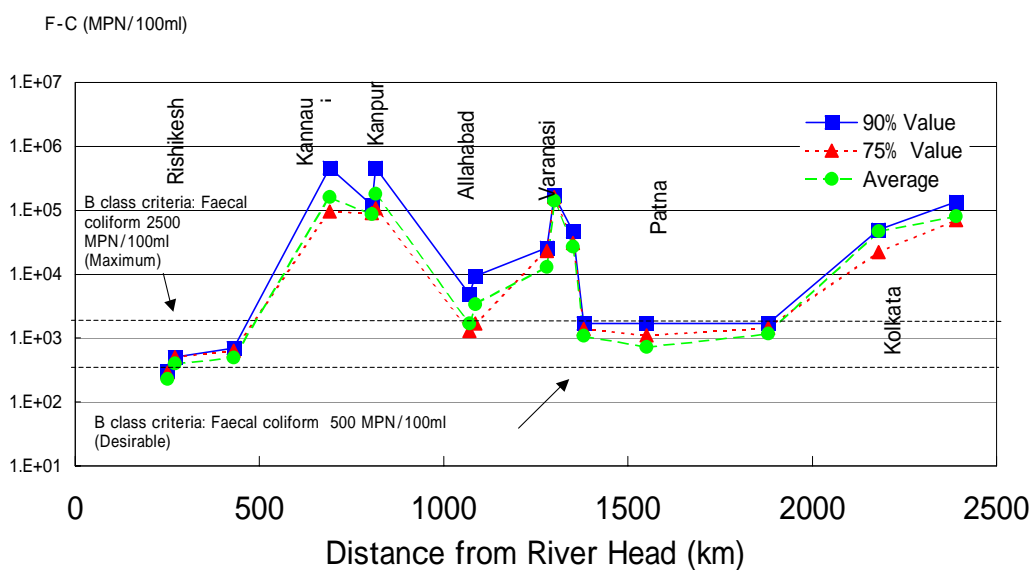
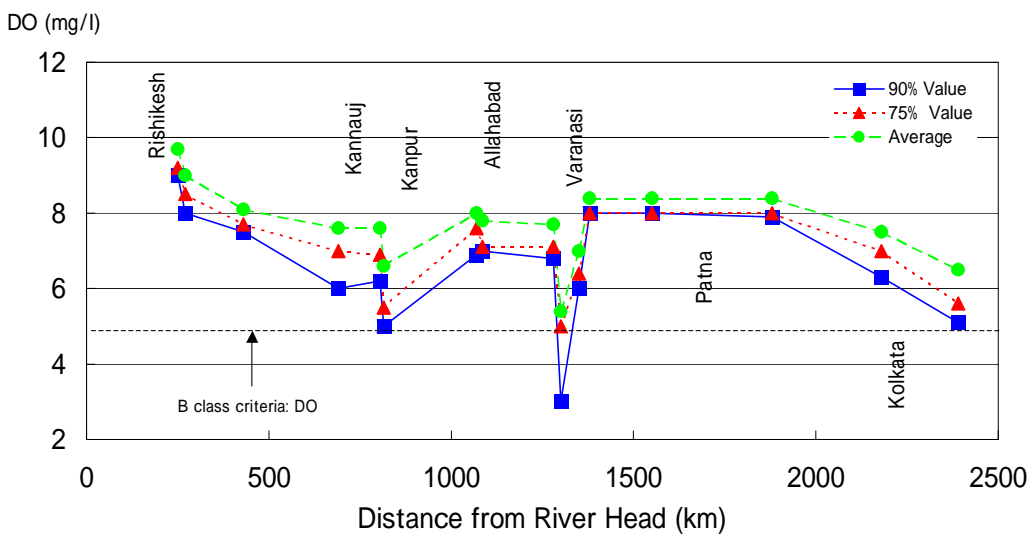
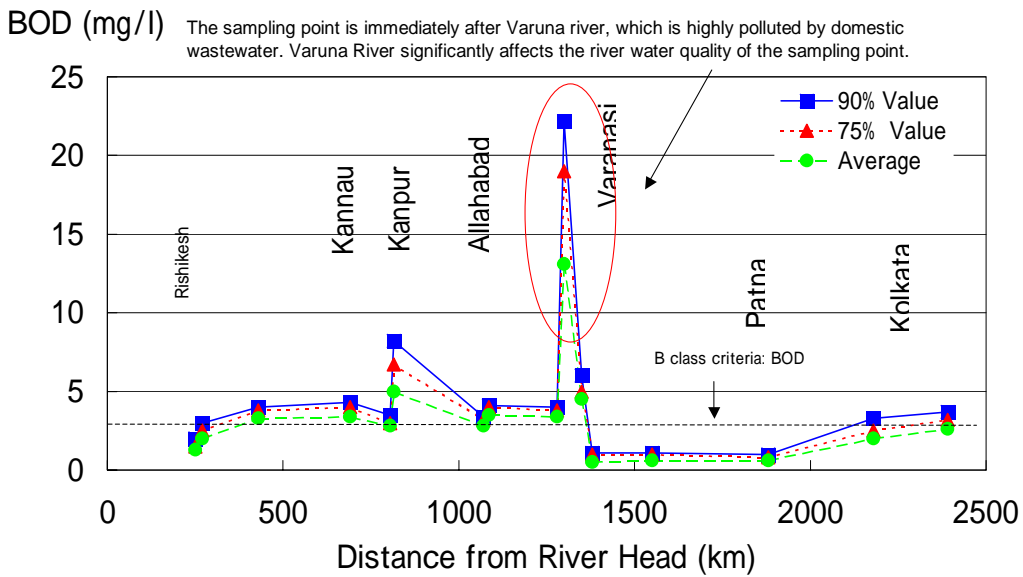


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Fig.B.2.4 Seasonal Variation of River Flow Rate

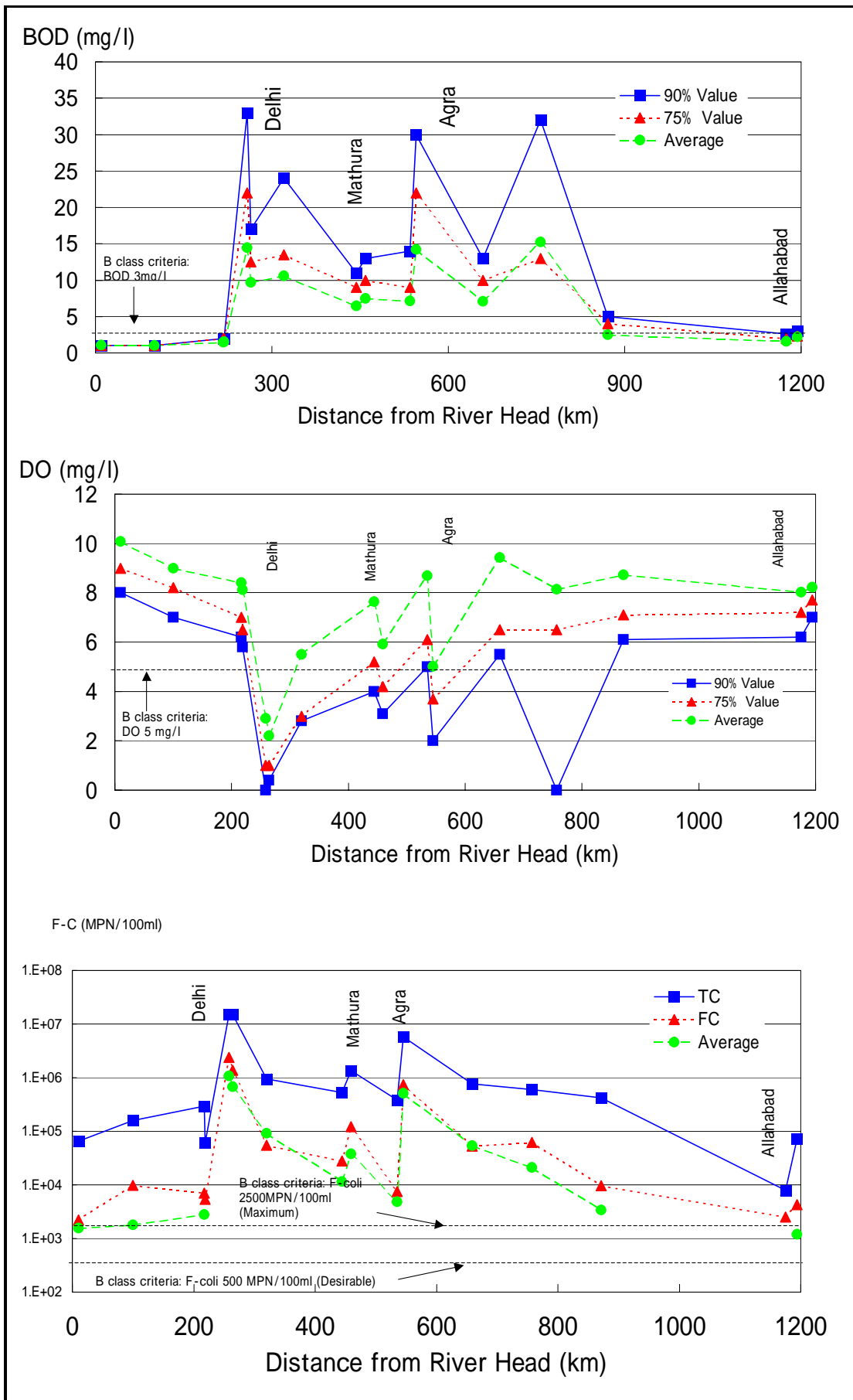




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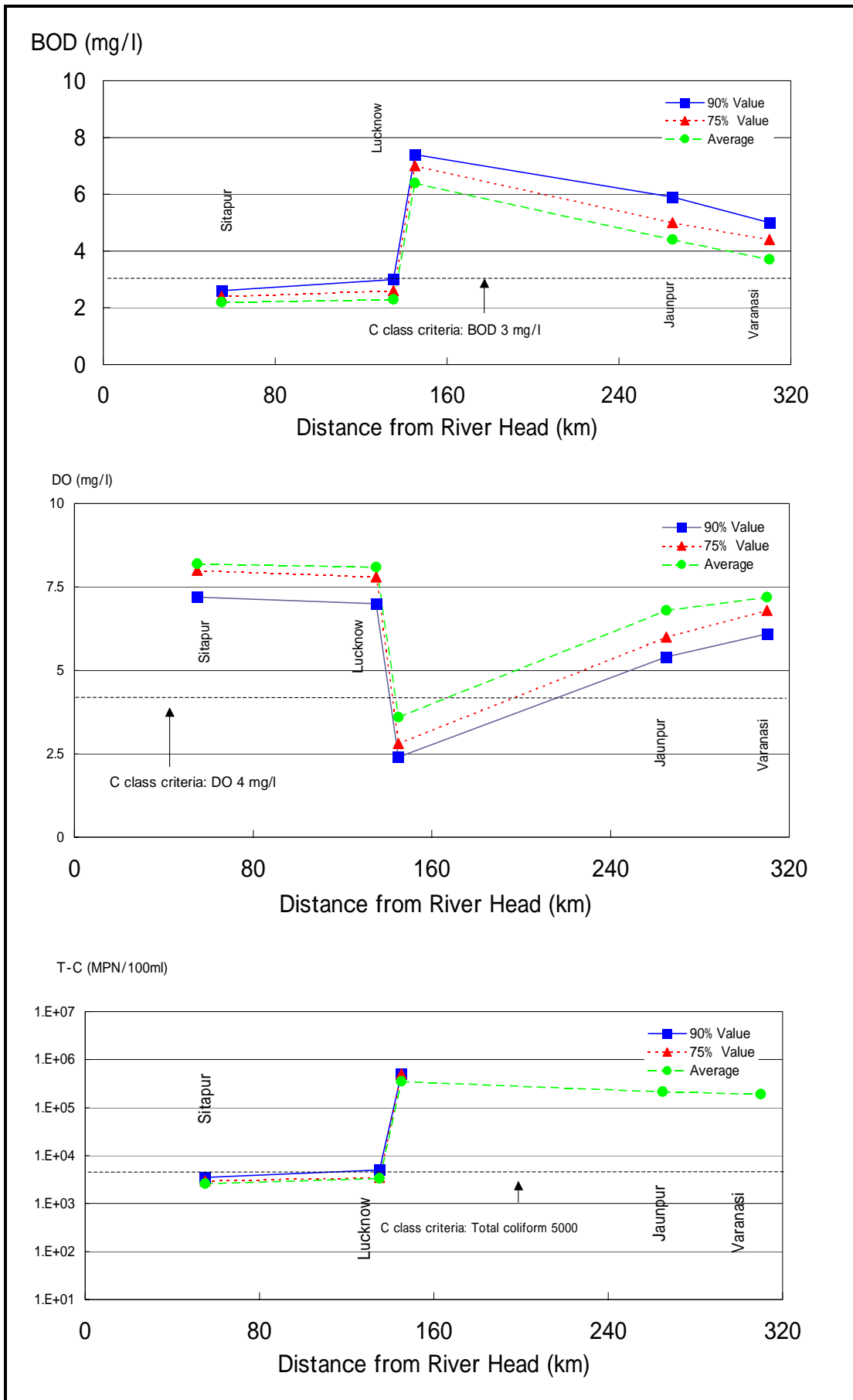
Fig.B.3.2 Longitudinal Profile of River Water Quality (Ganga River)



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Fig.B.3.3 Longitudinal Profile of River Water Quality (Yamuna River)



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Fig.B.3.4 Longitudinal Profile of River Water Quality (Gomati River)

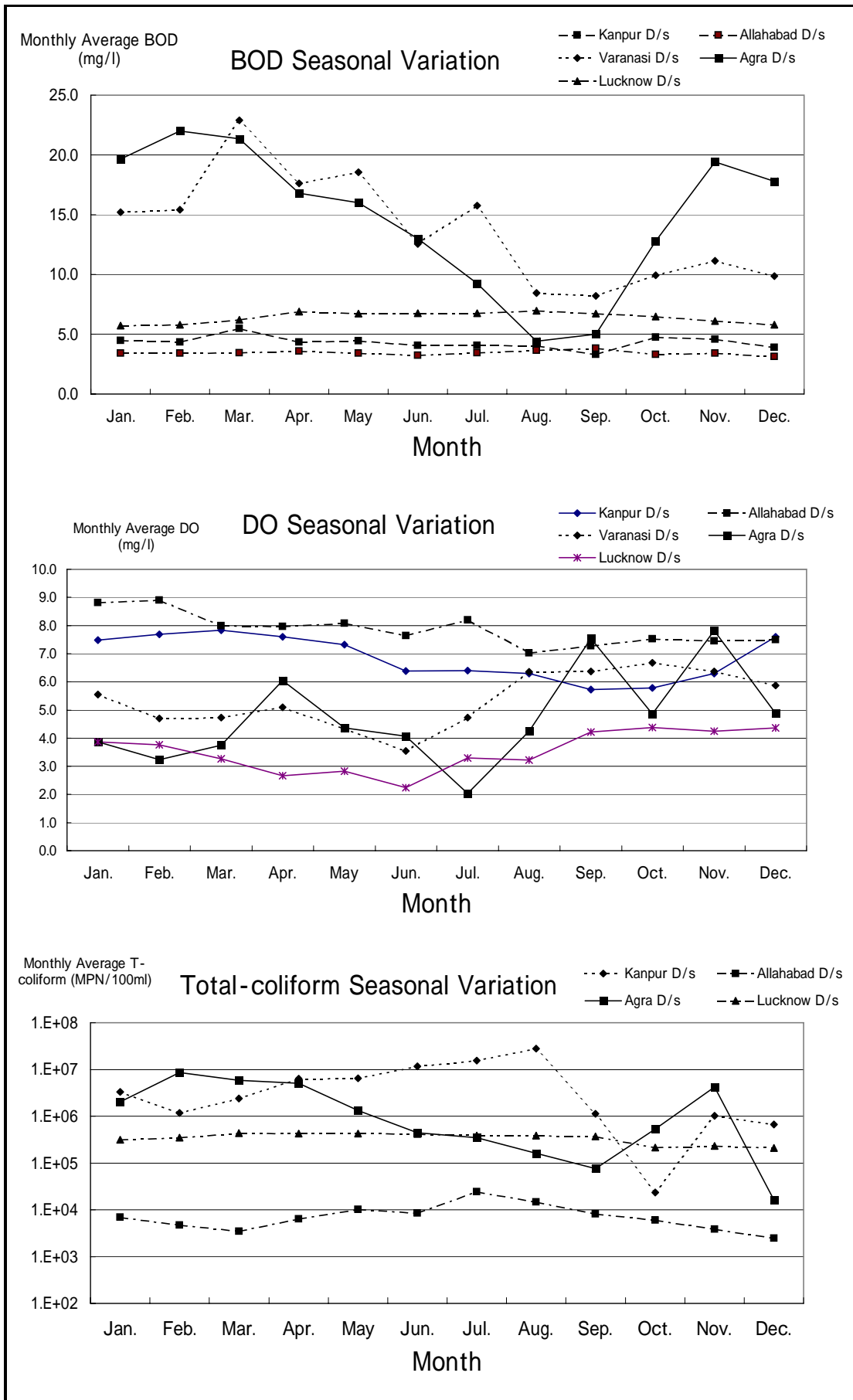
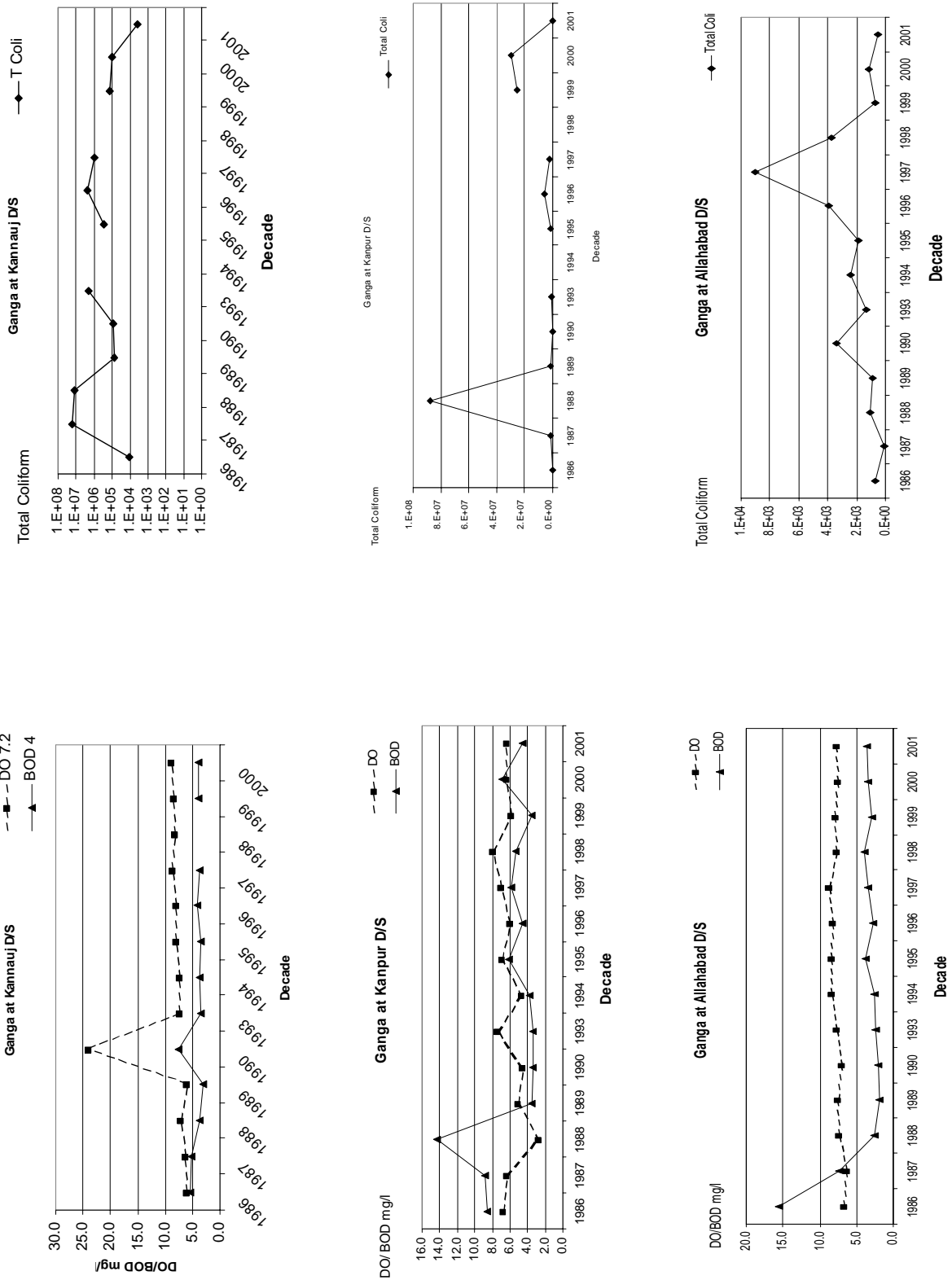


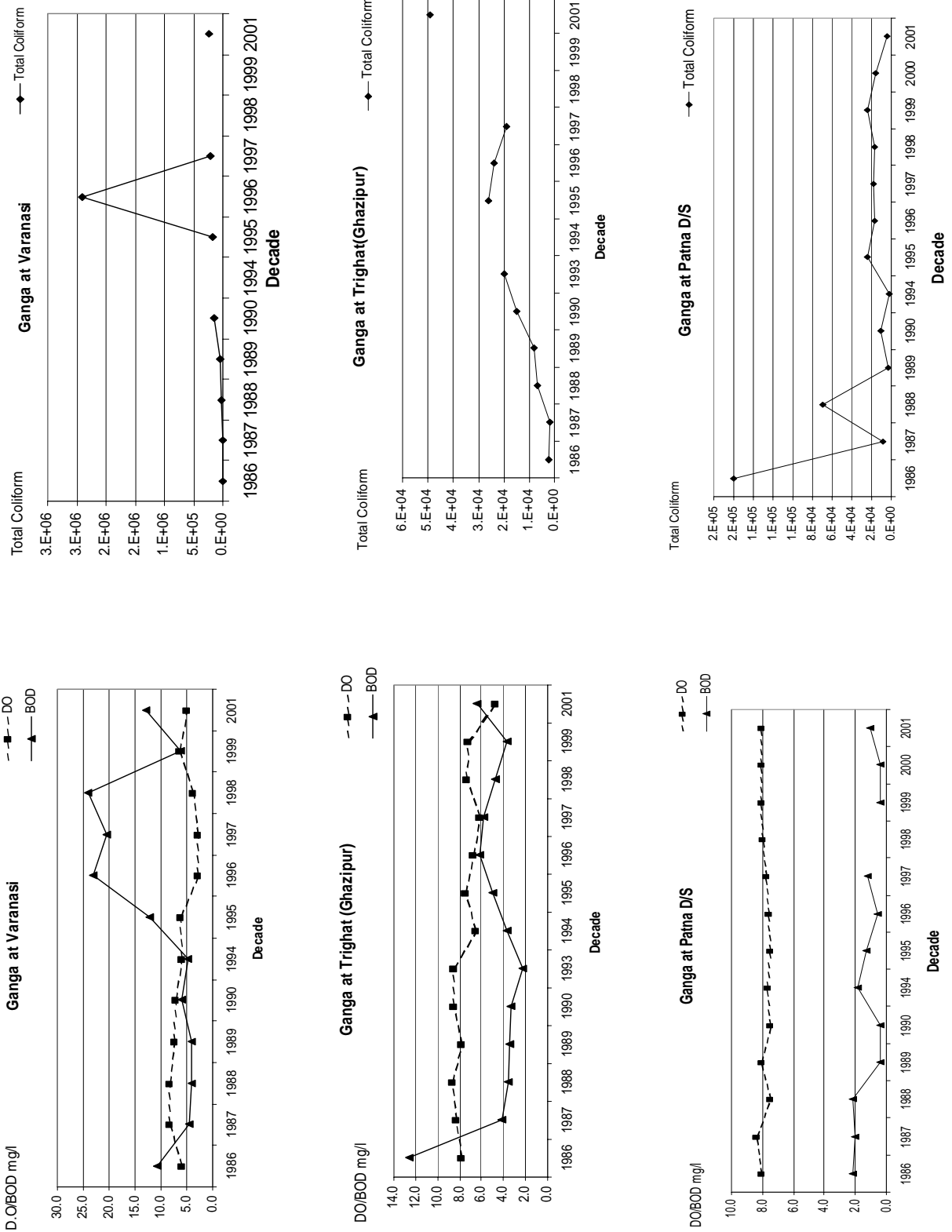
Fig.B.3.5 Seasonal Variation of River Water Quality



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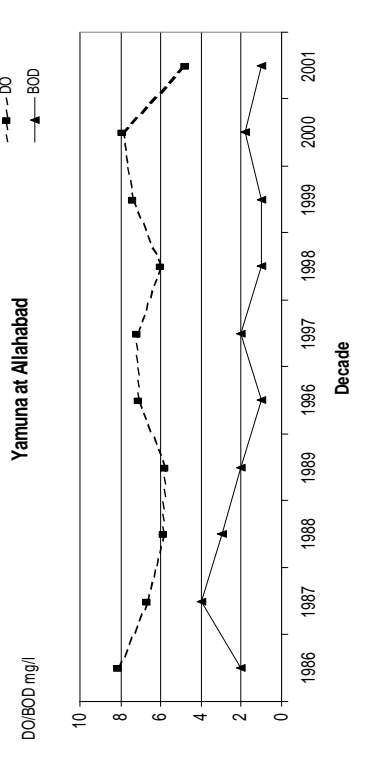
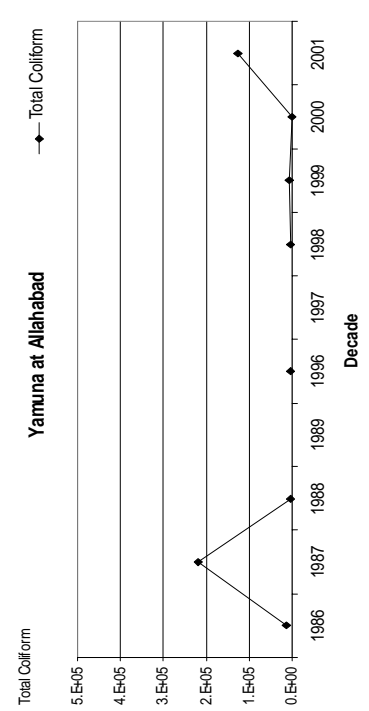
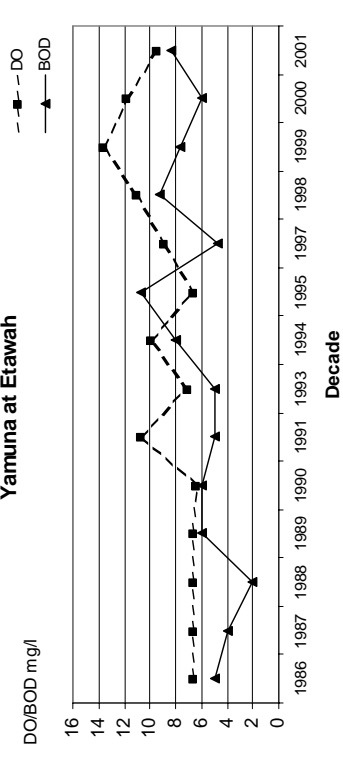
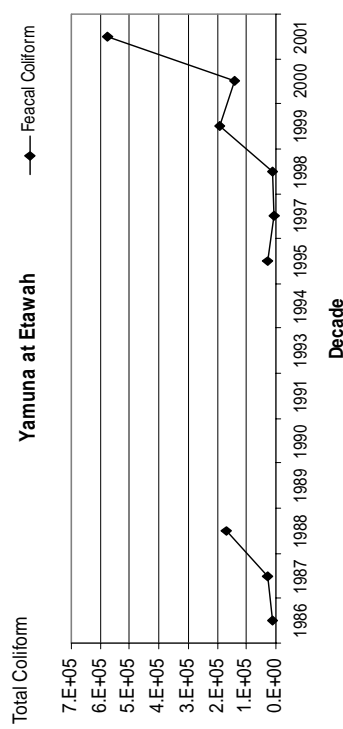
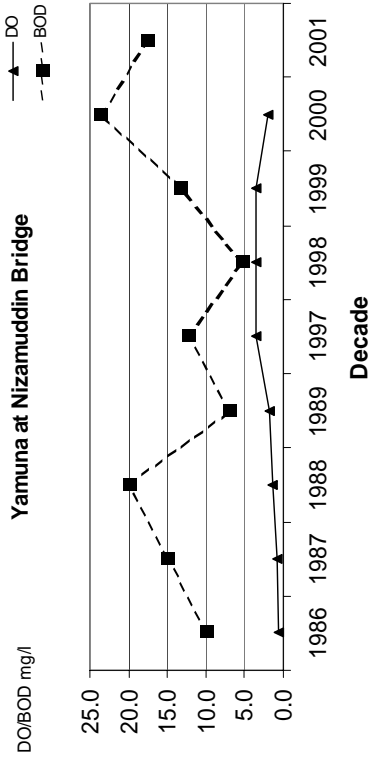
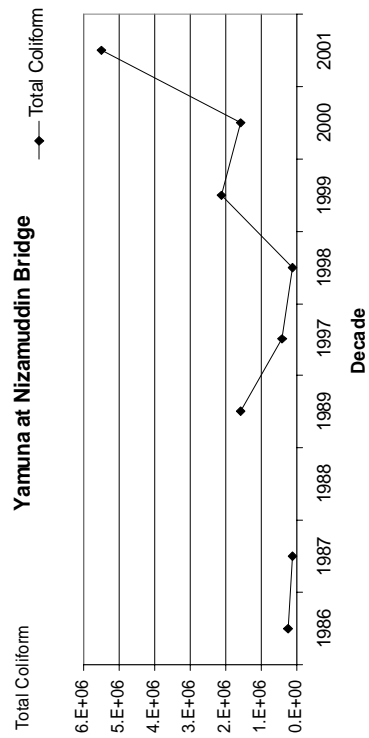
Fig. B. 3.6 River Water Quality Trend (1)



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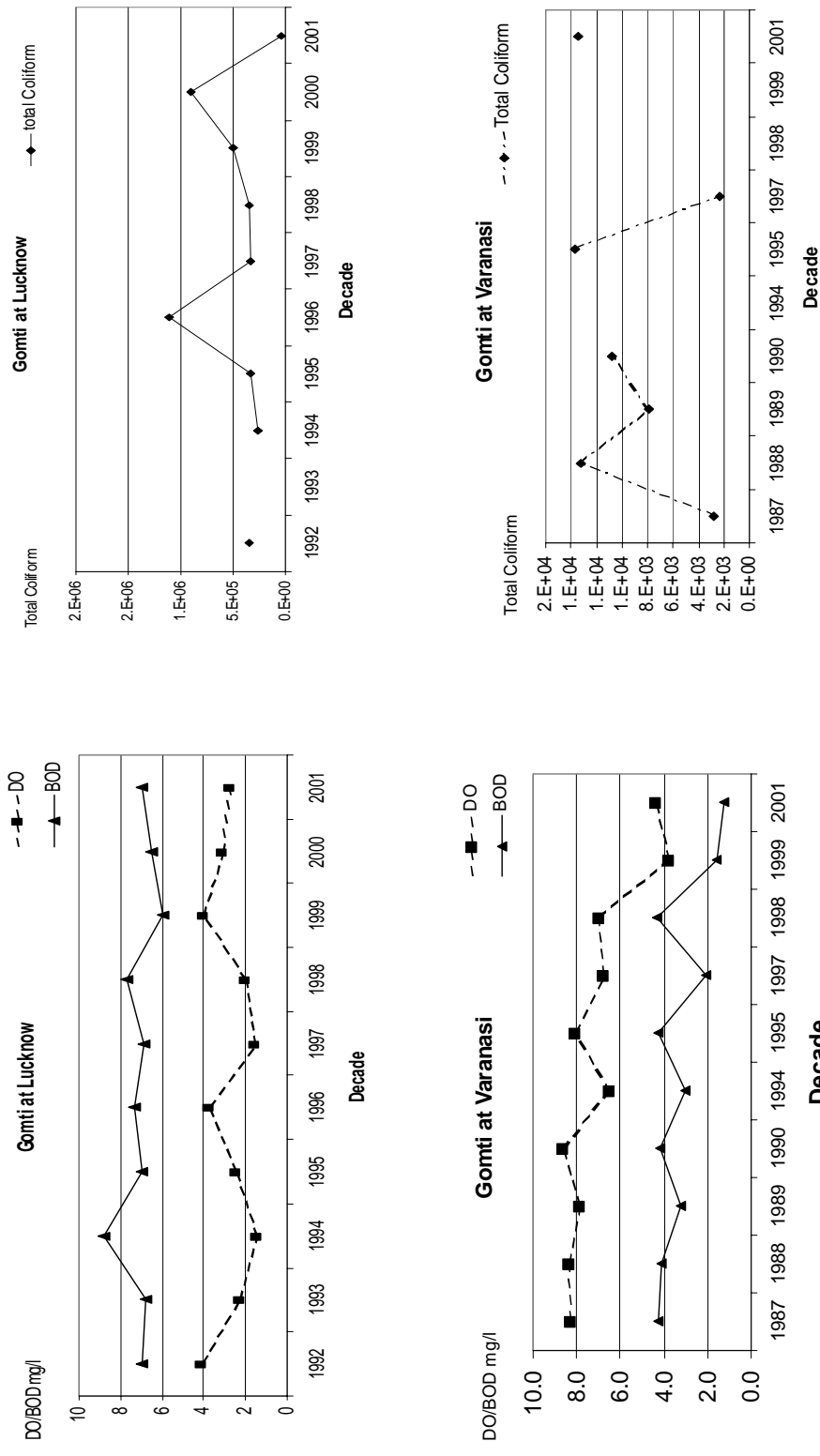
Fig. B. 3.6 River Water Quality Trend (2)



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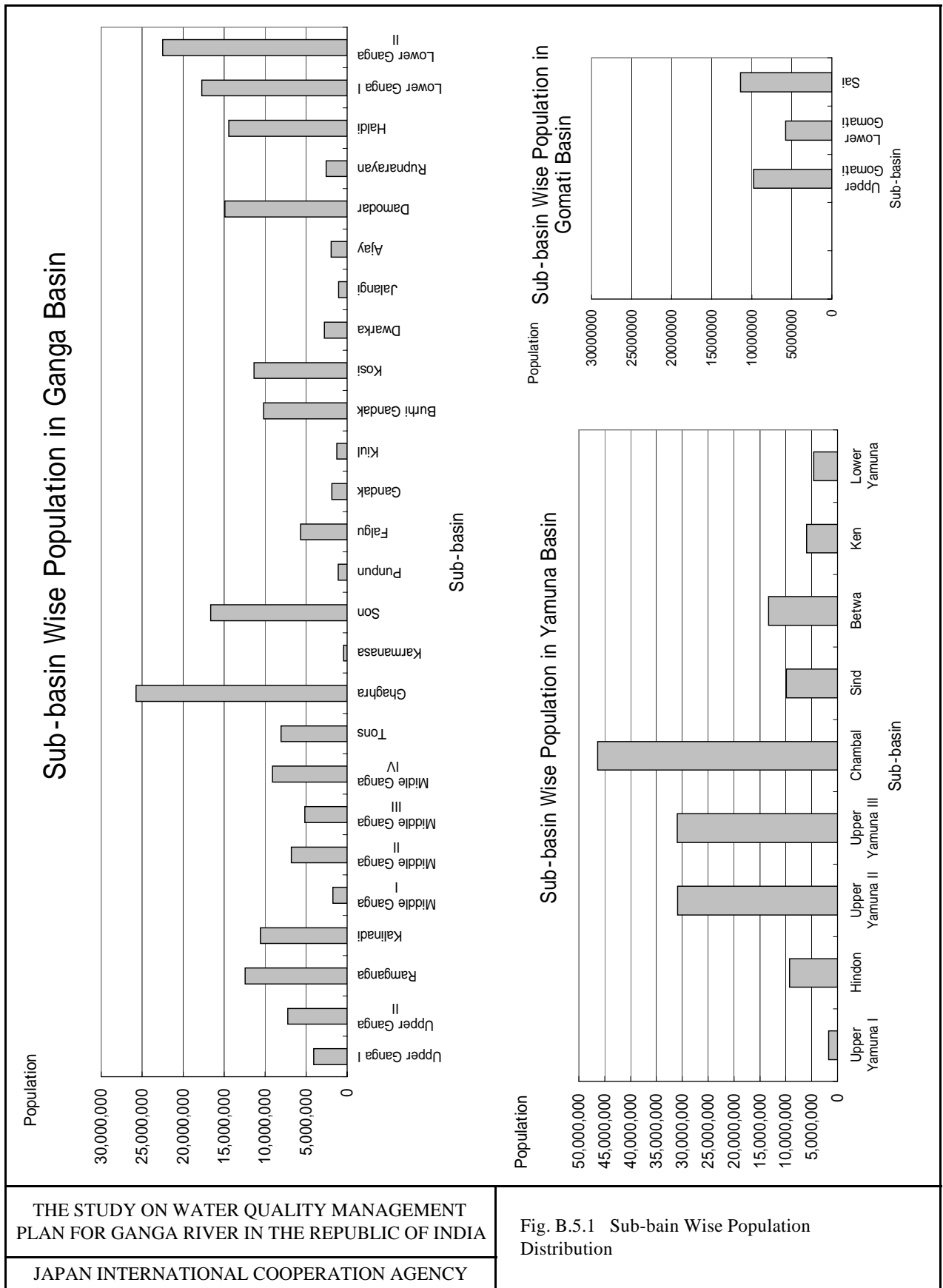
Fig. B. 3.6 River Water Quality Trend (3)



THE STUDY ON WATER QUALITY MANAGEMENT PLAN
FOR GANGA RIVER IN THE REPUBLIC OF INDIA

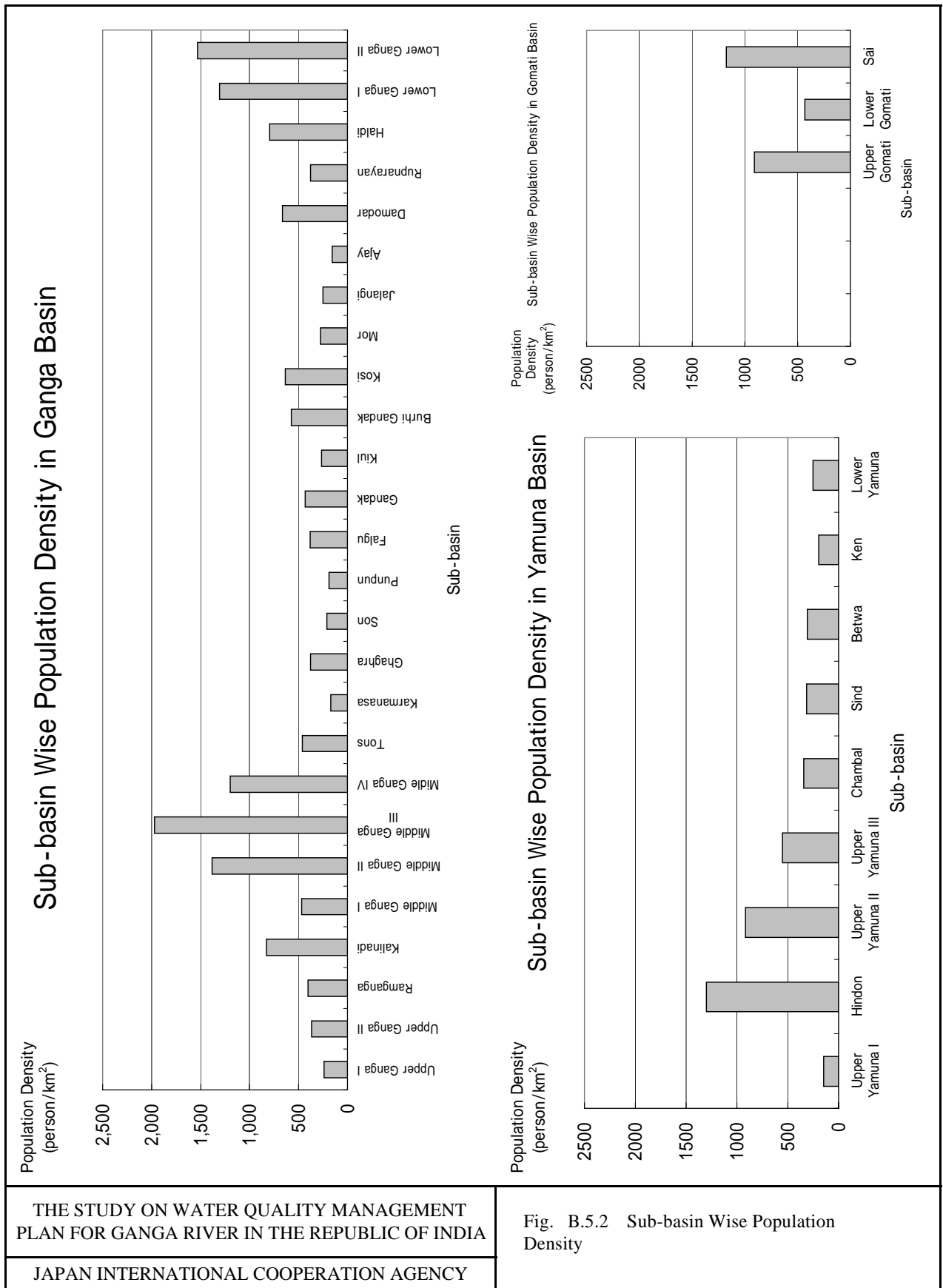
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Fig. B. 3.6 River Water Quality Trend (4)



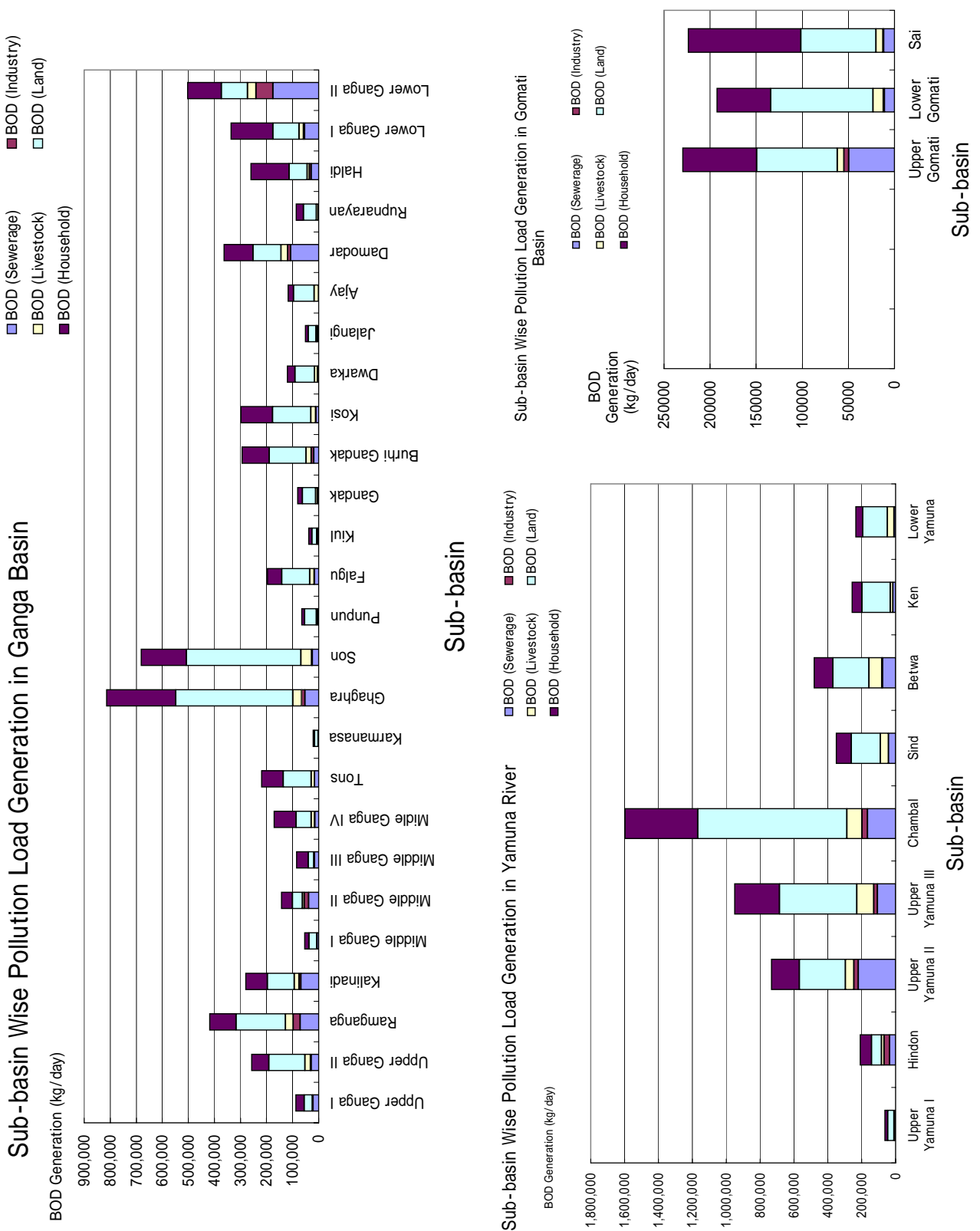
THE STUDY ON WATER QUALITY MANAGEMENT
PLAN FOR GANGA RIVER IN THE REPUBLIC OF INDIA
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Fig. B.5.1 Sub-bain Wise Population Distribution



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PLAN FOR GANGA RIVER IN THE REPUBLIC OF INDIA
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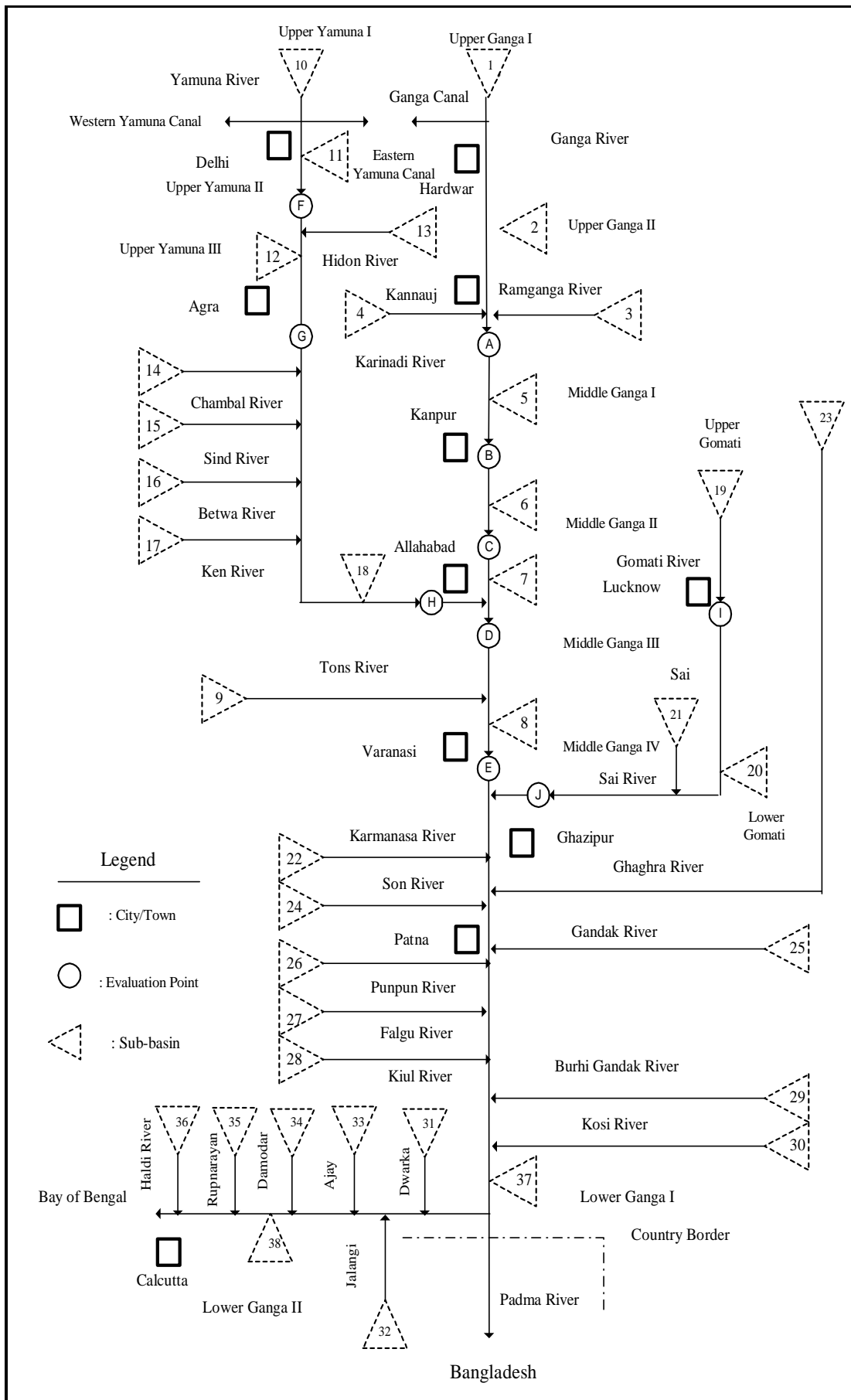
Fig. B.5.2 Sub-basin Wise Population Density



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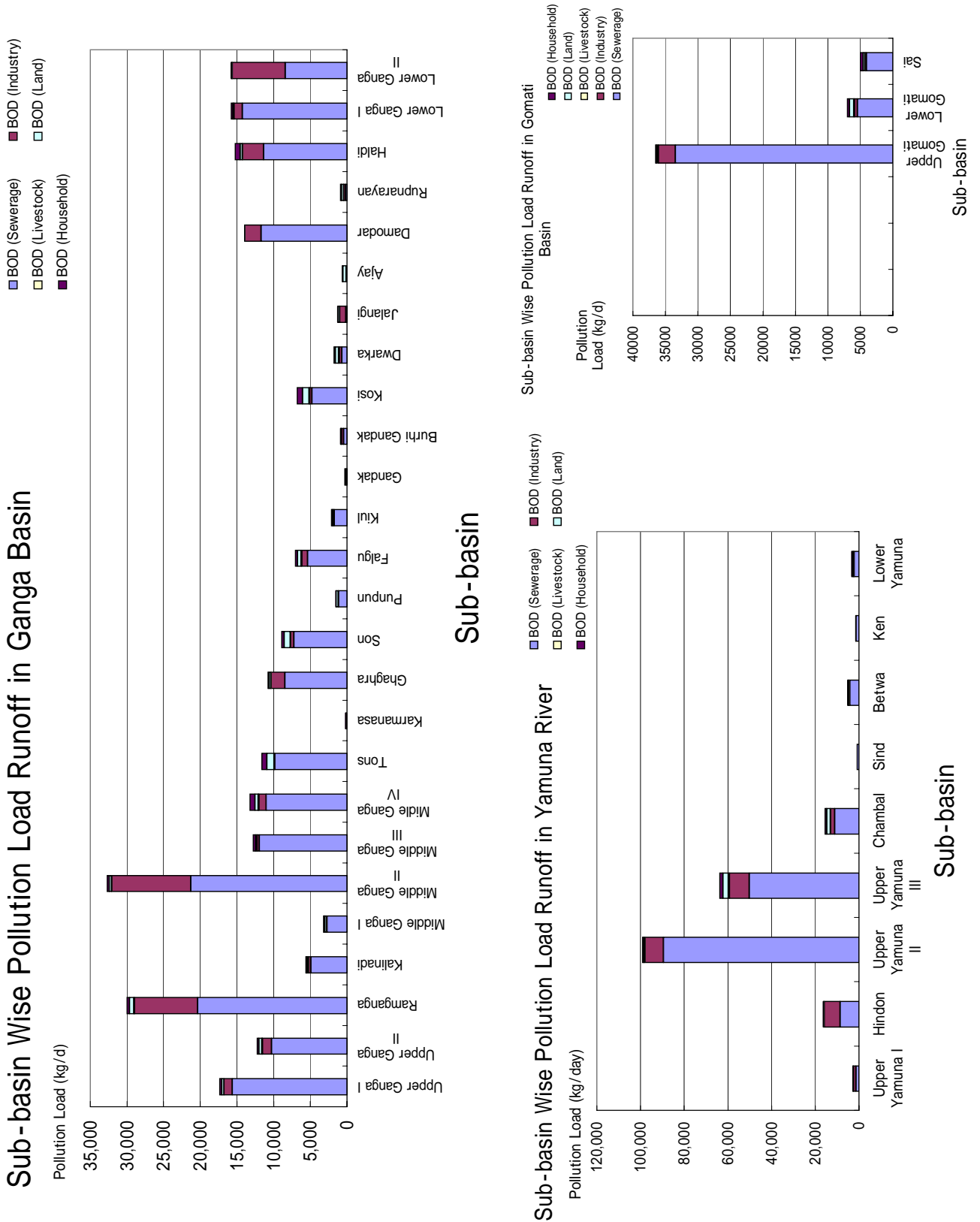
Fig. B. 5.3 Sub-basin Wise Pollution Load Generation



THE STUDY ON WATER QUALITY MANAGEMENT PLAN
FOR GANGA RIVER IN THE REPUBLIC OF INDIA

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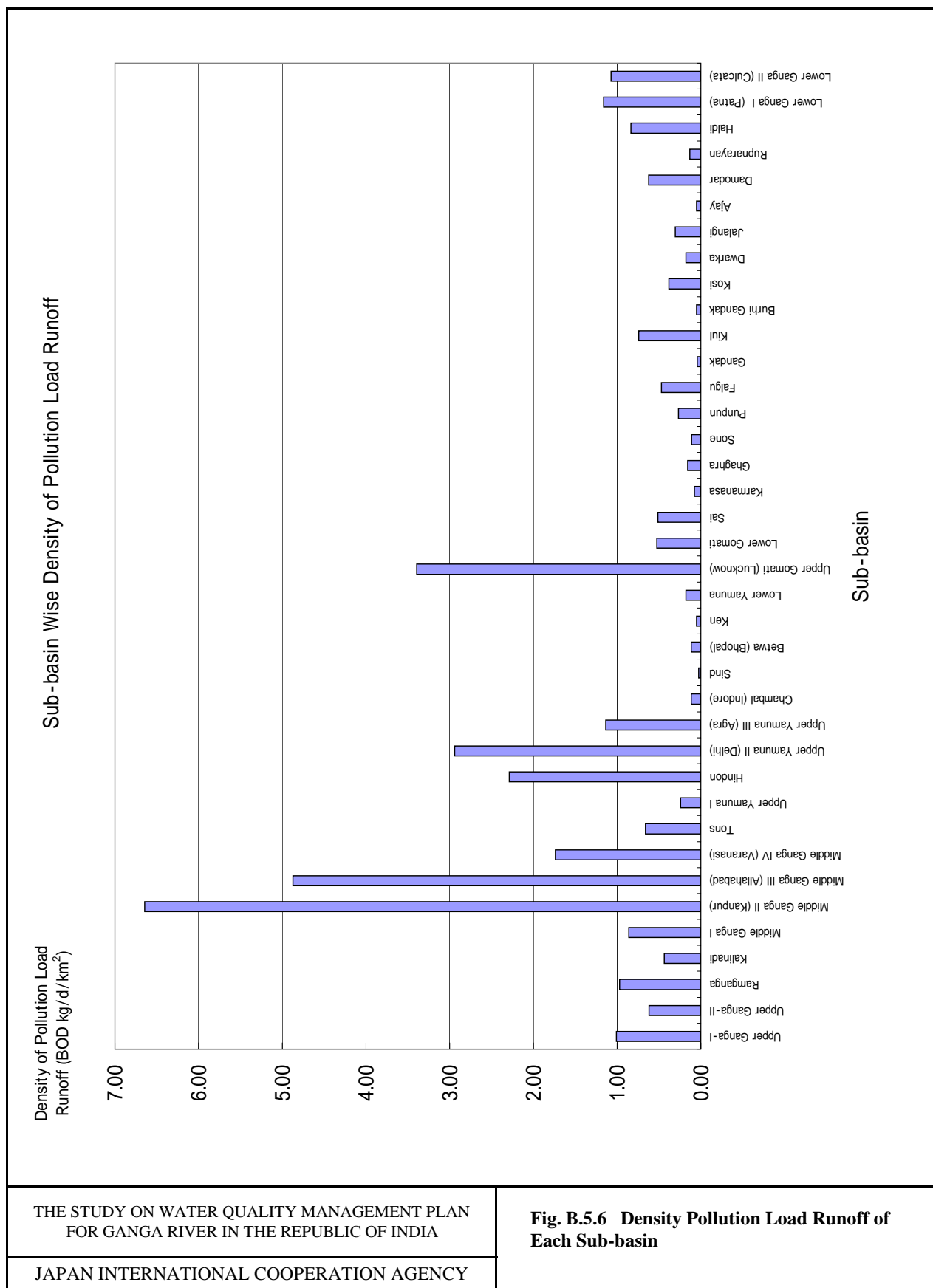
Fig.B.5.4 Schematic Diagram of the Simulation of Pollution Load Runoff and Water Quality



THE STUDY ON WATER QUALITY MANAGEMENT PLAN
FOR GANGA RIVER IN THE REPUBLIC OF INDIA

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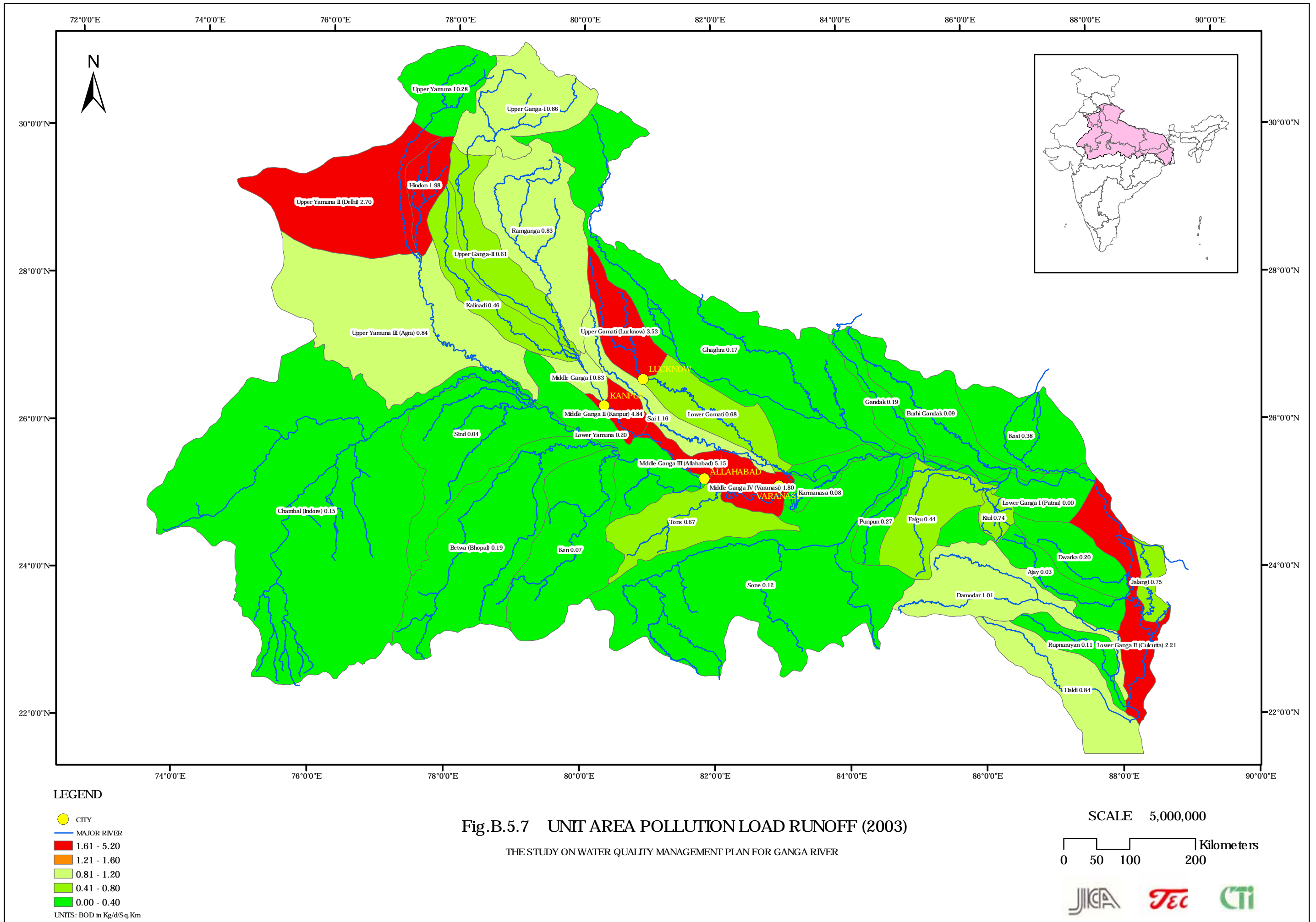
Fig. B. 5.5 Existing Pollution Runoff of Each Sub-basin

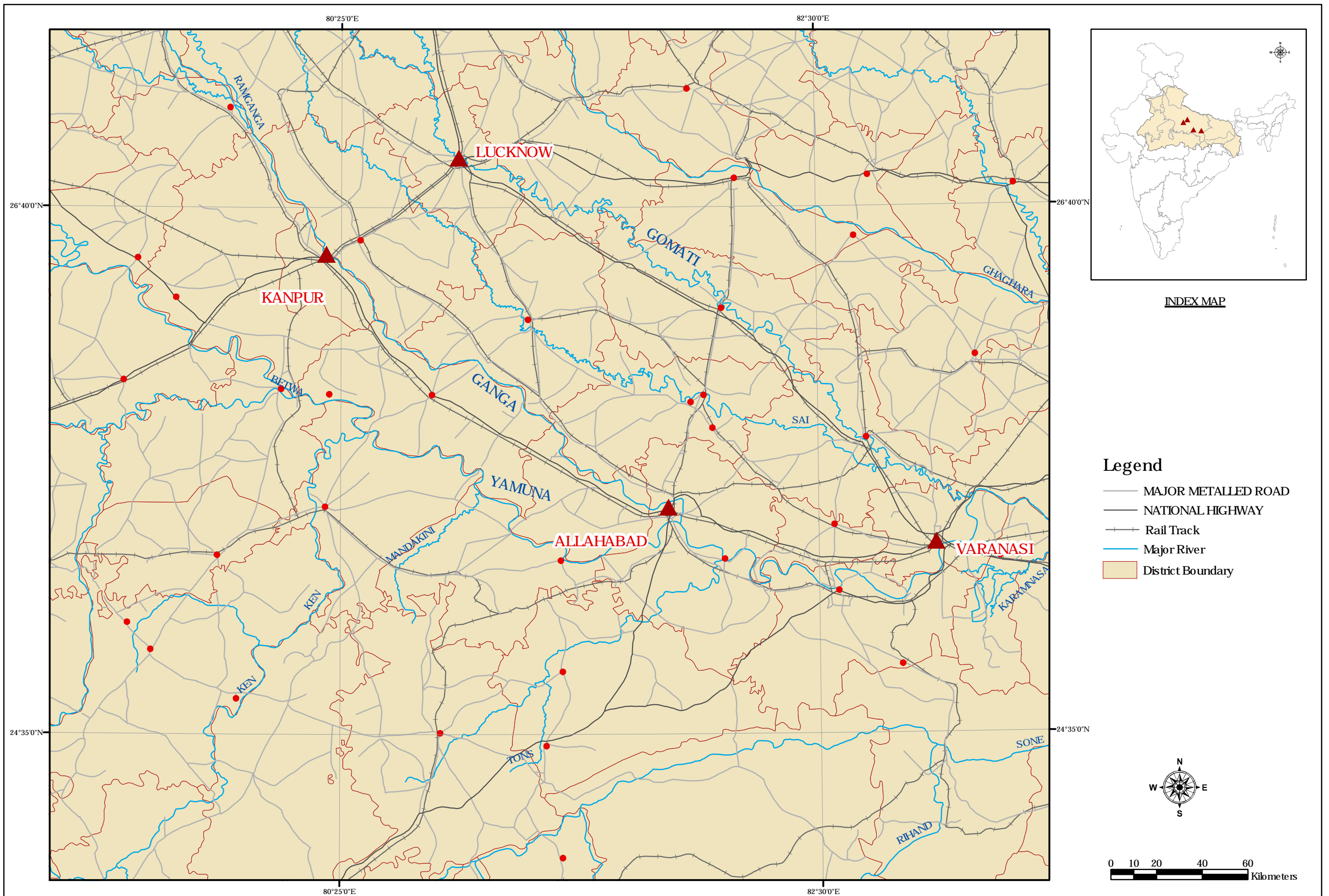





THE STUDY ON WATER QUALITY MANAGEMENT PLAN
FOR GANGA RIVER IN THE REPUBLIC OF INDIA

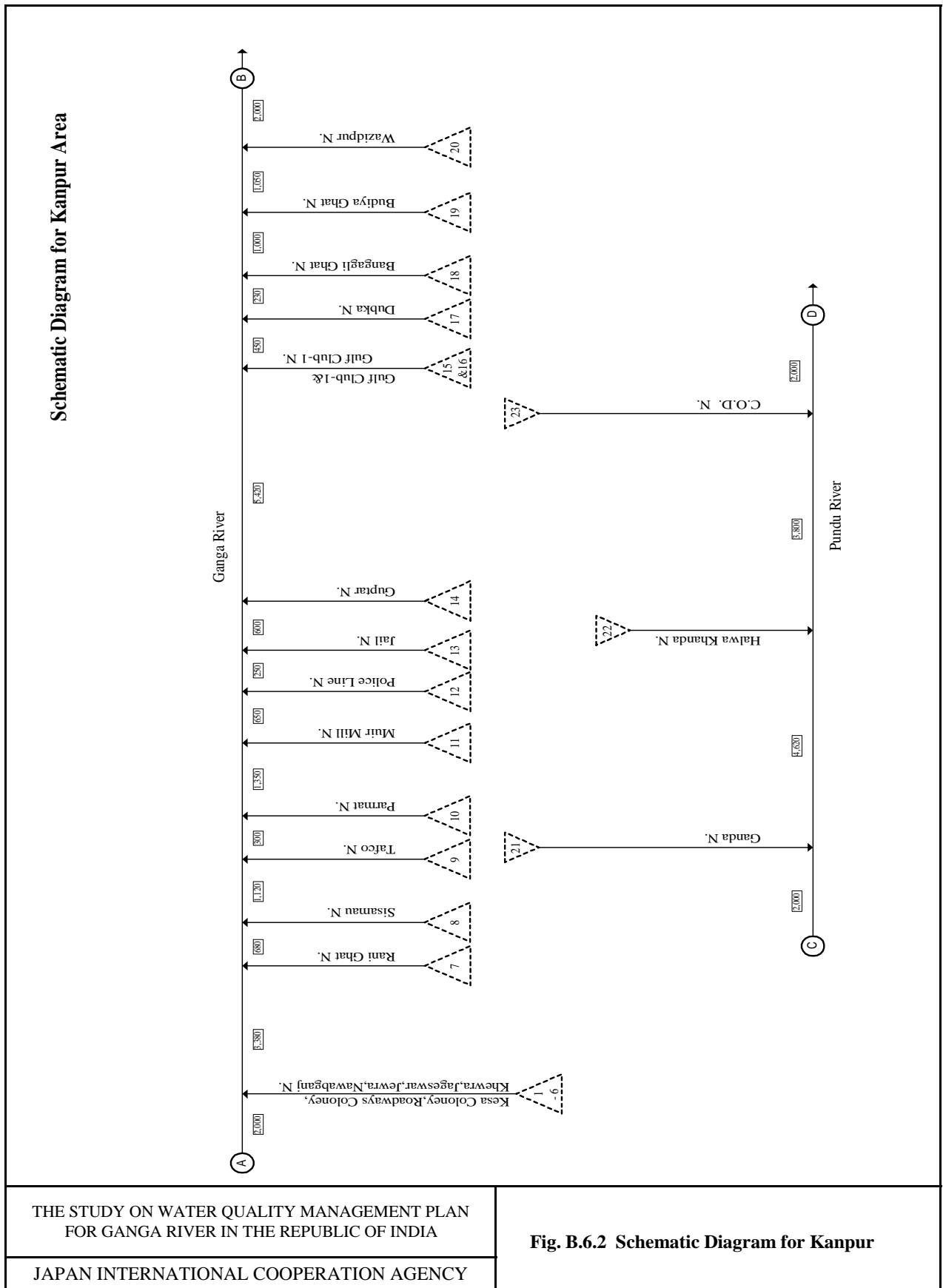
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Fig. B.5.6 Density Pollution Load Runoff of Each Sub-basin





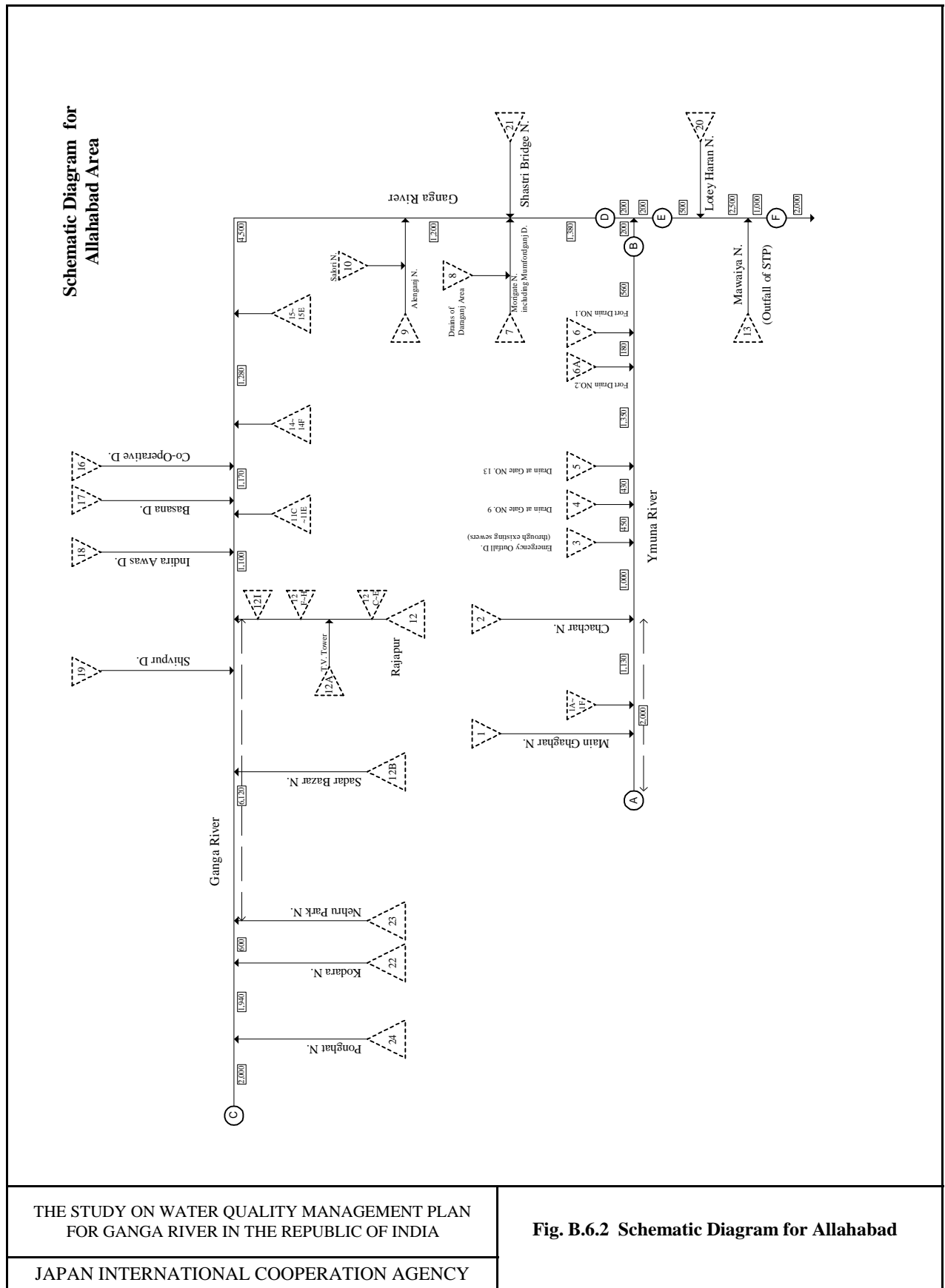
 JICA JAPAN INTERNATIONAL COOPERATION AGENCY  TOKYO ENGINEERING CONSULTANTS CO. LIMITED  CTI ENGINEERING INTERNATIONAL CO. LIMITED	PROJECT	LOCATION	FIGURE
	THE STUDY ON WATER QUALITY MANAGEMENT PLAN FOR GANGA RIVER IN THE REPUBLIC OF INDIA	VARANASI CITY	B.6.1
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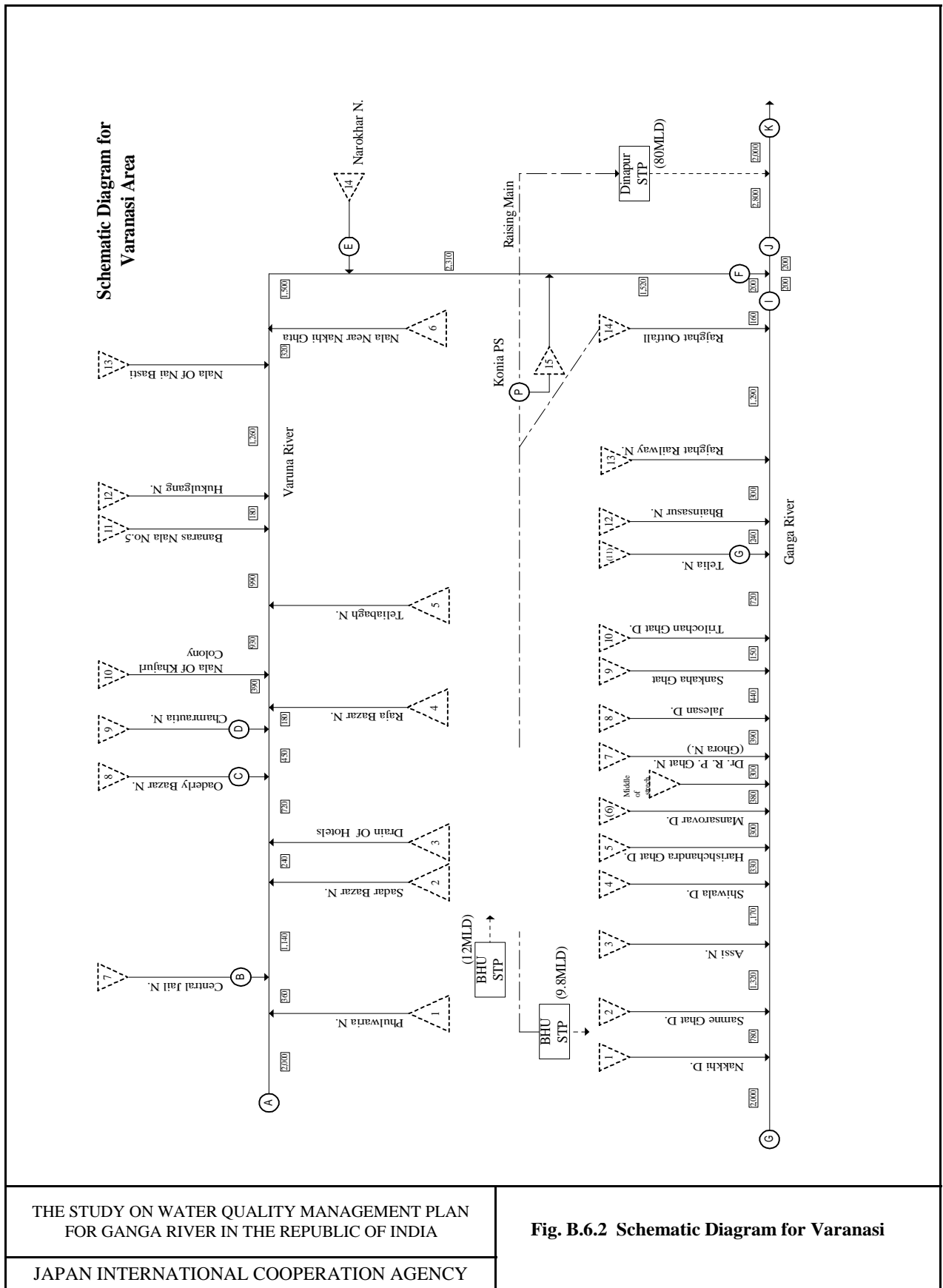
Fig. B.6.2 Schematic Diagram for Kanpur



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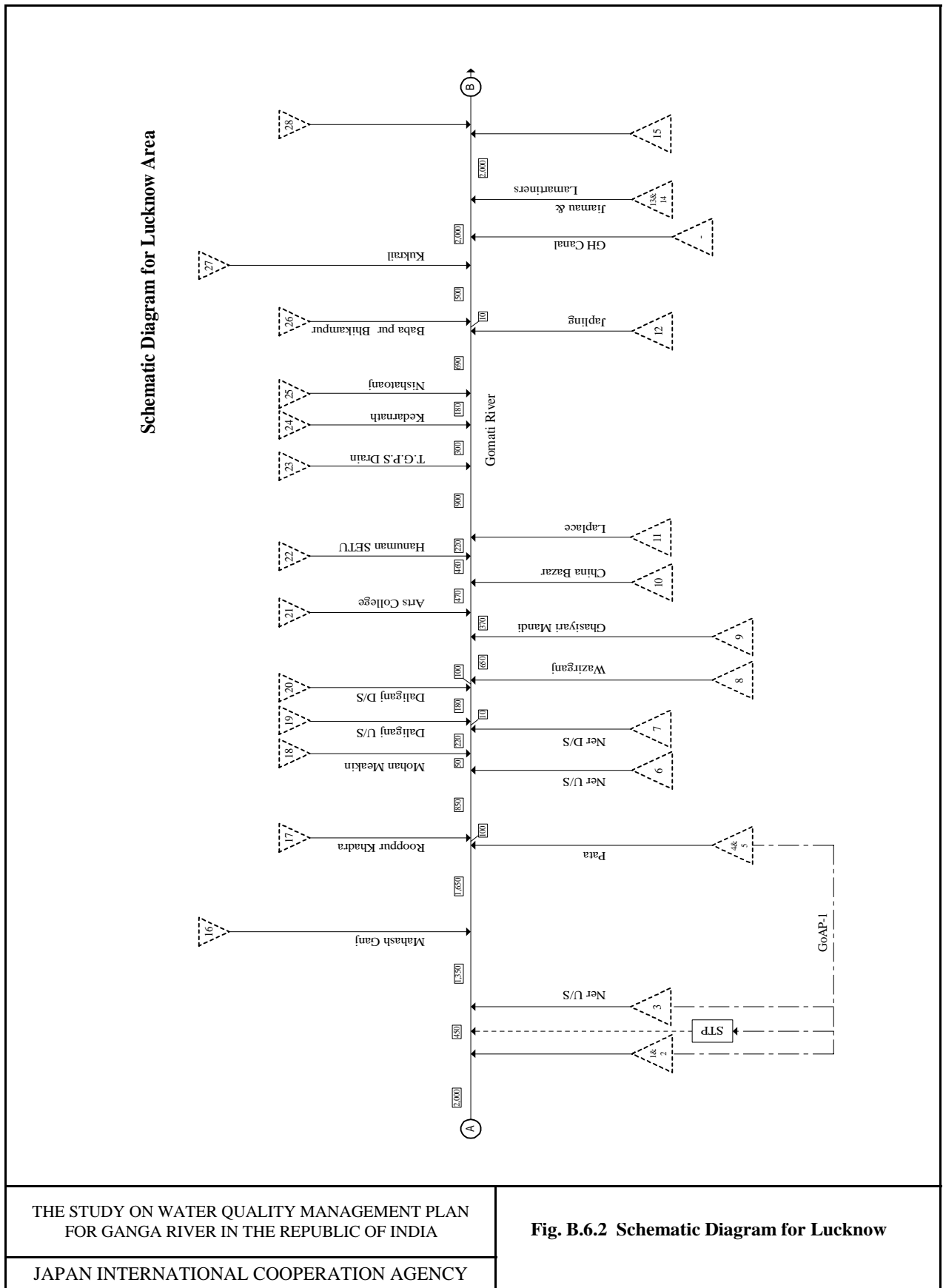
Fig. B.6.2 Schematic Diagram for Allahabad



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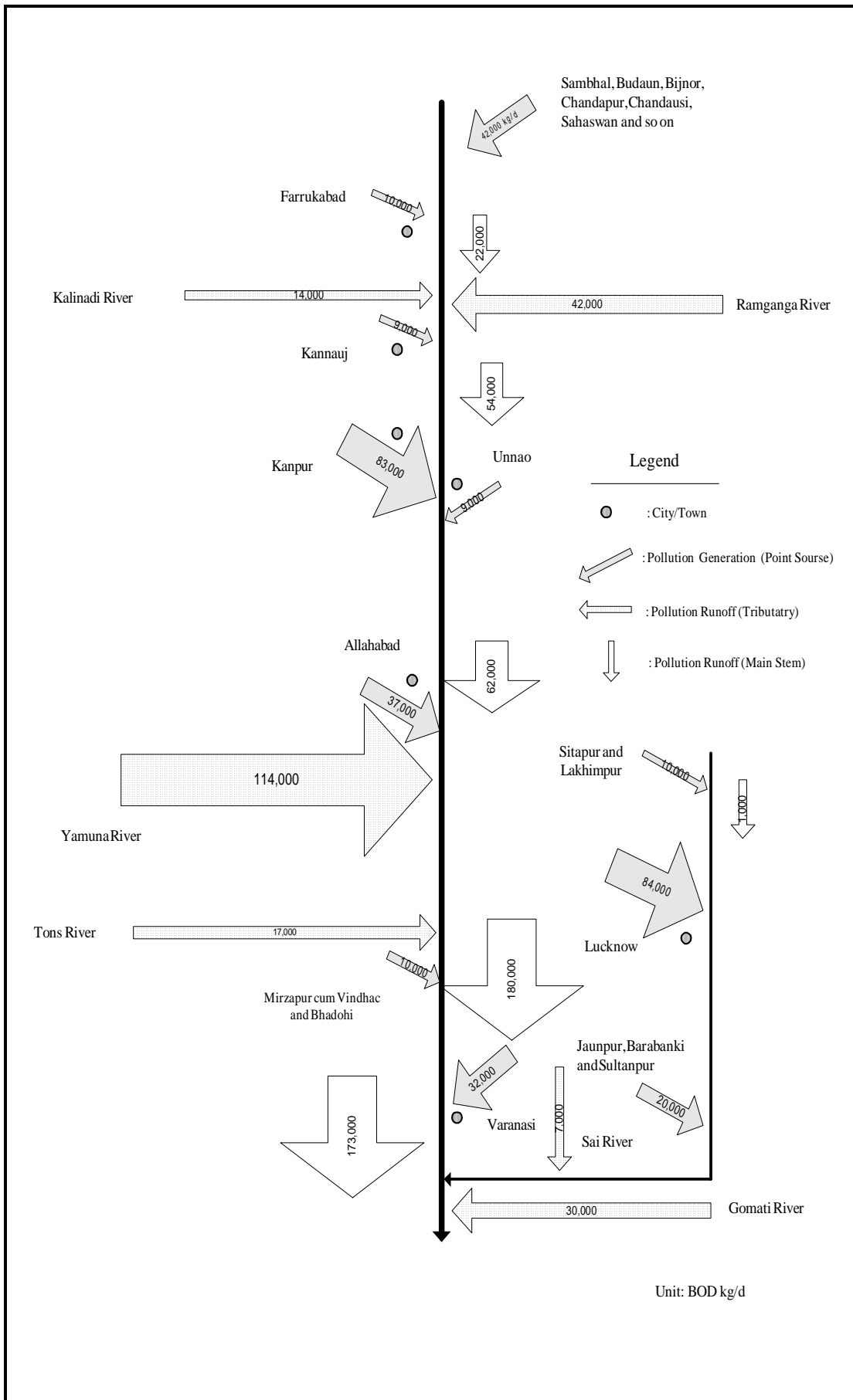
Fig. B.6.2 Schematic Diagram for Varanasi



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Fig. B.6.2 Schematic Diagram for Lucknow



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Figure B.7.1 Pollution Impact against Ganga River
(Domestic Pollution Load)

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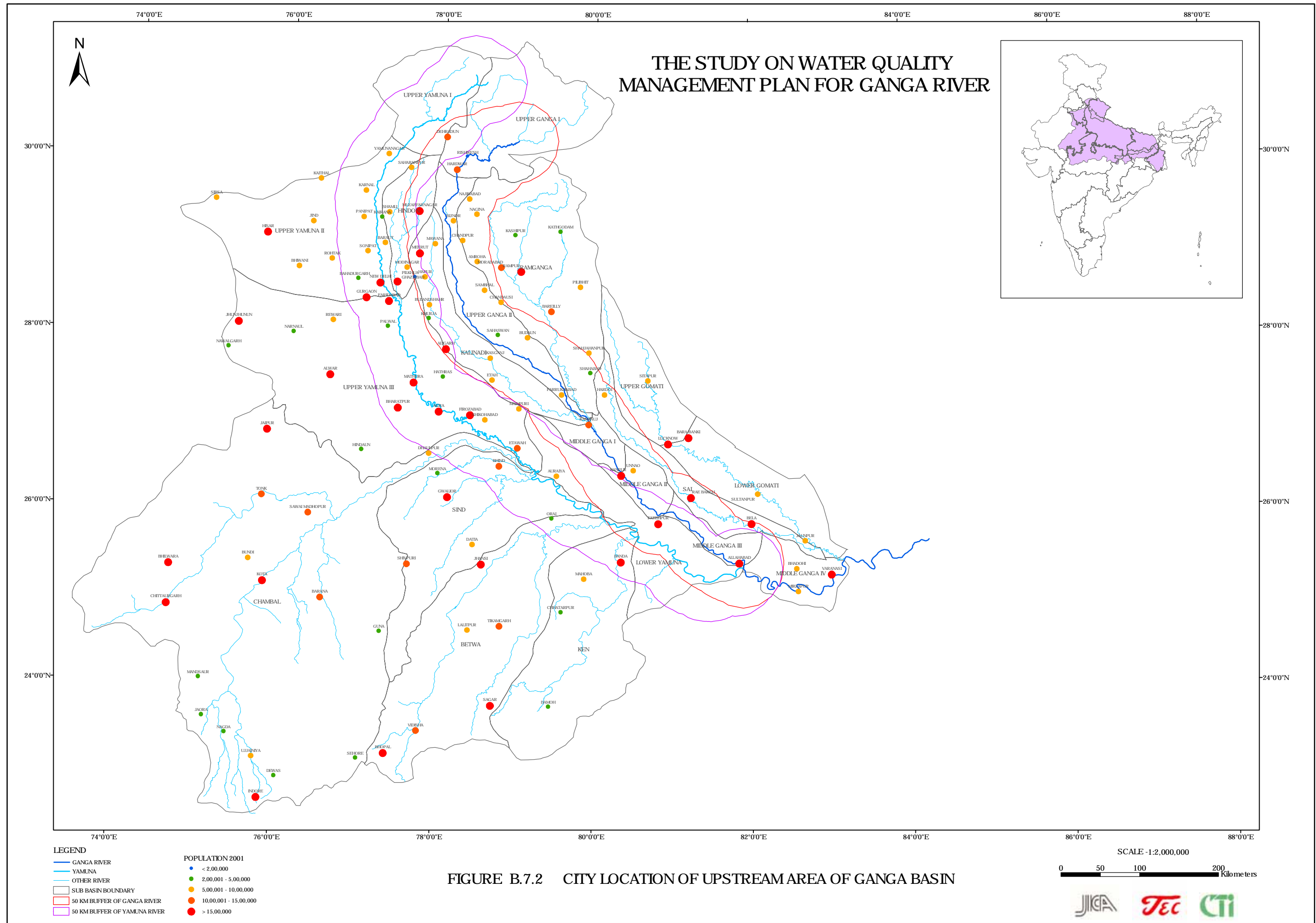
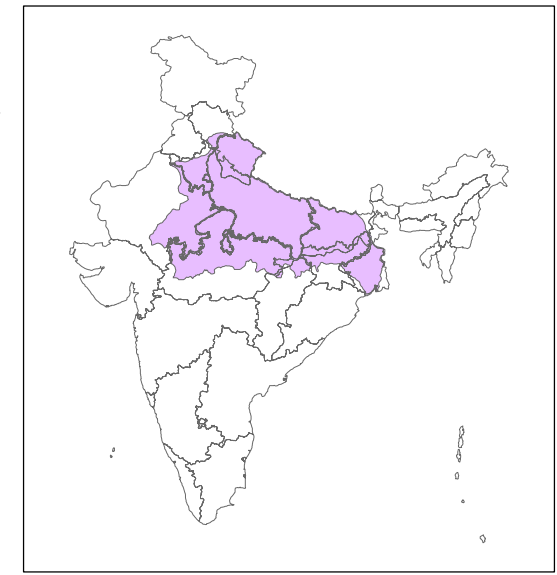
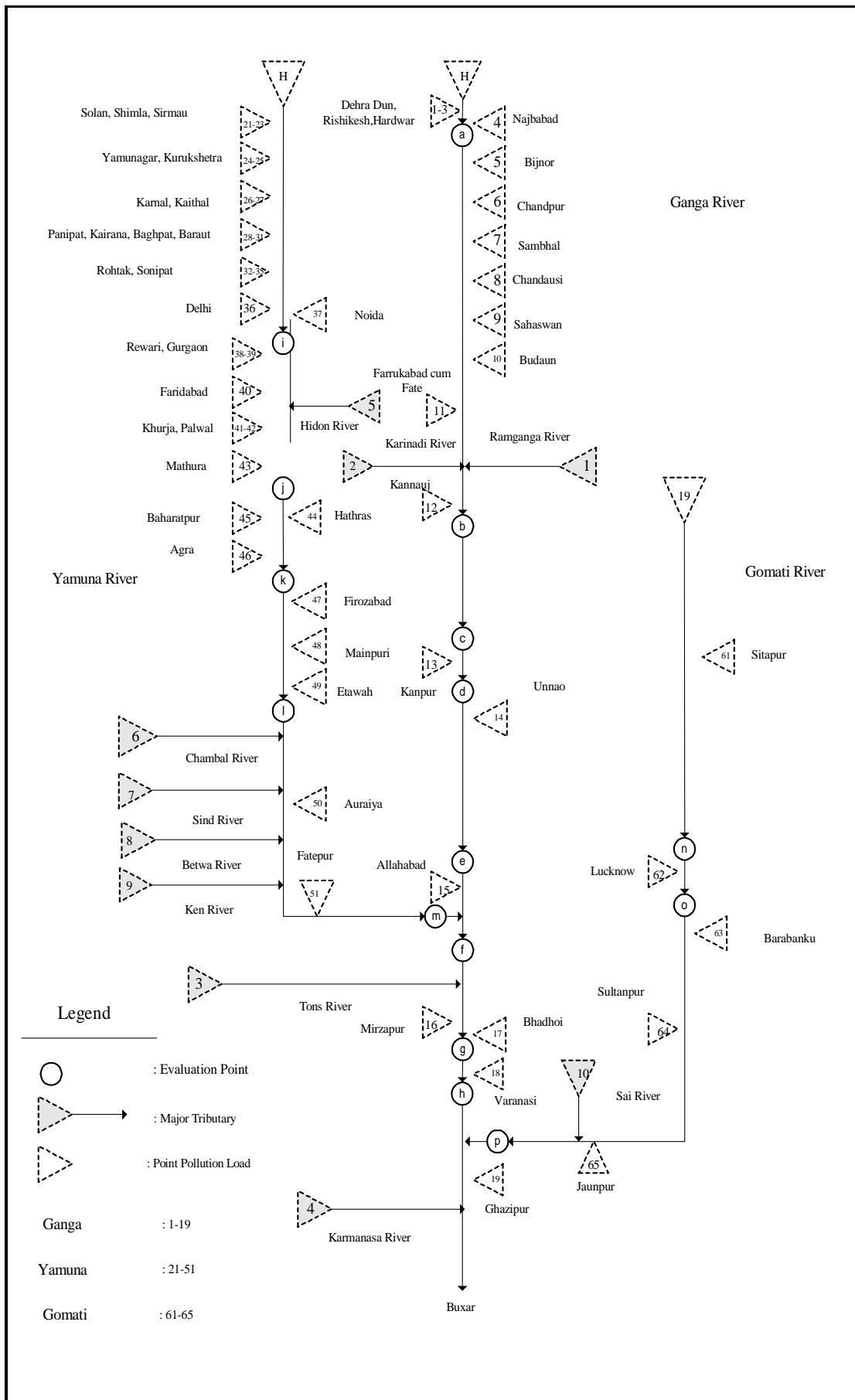


FIGURE B.7.2 CITY LOCATION OF UPSTREAM AREA OF GANGA BASIN



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Fig.B.7.3 Schematic Diagram for Simulation of Faecal Coliform (QUAL2E Model)

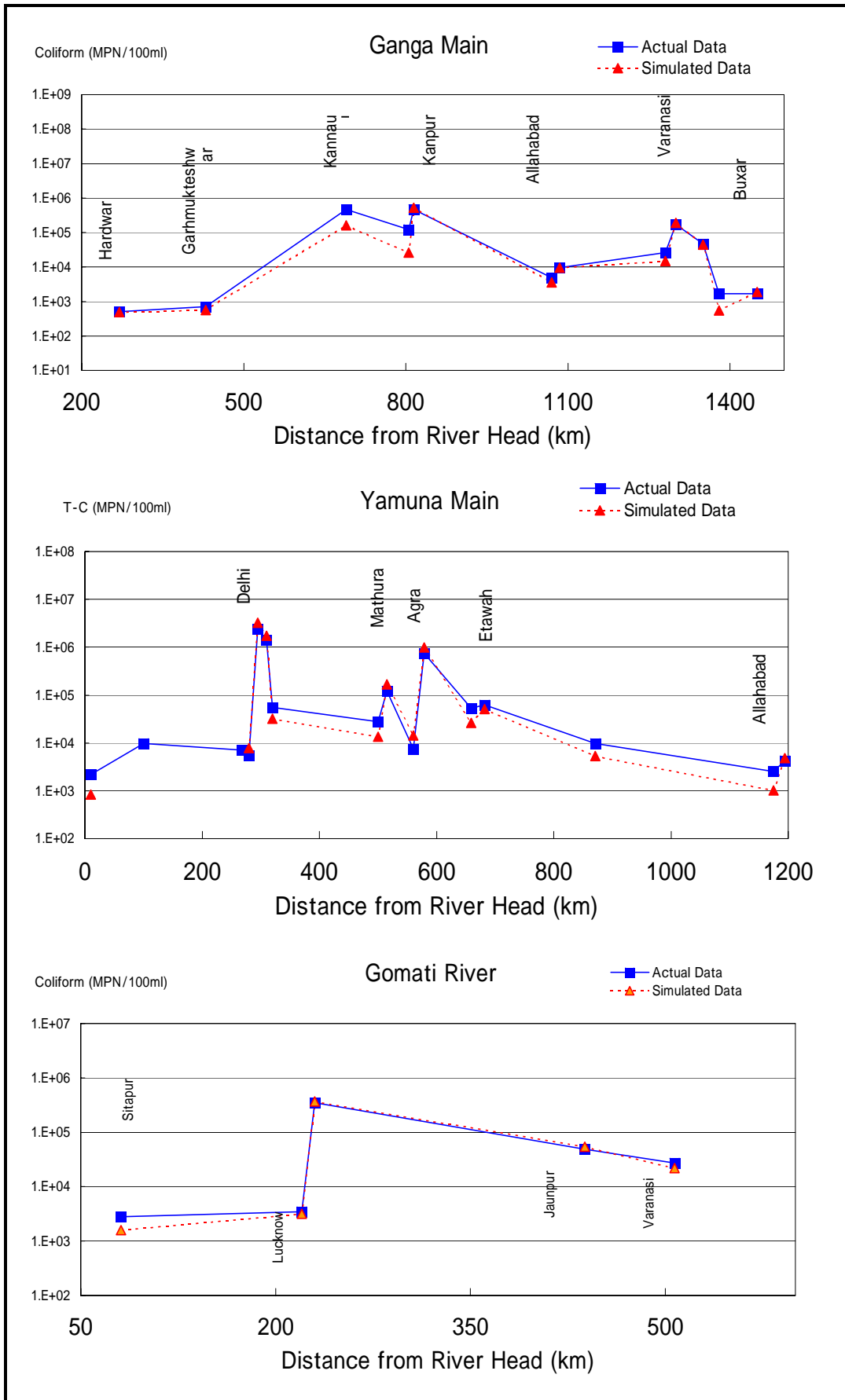
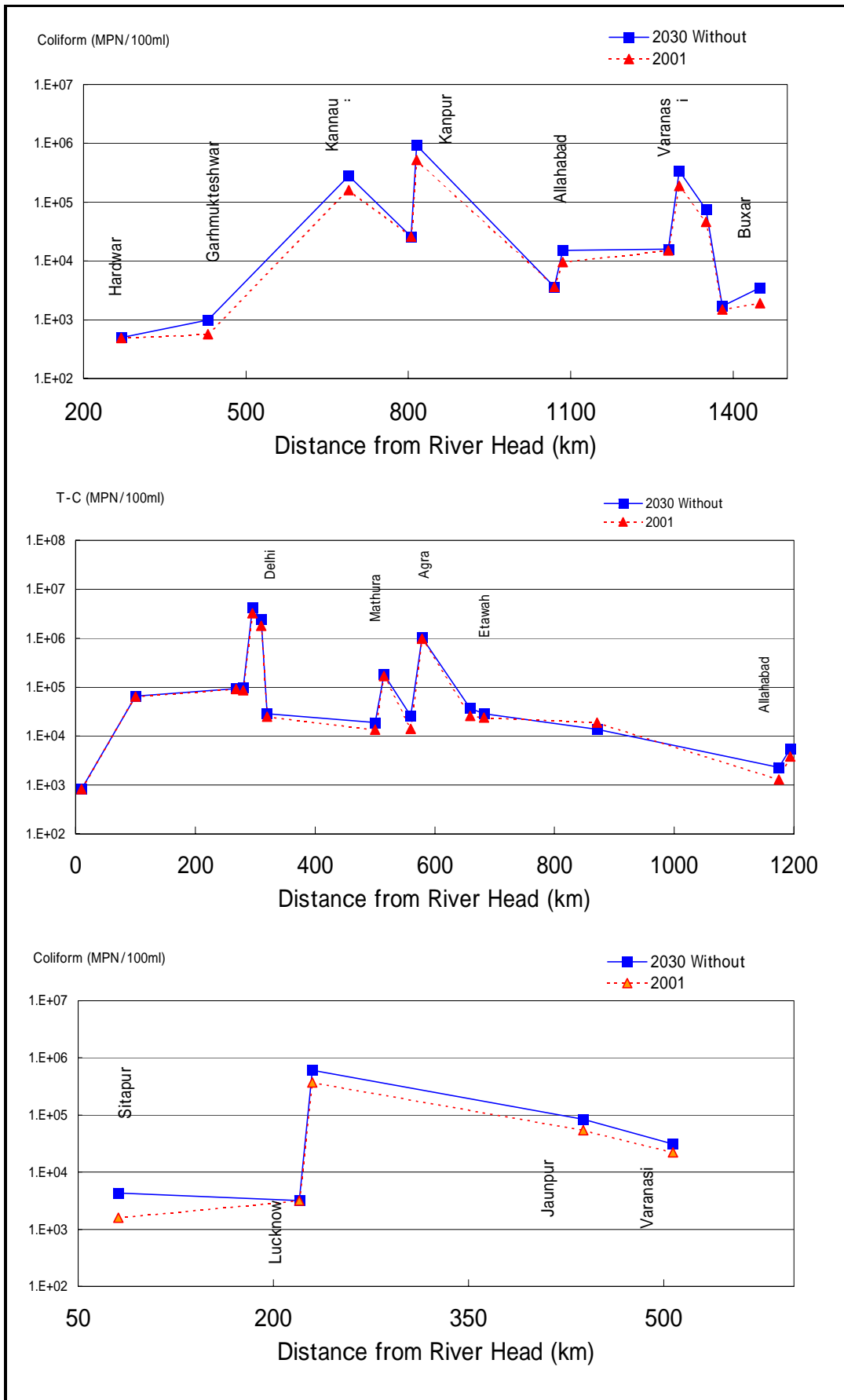
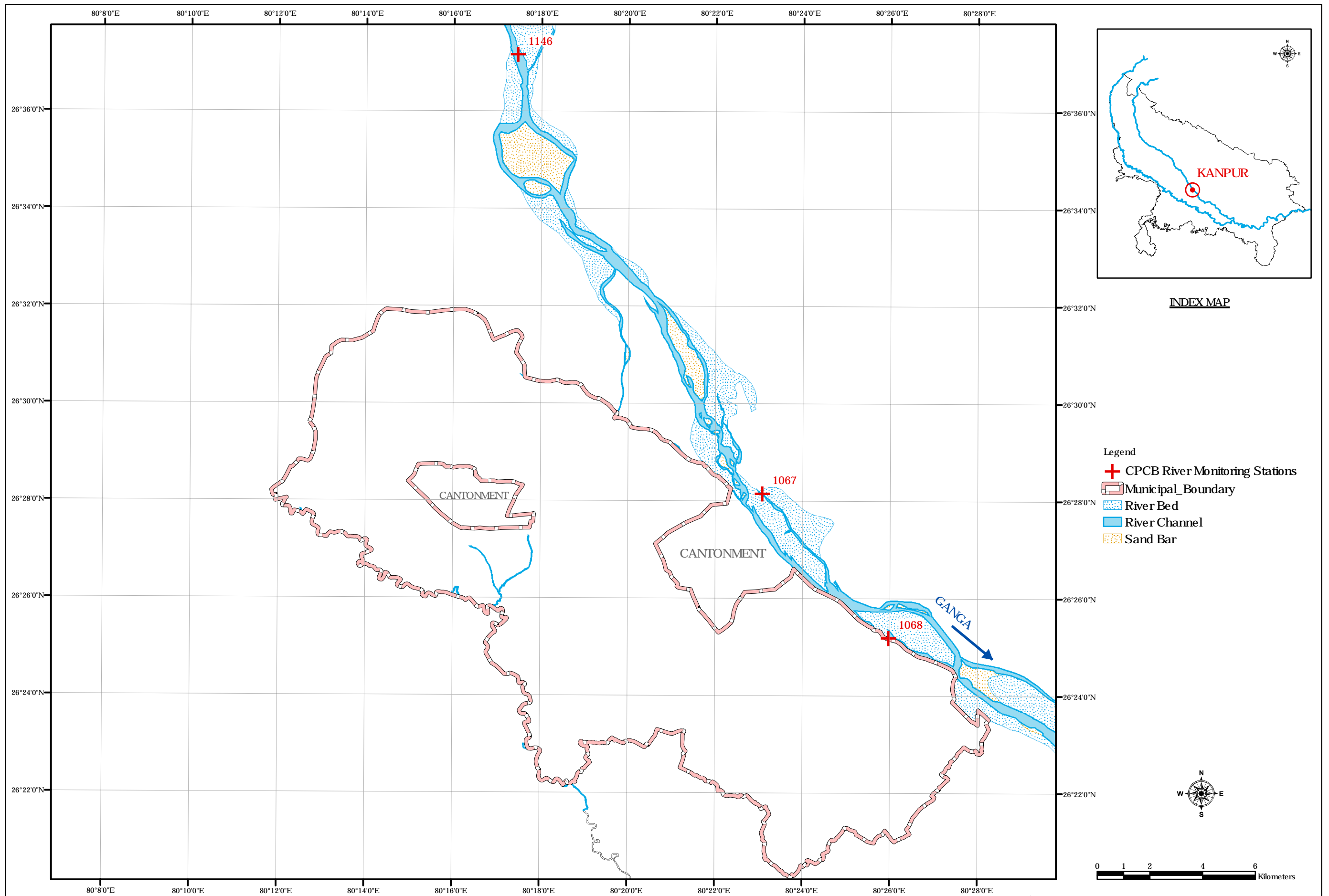





Figure B.7.4 Simulated Longitudinal Profile of Coliform Number (2001)

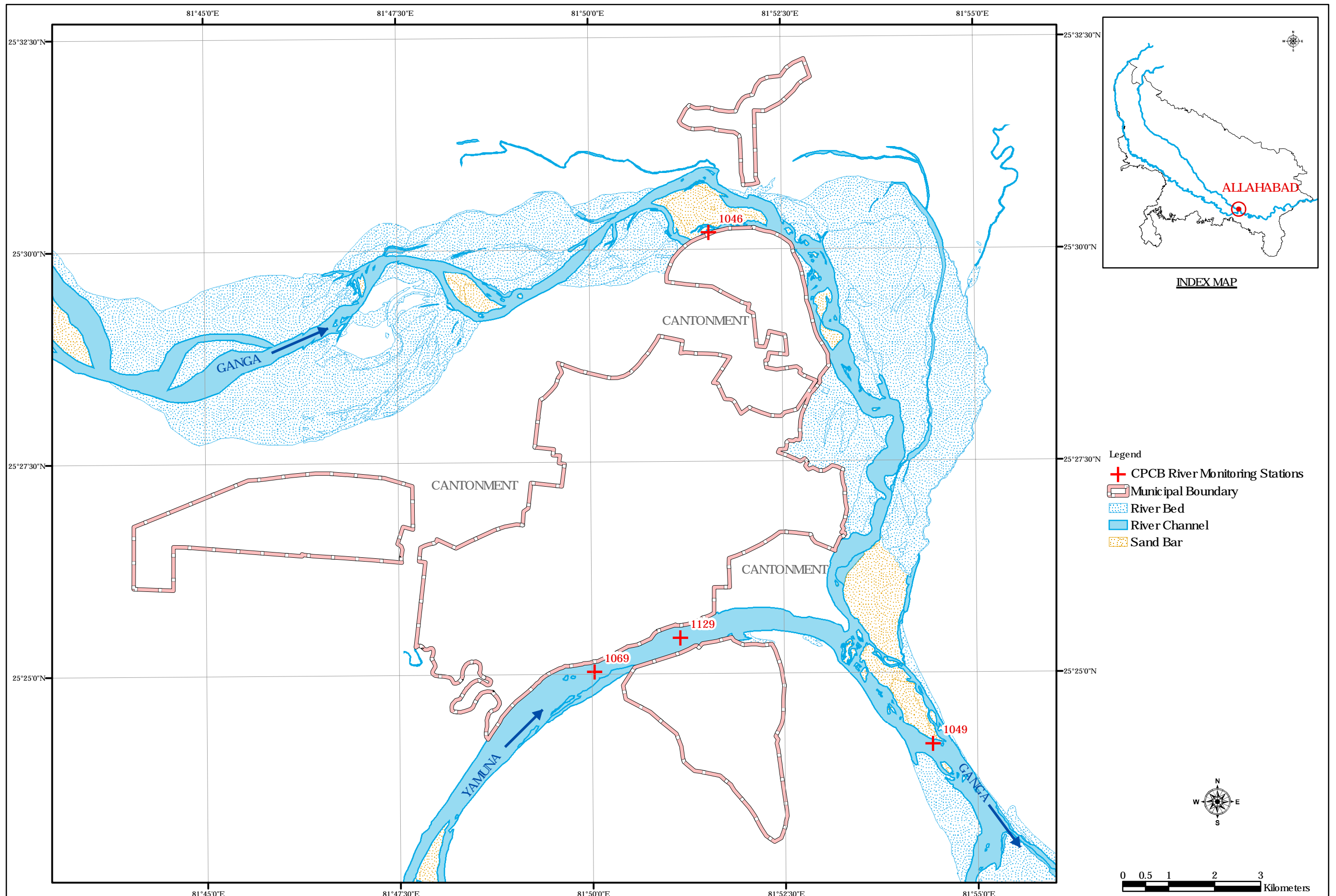


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Figure B.7.5 Simulated Longitudinal Profile of Coliform Number (Existing & 2030 Without)



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	THE STUDY ON WATER QUALITY MANAGEMENT PLAN FOR GANGA RIVER IN THE REPUBLIC OF INDIA	KANPUR CITY	LOCATION OF CPCB MONITORING STATIONS ON RIVER GANGA

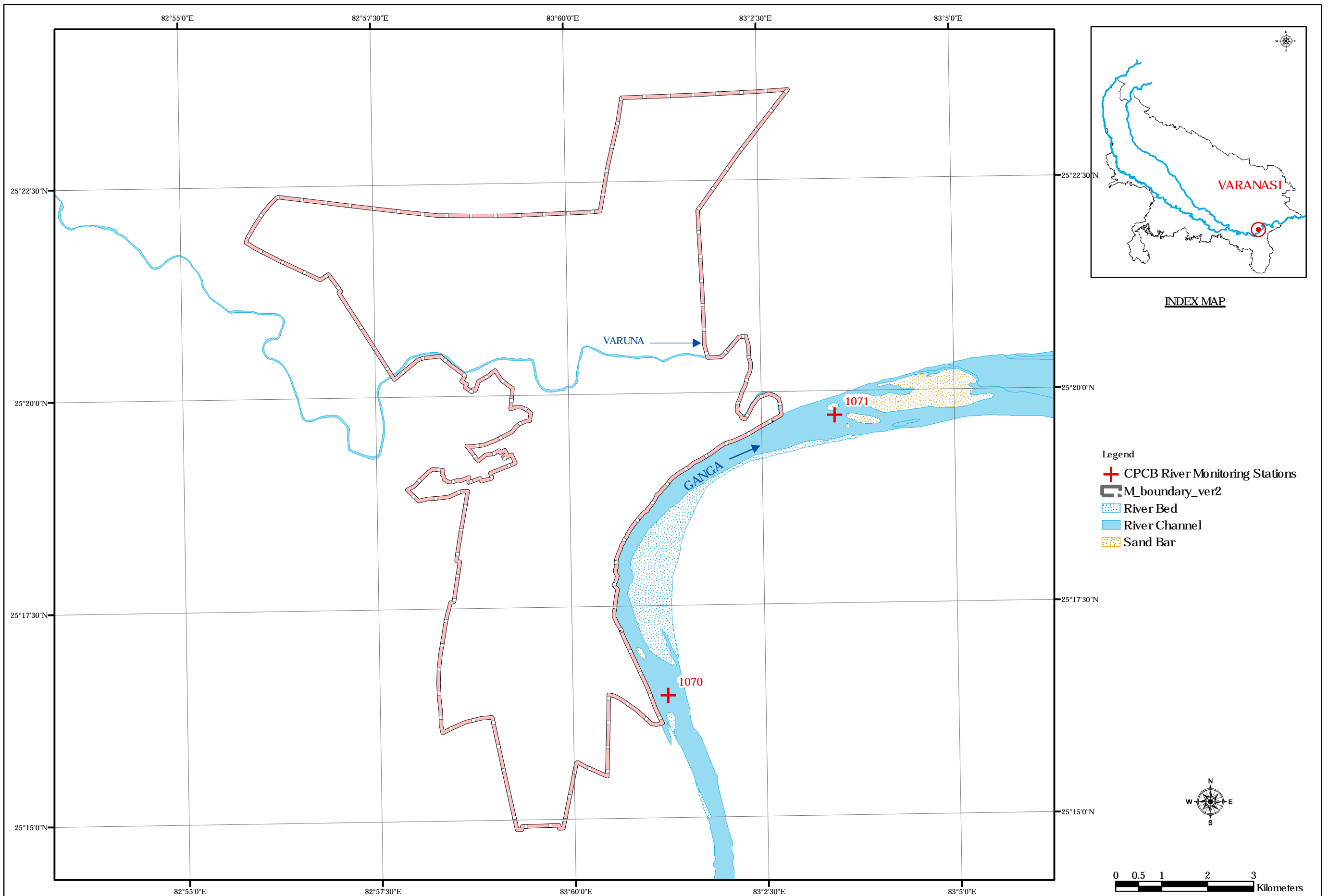


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LOCATION
 ALLAHABAD CITY

FIGURE B.7.7
 LOCATION OF CPCB MONITORING STATIONS
 ON RIVER YAMUNA & GANGA

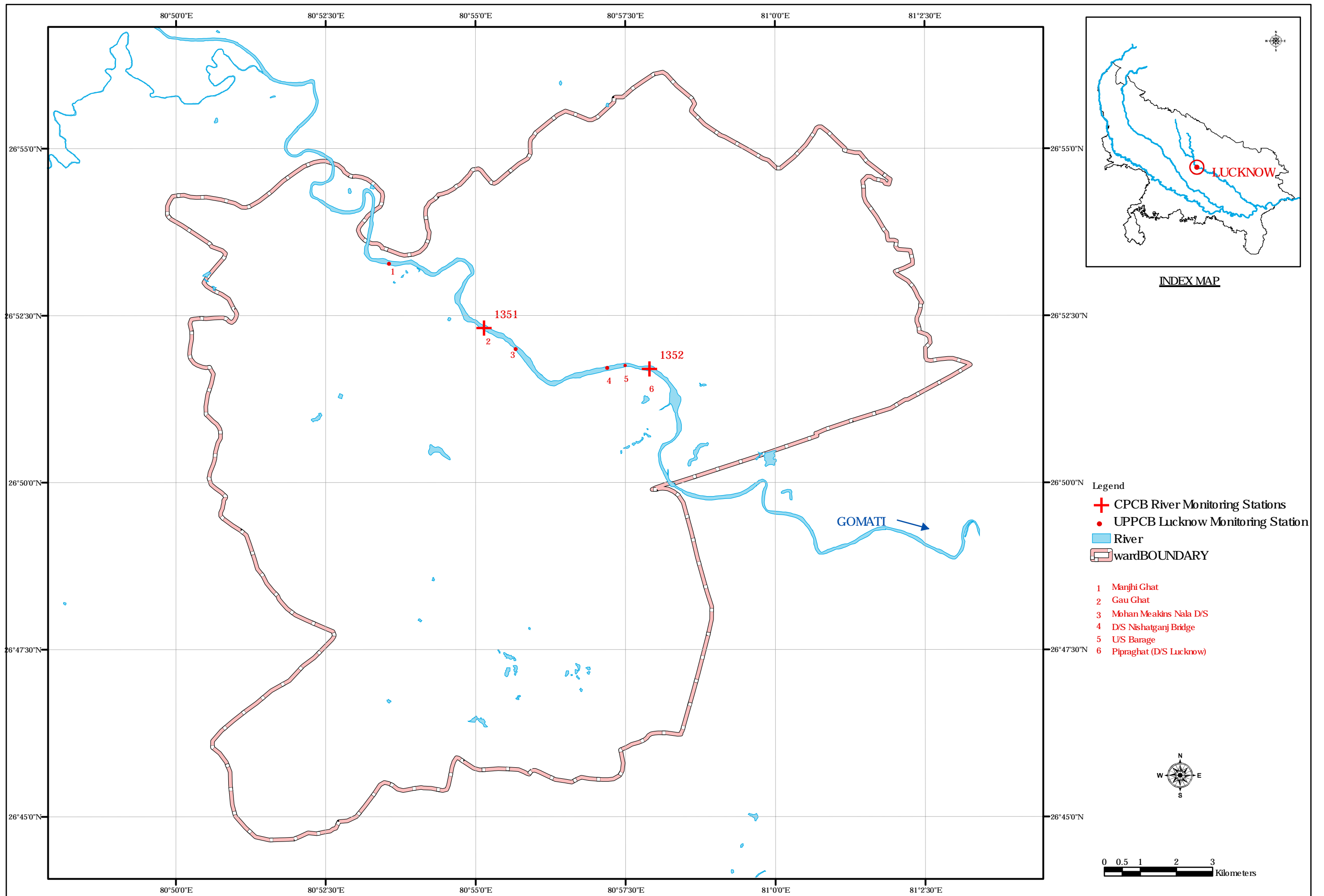





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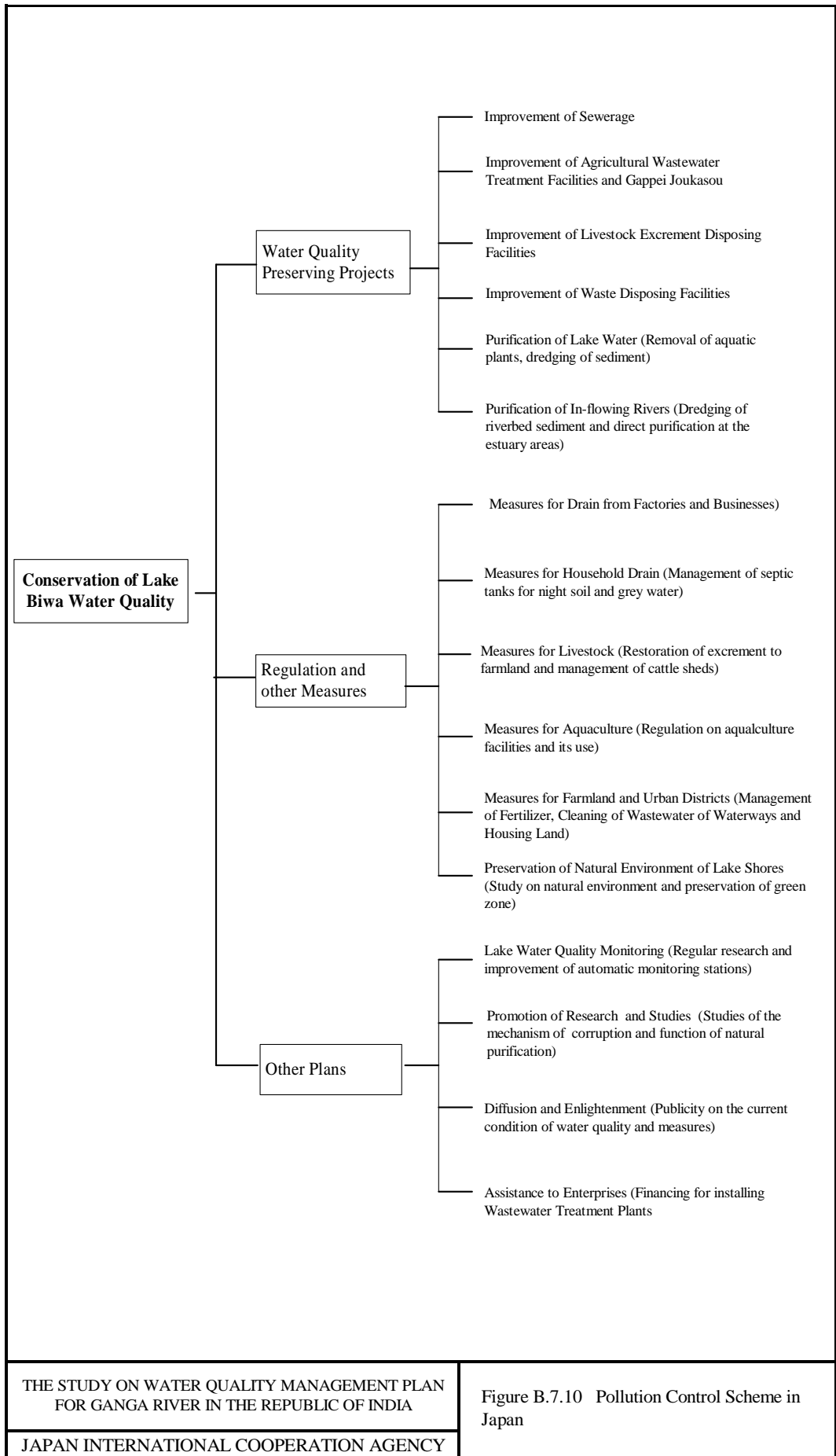
PROJECT
 THE STUDY ON WATER QUALITY MANAGEMENT PLAN
 FOR GANGA RIVER IN THE REPUBLIC OF INDIA

LOCATION
 VARANASI CITY

FIGURE B.7.8
 LOCATION OF CPCB MONITORING STATIONS
 ON RIVER GANGA



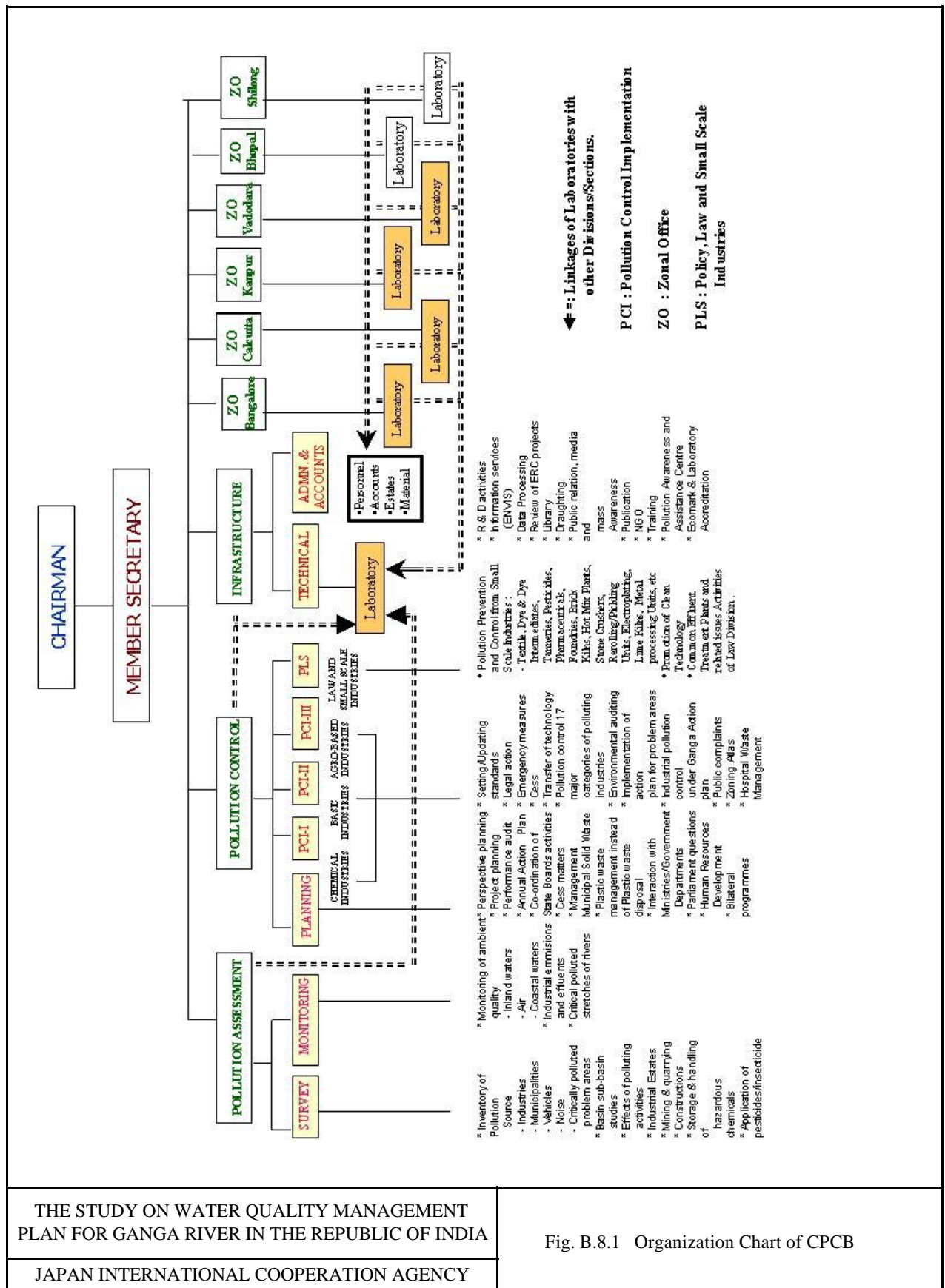
 JAPAN INTERNATIONAL COOPERATION AGENCY  TOKYO ENGINEERING CONSULTANTS CO. LIMITED  CTI ENGINEERING INTERNATIONAL CO. LIMITED	PROJECT	LOCATION	FIGURE
	THE STUDY ON WATER QUALITY MANAGEMENT PLAN FOR GANGA RIVER IN THE REPUBLIC OF INDIA	LUCKNOW CITY	B.7.9
		LOCATION OF CPCB MONITORING STATIONS ON RIVER GOMATI	



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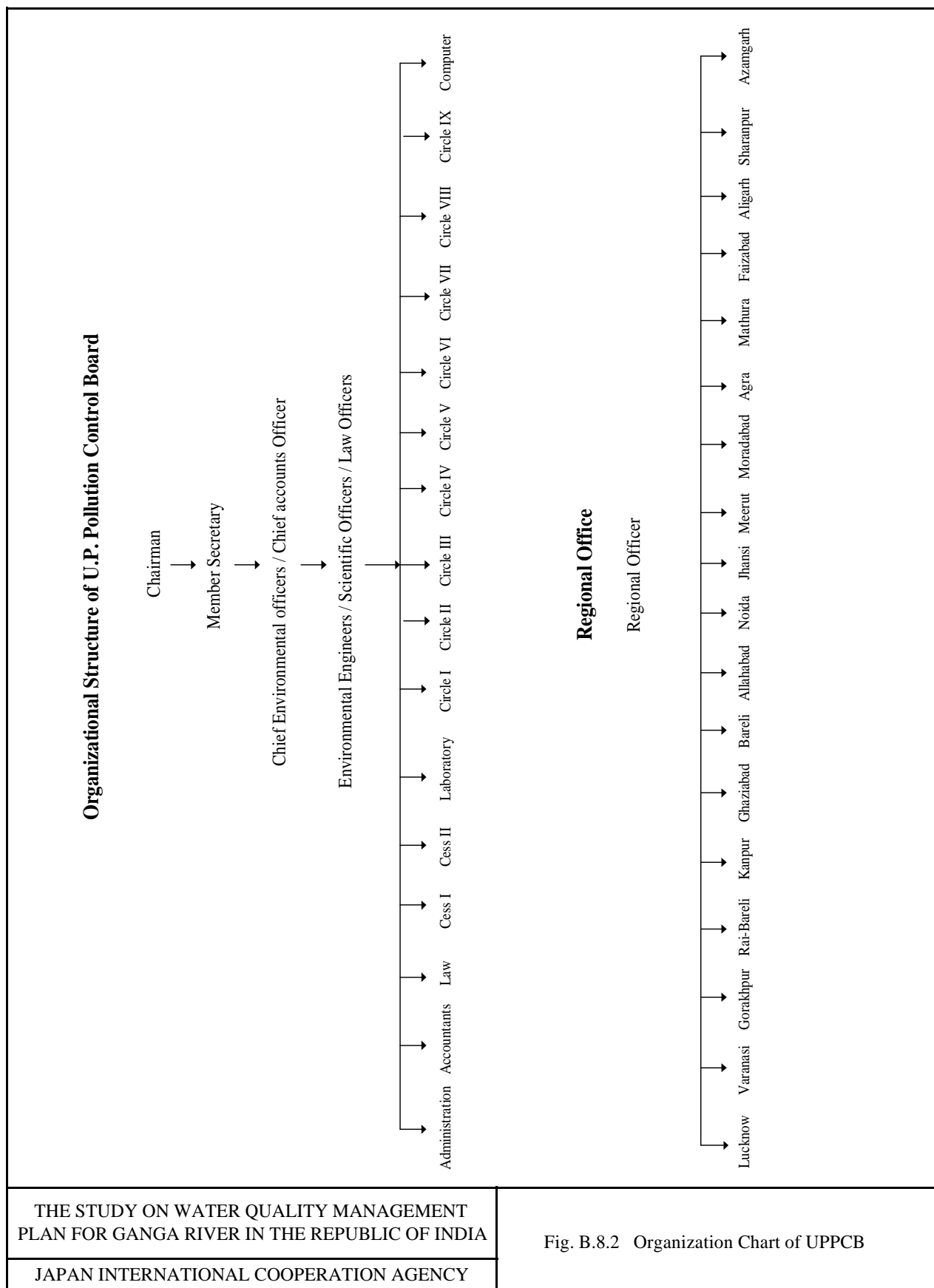
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Figure B.7.10 Pollution Control Scheme in Japan



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Fig. B.8.1 Organization Chart of CPCB



Appendix C

APPENDIX C
RELEVANT RIVER ACTION PLANS

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CHAPTER 1 GENERAL

1.1 FOREWORD

With the increase in population, there has been increase in demand of food and fiber. This resulted into the practice of intensive agriculture. The greater emphasis on agricultural growth and rapid pace of industrialization for overall development has brought in a host of environmental problems in recent years in India. Financial and technological constraints have led to lack of efficient conversion processes, thereby leading to generation of larger quantities of waste and hence additional pollution load being discharged into water bodies. The water pollution issues have been further compounded by high concentration of industries in certain regions and skewed distribution of rainfall. Realizing the importance of qualitative and quantitative conservation of natural resources including water, Government of India has enacted a number of laws to deal with arising pollution problems and to ensure a healthy water environment in the country. Some of the legislations dealing with water pollution control can be listed as follows:

- **The Water (Prevention and Control of Pollution) Act, 1974** – This act deals with establishment of an institutional structure for preventing and abating water pollution. It establishes standards for water quality and effluent. According to this law, polluting industries must seek permission to discharge waste into effluent bodies. The Central Pollution Control Board (CPCB) was constituted under this act.
- **The Water (Prevention and Control of Pollution) Cess Act, 1977** – This act provides for the levy and collection of cess or fees on water consuming industries and local authorities.
- **The Environment (Protection) Act, 1986** – This act authorizes the central government to protect and improve environmental quality, control and reduce pollution from all sources, and prohibit or restrict the setting and/or operation of any industrial facility on environmental grounds.
- **The Environment (Protection) Rules, 1986** – This law lays down procedures for setting standards of emission or discharge of environmental pollutants.

These laws empowered national bodies and state level counterparts to lay down and maintain ambient water standards, to demand details regarding effluent emissions, to prohibit polluting activities and to prevent new effluent discharges.

The water quality of River Ganga has gradually deteriorated with the increased human activities in the basin area and along its riverbanks. In order to prevent pollution of the Ganga River and improve its water quality, Ganga Action Plan (GAP) was formulated on the basis of a comprehensive study of the Ganga Basin carried out by CPCB in the year 1984 and GAP was launched in June 1985. Since 1985, a number of River Action Plans have been undertaken in the Ganga river basin for the pollution abatement into Ganga River and its tributaries. These Action Plans with their duration of implementation and approved costs are listed in Table 1.1.

Table 1.1 River Action Plans in Ganga River Basin

River Action Plan	Date of Start	Date of Completion	Cost Approved (Billion Rs.)
A. Ganga Action Plan Phase – I	June, 1985	March, 2000	4.6204
B. Ganga Action Plan Phase II			
1. Gomati Action Plan	April, 1993	March, 1999	0.6111
2. Yamuna Action Plan	April, 1993	April, 2002	5.0945
3. GAP-II (main stem)	July, 1995	December, 2001	3.9616
4. GAP-II (S/C town)	October, 1996	February, 1999	2.2095
5. Damodar Action Plan	October, 1996	December, 2001	0.2358
6. Extended Yamuna Action Plan	May, 2001	February, 2003	2.2260
7. CETP for Calcutta Tanneries (S/C order)	July, 1995	December, 2005	0.65
C. National River Conservation Plan	July, 1995	December, 2005	33.2942

Reference: 1. M.I.S. Report of Programmes Under National River Conservation Plan, Vol-II, March, 2003, Ministry of Environment & Forests, Government of India, New Delhi
2. M.I.S. Report of Programmes Under National River Conservation Plan, Vol-1, July, 2002, Ministry of Environment & Forests, Government of India, New Delhi

In addition to GAP Phase-I, other projects have also been implemented under GAP Phase-II to control pollution in various tributaries of Ganga River such as Gomati Action Plan, Yamuna Action Plan, Damodar Action Plan, GAP-II (main stem), GAP-II (S/C towns), etc. The implementation of National River Action Plan in other States of India has been undertaken to control pollution in various regions of the country to emphasize the need of maintaining hygienic environment in and around water bodies. The amount of wastewater to be intercepted, diverted or treated and capacity of commissioned STP under different River Action Plans have been given in the Table 1.2.

Table 1.2 Sanctioned and commissioned capacity of various pollution control infrastructures in different Action Plans

River Action Plan	Waste Water to be Intercepted, Diverted and Treated, MLD	Sanctioned Capacity of STP, MLD	Capacity Commissioned for I & D, MLD	Capacity Commissioned for Treatment, MLD	Remarks
A. Ganga Action Plan Phase – I	882	882	800.19	865	Covered 25 class I towns in 3 states
B. Ganga Action Plan Phase – II					
1. Yamuna Action Plan	743.25 (34 STPs)			724.25 (28 STPs)	21 towns covered in 3 states
2. Extended Yamuna Action Plan	724.25	19 (6 STPs)			15 towns covered in 3 states
3. Gomati Action Plan	269				3 towns covered in 1 state
4. Damodar Action Plan	67.53				12 towns covered in 2 states
5. GAP-II (main stem)	588.4				29 towns covered in 4 states
6. GAP-II (S/C town)					
7. CETP for Calcutta Tanneries (S/C order)	161.68				30 towns covered in 3 states
C. National River Conservation Plan	2455.47				61 towns in 11 states covered

Reference: 1. M.I.S. Report of Programmes Under National River Conservation Plan, Vol-II, March, 2003, Ministry of Environment & Forests, Government of India, New Delhi
2. M.I.S. Report of Programmes Under National River Conservation Plan, Vol-1, July, 2002, Ministry of Environment & Forests, Government of India, New Delhi

1.2 HISTORICAL STAKEHOLDER

Based on the results of the Comprehensive study report prepared by the Central Pollution Control Board (CPCB) in 1984, Government of India (GOI) constituted the “Central Ganga Authority” (GAA) with the Prime Minister of India as the Chairman and Chief Ministers of Uttar Pradesh (UP), Bihar and West Bengal along with some selected Union Ministers and Secretaries as its members in February 1985. The purpose was to initiate actions to prevent pollution of Ganga River under the scheme named “Ganga Action Plan” (GAP). After the formation of GAA, “Ganga Project Directorate” (GPD) was established as a wing of the Department of Environment to appraise and clear the projects, to release funds and to coordinate various activities under Action Plan. Further, the Urban Development Department and Environment Department were identified as the nodal agencies at state levels. The different state government agencies like Public Health Engineering Departments (PHED), State Pollution Control Boards (SPCB), Development Authorities and Local Bodies, etc., were identified as executing agencies under the supervision of the nodal department.

With the formation of coordinating agencies, GAP was launched in 1985 to expedite the smooth implementation of pollution control project for the entire Ganga basin, which encompassed about 840,000 km² (in the Indian Territory) with around 2,500 km length from Devprayag to the Bay of Bengal. Meanwhile, the Monitoring Committee of CPCB designated Environment Standard for river water quality such as BOD₅, DO, Total Coliform (TC) and Faecal Coliform (FC) in 1987. During past decade, several other funding agencies and authorities have been involved with the implementation of various basin-wide river pollution control programs like Yamuna Action Plan (YAP), Gomati Action Plan (GoAP), etc.

CHAPTER 2 GANGA ACTION PLAN PHASE-I

The objective of GAP-I was pollution abatement to improve the water quality of River Ganga by interception and diversion of domestic sewage, treatment of sewage before disposal into water bodies, and control of nonpoint sources pollution from human defecation and agricultural runoff. The purpose was also to conserve the biodiversity of the river by integrated river basin management approach, and to get experience for planning similar pollution control programs for other rivers. Different kinds of activities were planned for the states of Uttar Pradesh, Bihar and West Bengal under GAP-I and altogether 25 class-I cities (population over 0.1 million) were covered in these 3 states (Tables 1.2 and 2.4). The number of sanctioned and completed schemes for each category under GAP-I has been given in Table 2.1. To accomplish the task of pollution abatement in this plan, a total of 259 schemes were completed out of 261 sanctioned schemes (Table 2.1). The total approved cost for this project was INR 4.62 billion (INR 462.0 crore).

Table 2.1 Distribution of completed schemes by type and state under GAP-I

Type of Scheme	Uttar Pradesh	Bihar	West Bengal	Total
Sewage Interception & Diversion	40 (40)	17 (17)	31 (31)	88 (88)
Sewage Treatment Plants	13 (13)	5 (7)	15 (15)	33 (35)
Low Cost Sanitation	14 (14)	7 (7)	22 (22)	43 (43)
Crematoria	3 (3)	8 (8)	17 (17)	28 (28)
River Front Facilities	8 (8)	3 (3)	24 (24)	35 (35)
Other Schemes	28 (28)	3 (3)	1 (1)	32 (32)
Total	106 (106)	43 (45)	110 (110)	259 (261)

The numbers in () indicate total number of schemes sanctioned till 31 March 2003

- Reference: 1. M.I.S. Report of Programmes Under National River Conservation Plan, Vol-II, March, 2003, Ministry of Environment & Forests, Government of India, New Delhi
2. M.I.S. Report of Programmes Under National River Conservation Plan, Vol-1, July, 2002, Ministry of Environment & Forests, Government of India, New Delhi

Brief information on various types of facilities developed during GAP-I has been given in Table 2.2. These activities included construction, improvement and installation of sewage interception and diversion, sewage treatment plants, low cost sanitation, crematoria, river front facilities and other facilities.

In the Ganga River basin, total amount of generated wastewater was estimated to be 1,340 MLD in 1985 (Table 2.3). Out of this, 882 MLD was planned to be intercepted, diverted or treated in GAP Phase-I. In addition to this, 478 MLD is planned to be intercepted/diverted or treated in GAP Phase-II. The capacity and type of Sewage Treatment Plants (STPs) installed or improved under GAP Phase-I in 25 class-I cities of 3 states are given in Table 2.4. Total created capacity of STPs installed or modified in GAP Phase-I is 882 MLD (Table 2.4).

Table 2.2 Key details of works undertaken in different schemes of GAP-I

States	Sanctioned Cost (Billion Rs.)	Number of Schemes			Length of Sewers (km)		
		Sanctioned	Completed	Ongoing	Sanctioned	Completed	Ongoing
<u>A. Interception and Diversion</u>							
Uttar Pradesh	0.4239	40	40	0	136	136	0
Bihar	0.1970	17	17	0	59.34	53.71	5.63
West Bengal	0.8414	31	31	0	175.66	173.14	2.52
Sub Total	1.4622	88	88	0	371.00	362.85	8.15
<u>Main Pumping Station</u>							
Uttar Pradesh		33	25	8			

Bihar		27	27	0			
West Bengal		68	65	3			
Sub Total		128	117	11			
B. Sewage Treatment Plant					Capacity to Capacity be created, created, MLD		
					MLD	MLD	
Uttar Pradesh	1.0225	13	13	0	375.09	375.09	
Bihar	0.1902	7	5	2	135.5	118.0	
West Bengal	0.7361	15	15	0	371.6	371.6	
Sub Total	1.9488	35	33	2	882.19	864.69	
C. Low Cost Sanitation					Number of units/seats in Community Toilets		
Uttar Pradesh	0.1000	14	14	0	189/2520	183/2490	0
Bihar	0.0550	7	7	0	116/1528	116/1523	0
West Bengal	0.0679	22	22	0	2458/2724	2458/2724	0
Sub Total	0.2229	43	43	0	2763/6772	2757/6737	
					Number of units/seats in Individual Toilets		
Uttar Pradesh					24965	22587	0
Bihar					6725	6725	0
West Bengal					20710	20698	0
Sub Total					52400	50010	
D. Crematoria					Number of Crematoria		
Uttar Pradesh	0.0197	3	3	0	3	3	0
Bihar	0.0372	8	8	0	8	8	0
West Bengal	0.0781	17	17	0	17	17	0
Sub Total	0.135	28	28	0	28	28	0
E. Bathing Ghat					To be	Developed	Ongoing
					developed		
Uttar Pradesh	0.0637	8	8	0	44	43	
Bihar	0.0087	3	3	0	10	10	
West Bengal	0.0678	24	24	0	75	75	
Sub Total	0.1402	35	35	0	129	128	

Reference: 1. M.I.S. Report of Programmes Under National River Conservation Plan, Vol-1, July, 2002, Ministry of Environment & Forests, Government of India, New Delhi

Table 2.3 Capacity of Wastewater Treatment under GAP-I

States	Total Wastewater from Class I towns, MLD	Quantity to be intercepted/diverted /treated, MLD	Planned for GAP Phase – II, MLD	Completed till March, 2003, MLD	
				I & D	Treated
Uttar Pradesh	679.6	375.09	362	375.09	375.09
Bihar	132.7	135.5	21.7	135.5	118
West Bengal	527.5	371.6	94	289.6	371.6
Total	1339.8	882.19	477.7	800.19	864.69

The numbers in () indicate total number of schemes sanctioned till 31 March 2003

Reference: 1. M.I.S. Report of Programmes Under National River Conservation Plan, Vol-1, July, 2002, Ministry of Environment & Forests, Government of India, New Delhi

The generated wastewater load in year 1985 (1,340 MLD) was based on the population in that year.

There has been around 35% increase in population from 1985 to 2001 and assuming increase in wastewater generation in the same ratio, the total wastewater generated should be around 1810 MLD in the year 2001. Therefore further installation of wastewater treatment facilities will be needed to cope up with the increased effluent loads.

During implementation of GAP Phase-I, there were some setbacks. There were some instances of land acquisition problems. In some cases, contractor was not capable enough to continue working with the project and they left the work after being paid some advance money. There were also some hindrances due to legal suits filed. There were some cases of budget delays after CCEA approval of the budget and hence the work was affected. Due to lack of finance or capability, the operation and maintenance of many of STPs were not up to the mark. There were instances of power supply interruption due to financial problems and in such cases the STPs could not operate. Higher amount of BOD load were discharged into river than expected due to poor maintenance of the infrastructures. The performance of project was influenced negatively by the lack of public awareness, hygienic awareness and due to higher illiteracy. Crematoria were not much in use due to private financial matters in few cases. Out of 119 private enterprises and factories located in the Ganga basin, 73 factories were found to discharge their wastewater without effluent treatment. Most of the effluent treated water is discharged into river without disinfections thereby increasing Total Coliform (TC) and Faecal Coliform (FC) concentration of river water. Activities like open defecation, throwing of dead animals adds to increasing TC and FC. Therefore, there is need to plan for the pollution abatement in the basin, taking care of these obstacles and setbacks. There is a need to implement effective plans for proper maintenance and operation of infrastructures to prevent pollution of river water.

Table 2.4 Details about Sewage Treatment Plant under GAP-I

Town	Capacity, MLD		Type	Completion Date
	Old	New		
Uttar Pradesh				
1. Kankhal, Hardwar	0	18	ASP	30 March, 1996
2. Swargashram-Rishikesh	0	0.33	RBRC	31 March, 1991
3. Lakkar Ghat, Rishikesh	0	6	OP	30 June, 1990
4. Farukhabad	0	3.96	OP	31 March, 1993
5. Kanpur	0	36	UASB	30 April, 1996
6. Chrome Recovery Pilot Plant, Kanpur	0	0.0045		15 January, 1989
7. Kanpur	0	130	ASP	1997
8. Kanpur	0	5	UASB	30 April, 1996
9. Allahabad	0	60	ASP	31 March, 1999
10. Mirzapur	0	14	UASB	31 December, 1993
11. Varanasi, BHU	1.8	8	ASP (both)	31 January, 1990
12. Varanasi, Dinapur	0	80	ASP	31 December, 1993
13. Varanasi, SPT, DLW	0	12	ASP	31 January, 1989
Sub Total	1.8	373.294		
Bihar				
14. Chapra	0	2	OP	31 December, 1999
15. Patna, Eastern Zone	0	4	OP	
16. Patna, Saidpur	28	17	ASP (both)	31 December, 1999
17. Patna, Beur	20	15	ASP (both)	31 December, 1993
18. Patna, Southern Zone	0	25	AL	30 June, 1994
19. Munger	0	13.5	AL	
20. Bhagalpur	0	11	AL	30 June, 1994

Sub Total	48	87.5		
West Bengal				
21. Chandannagar	4.54	18.16	OP (old), TF (new)	31 January, 1993
22. Behrampore	0	4	OP	31 March, 1993
23. Nabadwip	0	4	OP	31 March, 1993
24. Kalyani	11	6	TF (old), OP (new)	31 March, 1992
25. Bhatpara Gr. E	0	10	OP	31 March, 1995
26. Bhatpara, Gr. B	8.5	10	ASP (both)	31 March, 1994
		4.5	ASP	
27. Titagarh	4.5	14	OP (both)	31 March, 1993
		4.5	ASP	
28. Panihati	0	12	OP	31 December, 1993
29. Baranagar, Kamarhati	0	40	TF	31 March, 1994
30. Garden Reach	0	47	ASP	31 December, 1996
31. South Suburban (E)	0	30	OP	
32. Howrah	45	0	TF	31 December, 1991
33. Serampore	18.9	0	TF	31 March, 1993
34. Bally	0	30	OP	31 October, 1994
35. Cossipore – Chitpur	0	45	ASP	1997
Sub Total	101.44	270.16		
Total	151.24	730.95		

Reference: 1. M.I.S. Report of Programmes Under National River Conservation Plan, Vol-1, July, 2002, Ministry of Environment & Forests, Government of India, New Delhi

Nevertheless, the impact of GAP Phase-I has been generally observed to be positive in the middle stretch of the Ganga River in the cities of Kanpur, Allahabad and Varanasi. In these cities, DO measure (an indicator of water quality) continued to decline up to 1992 but has improved thereafter. However, in some cases it still did not meet the prescribed standard of BOD of 3 mg/l because of lack of treatment capacity of the cities and lower volume of minimum flow of river itself in dry season.

After completion of Phase-I, it has been felt necessary to extend the Ganga Action Plan and to apply similar Action Plans to other major cities located on the bank of Ganga River in order to control pollution load flow into the rivers. Consequently, River Action Plans have been applied to other major rivers of the country under the two schemes of GAP Phase-II and the National River Conservation Plan (NRCP). The total approved cost for GAP Phase-II is around INR 14.966 billion (INR 1496.6 crore). Under GAP Phase-II many action plans such as Gomati Action Plan, Yamuna Action Plan, Damodar Action Plan, GAP-II (main stem), GAP-II (S/C town), etc. has been taken up (Table 1.1).

CHAPTER 3 GANGA ACTION PLAN PHASE-II (GAP-II)

3.1 GAP-II (MAIN STEM AND S/C TOWNS)

Measures related to pollution control were also implemented in the main stem of Ganga River and some other towns as instructed by the Supreme Court. Tables 3.1 and 3.2 present numbers of such activities under each category that were completed and sanctioned for the two cases. GAP-II (Main Stem) has been implemented from July 1995 to December 2001 covering 29 towns of 4 states of Uttar Pradesh, Uttaranchal, Bihar and West Bengal. In this plan one STP of 32 MLD capacity was completed in Haridwar-Rishikesh. Under GAP-II (Main Stem), it was planned to intercept/divert or treat around 588 MLD of wastewater. However, in this plan along the main stem of Ganga River altogether only 12 schemes have been completed out of 73 sanctioned schemes.

Under GAP-II (S/C Towns), pollution control measures are planned to be implemented in 30 different cities that have been directed by the Supreme Court. In this programme, most of the schemes deal with interception and diversion works, low cost sanitation and river front development works. It is also planned to take up 2 STP works in Uttaranchal and 8 STP works in West Bengal and are yet to be completed. Altogether, only 6 schemes have been completed out of 73 sanctioned schemes during October 1996 to February 1999.

Table 3.1 Number of sanctioned and completed schemes under GAP-II (Main Stem)

(As on 31 January 2003)

Type of Scheme	Uttar Pradesh	Uttaranchal	Bihar	West Bengal	Total
Interception & Diversion	4 (13)	2 (2)	0 (0)	0 (12)	6 (27)
Sewage Treatment Plants	0 (2)	1 (1)	0 (0)	0 (2)	1 (5)
Low Cost Sanitation	3 (5)	0 (1)	0 (8)	0 (0)	3 (14)
Crematoria	0 (1)	0 (0)	0 (2)	0 (3)	0 (6)
River Front Facilities	0 (0)	0 (0)	0 (11)	1 (6)	1 (17)
Other Schemes	1 (3)	0 (0)	0 (0)	0 (1)	1 (4)
Total	8 (24)	3 (4)	0 (21)	1 (24)	12 (73)

The numbers in () indicate total number of schemes sanctioned till 31 March 2003

Table 3.2 Number of sanctioned and completed schemes under GAP-II(Supreme Court Towns)
(As on 31 January 2003)

Type of Scheme	Uttar Pradesh	Uttaranchal	Bihar	West Bengal	Total
Interception & Diversion	0 (2)	0 (6)	0 (0)	0 (22)	0 (30)
Sewage Treatment Plants	0 (0)	0 (2)	0 (0)	0 (8)	0 (10)
Low Cost Sanitation	0 (3)	0 (9)	0 (0)	0 (0)	0 (12)
Crematoria	0 (0)	0 (0)	0 (0)	0 (1)	0 (1)
River Front Facilities	0 (0)	6 (6)	0 (0)	0 (13)	6 (19)
Other Schemes	0 (0)	0 (1)	0 (0)	0 (0)	0 (1)
Total	0 (5)	6 (24)	0 (0)	0 (44)	6 (73)

The numbers in () indicate total number of schemes sanctioned till 31 March 2003

3.2 GOMATI ACTION PLAN PHASE-I AND PHASE-II

To control the pollution load from cities of Lucknow, Sultanpur and Jaunpur into River Gomati, Gomati Action Plan Phase-I (GoAP-I) was implemented from April 1993 to March 1999 with part of the work completed in the city of Lucknow aided by DFID, UK. Total approved cost for this plan was INR 0.61 billion (INR 61.11 crore). River Gomati receives discharge of around 356.03 MLD from 26 city drains in Lucknow. In Phase-I, 15 schemes out of 27 sanctioned schemes were completed (Table 3.3) under different categories of activities. Under these schemes interception and diversion were constructed for

Gaughat Nala, Nagaria Nala, Sarkata Nala, Pata Nala, Wazirganj Nala and Ghasiyari Mandi Nala. STP with a capacity of 42 MLD was also constructed with FAB technology requiring less area than conventional systems. Two schemes named construction of rising main to Kukrail IPS and interception/diversion of Kukrail Nala are still under consideration. Few activities under interception and diversion, which were sanctioned, are still to be completed (Table 3.3).

Table 3.3 Number of sanctioned and completed schemes under GoAP-I
(As on 31 January 2003)

Type of Scheme	Uttar Pradesh	Total
Interception & Diversion	9 (18)	9 (18)
Sewage Treatment Plants	0 (2)	0 (2)
Low Cost Sanitation	2 (2)	2 (2)
Crematoria	2 (2)	2 (2)
River Front Facilities	0 (0)	0 (0)
Other Schemes	2 (3)	2 (3)
Total	15 (27)	15 (27)

The numbers in () indicate total number of schemes sanctioned till 31 March 2003

After the completion of GoAP-I, it has been proposed to undertake Gomati Action plan Phase-II (GoAP-II) so called “Pollution Control of River Gomati at Lucknow” under Integrated Ganga River Basin Management Programme, to be sanctioned by NRCD, MOEF. Under GoAP-II, it has been proposed to intercept & divert the sewage flow carried by drains on upstream of Gomati River to a STP located near the out fall of Sarkata Nala. The remaining flow of 21 drains is to be conveyed to downstream of barrage up to proposed STPs. GoAP-II consists of diversion of 25 drains including 24 SPS, rising main of 37 kilometers length, 21 LCSs and 3 STPs of 412 MLD capacity with costs of INR 317.60 crore (vide “Brief Note on Pollution Control of River Gomati at Lucknow under Integrated Ganga River Basin Management Programme”, March 2002).

Meanwhile, the second phase of GoAP has been sanctioned in May 2003 and is planned to start soon. A total budget of INR 2.6326 billion (INR 263.26 crore) has been estimated for the implementation of this phase of project. Thus the sanctioned activities falls short (INR 54 crore) of what had been proposed and additional work is needed for effective control of pollution into River Gomati. The activities to be carried out under this plan include construction of interception/diversion on 19 sewers, MPS near Gwari culvert, 345 MLD UASB sewage treatment plant near Kakraha, 25 MLD WSP sewage treatment plant and 5 MLD FAB technology based STP at Daulatganj. Other activities also include land acquisition for STP, public awareness, low cost sanitation and afforestation along river.

It is likely that with the execution of priority works, water quality of Gomati River on upstream reaches will be improved but the overall improvement will be only after completion of all the works envisaged in the aforesaid Comprehensive Project.

3.3 YAMUNA ACTION PLAN PHASE-I AND PHASE-II

For water pollution abatement and water quality conservation in Yamuna River, Yamuna Action Plan Phase-I (YAP-I) has been implemented by NRCD from April 1993 to February 2003 (along with the extended phase). YAP-I (along with the extended phase) was funded by JBIC under soft loan amounting INR 7.3205 billion (INR 732.05 crore) and covered 21 towns in 3 states of Haryana, Delhi and Uttar Pradesh. The details on number of schemes sanctioned and completed under YAP-I and under extended phase have been shown in Tables 3.4, 3.5 and 3.6. In this plan, 34 STPs were constructed/installed with their total sewage handling capacity amounting to 743 MLD (Table 3.7) and around 180 km of sewer was constructed (Table 3.6). Other activities include construction of low cost sanitation facilities, crematoria and river front improvements. After the implementation of project, a few deficiencies were observed in the use of developed infrastructures. Low cost sanitation units were observed to be underutilized and the maintenance was also not enough. Therefore, more efforts must be put in to

popularize the use of LCS units and to check proper operation and management of these units. The use of crematoria was also not plenty and there is a need of public awareness activity to highlight advantage of using such crematoria and remove social taboos. It is also required to properly monitor the performance of STPs on regular basis and apply the corrective measures if need be. For proper operation and maintenance of pumping stations and STPs, sufficient fund should be allocated to or generated in concerned agencies. Further efforts should be made to improve the impact of Public Participation and Public Awareness programs due emphasis must be given on such schemes. If there is a need, the Institutional and Capacity Building of concerned agencies must be given due attention to improve the performance of pollution control measures.

Table 3.4 Number of sanctioned and completed schemes under YAP-I

(As on 31 January 2003)

Type of Scheme	Delhi	Haryana	Uttar Pradesh	Total
Interception & Diversion	0 (0)	16 (20)	29 (29)	45 (49)
Sewage Treatment Plants	2 (2)	12 (17)	14 (14)	28 (33)
Low Cost Sanitation	0 (0)	5 (6)	8 (8)	13 (14)
Crematoria	1 (1)	6 (6)	8 (8)	15 (15)
River Front Facilities	0 (0)	1 (1)	3 (4)	4 (5)
Other Schemes	0 (0)	5 (11)	10 (16)	15 (27)
Total	3 (3)	45 (61)	72 (79)	120 (143)

The numbers in () indicate total number of schemes sanctioned till 31 March 2003

Table 3.5 Number of sanctioned and completed schemes under YAP Extended Phase

(As on 31 January 2003)

Type of Scheme	Delhi	Haryana	Uttar Pradesh	Total
Interception & Diversion	0 (0)	10 (10)	14 (17)	24 (27)
Sewage Treatment Plants	0 (5)	10 (10)	16 (20)	26 (35)
Low Cost Sanitation	1 (2)	6 (6)	7 (8)	14 (16)
Crematoria	1 (1)	0 (1)	1 (2)	2 (4)
River Front Facilities	0 (0)	0 (0)	0 (0)	0 (0)
Other Schemes	0 (1)	2 (2)	6 (9)	8 (12)
Total	2 (9)	28 (29)	44 (56)	74 (94)

The numbers in () indicate total number of schemes sanctioned till 31 March 2003

Table 3.6 Key details of various types of schemes under YAP

States	Sanctioned Cost (Billion Rs.)	Number of Schemes			Length of Sewers (km)		
		Sanctioned	Completed	Ongoing	Sanctioned	Completed	Ongoing
A. Interception and Diversion							
Haryana	0.6249	20	16	4	130.8	118.88	11.92
Delhi	0	0	0	0	0	0	0
Uttar Pradesh	0.8159	29	29	0	48.1	48.1	0
Sub Total	1.4408	49	45	4	178.9	166.98	11.92
B. Main Pumping							
Station							
Haryana	0.2896	9	9	0	22	15	7
Delhi	0	0	0	0	0	0	0
Uttar Pradesh	0.2880	5	3	2	38	37	1
Sub Total	0.5776	14	12	2	60	52	8
C. Sewage Treatment Plant							
					Capacity to be created, MLD	Capacity created, MLD	Number of created STP
Haryana	1.1067	16	12	4	322	306.5	11
Delhi	0.1344	2	2	0	20	20	2

Uttar Pradesh	0.9421	15	15	0	401.25	401.25	15
Sub Total	2.1832	33	29	4	743.25	727.75	28
D. Low Cost Sanitation					Number of units/seats		
Haryana	0.0274	6	5	1	31/560	31/560	0
Delhi	0	0	0	0	0	0	0
Uttar Pradesh	0.0515	8	8	0	142/1720	142/1720	0
Sub Total	0.0789	14	13	1	173/2280	173/2280	0
E. Crematoria					Number of Furnace		
Haryana	0.0022	6	6	0	24	24	0
Delhi	0.0414	1	1	0	1	1	0
Uttar Pradesh	0.0069	8	8	0	76	72	4
Sub Total	0.0505	15	15	0	101	97	4
F. Bathing Ghat					To be	Developed	Ongoing
				developed			
Haryana	0.0073	1	1	0	2	2	0
Delhi	0	0	0	0	0	0	0
Uttar Pradesh	0.0093	4	2	2	5	1	2
Sub Total	0.0166	5	3	2	7	3	2

Table 3.7 Capacity of Sewage Treatment Plant under YAP

Town	STP Numbers	Capacity, MLD	Type
Haryana			
1. Yamunanagar	STP-I	10	UASB
	STP-II	25	UASB
2. Karnal	STP-I	40	UASB
	STP-II	8	OP
3. Panipat	STP-I	10	UASB
	STP-II	35	UASB
4. Sonapat	STP-I	30	UASB
5. Gurgaon	STP-I	30	UASB
6. Faridabad	STP-I	20	UASB
	STP-II	45	UASB
	STP-III	50	UASB
7. Chhchhrauli	STP	1	OP
8. Gharaunda	STP	3	OP
9. Gohana	STP	3.5	OP
10. Indri	STP	1.5	OP
11. Palwaal	STP	9	OP
12. Radaur	STP	1	OP
Sub Total	17 STPs	322	
Delhi			
13. Delhi	STP-I	10	ASP
	STP-II	10	ASP
Sub Total	2 STPs	20	
Uttar Pradesh			
14. Saharanpur	STP	38	UASB
15. Muzaffarnagar	STP	32.5	OP
16. Ghaziabad	STP-I	70	UASB
		3	KT
	STP-II	56	UASB
17. Noida	STP-I	34	UASB
	STP-II	27	UASB
	STP-III	9	OP
18. Vrindavan	STP-I	4	OP

	STP-II	0.5	OP
19. Mathura	STP-I	14.5	OP
	STP-II	12.5	OP
20. Agra	STP-I	78	UASB
	STP-II	10	OP
	STP-III	2.25	OP
21. Etawah	STP	10	OP
Sub Total	15 STPs	401.25	
Total	34 STPs	743.25	

Reference: 1. M.I.S. Report of Programmes Under National River Conservation Plan, Vol-II, March, 2003, Ministry of Environment & Forests, Government of India, New Delhi

The implementation of YAP-I partially helped in improving the Yamuna river water quality. However, it is necessary to prepare and implement a holistic plan to address the present and future pollution load generated in Yamuna river basin. Based on the YAP-I inventory documents, Yamuna Action Plan Phase-II (YAP-II) is planned to be formulated to undertake the remaining works to accomplish the objectives of the current issues. The draft of YAP-II proposed to NRCD, MOEF consists of the following works for next phase (vide “The Pre-Feasibility Study on Yamuna Action Plan Phase-II”, August 2000).

- (1) Works of sewerage, low cost sanitation, crematoria, etc. in additional towns of Haryana and U.P. which were not included in YAP-I and are expected to release their wastewater discharges into Yamuna River due to their high increase of population. In U.P., the additional town covered in the Pre-Feasibility Study is Allahabad City.
- (2) Additional works in the existing six cities of Haryana and eight cities in U.P to meet the shortfall in capacity due to population growth. The works will include such items as additional sewerage, augmentation in the capacity of STPs to meet the requirement of additional treatment capacity as a result of growth in population, augmentation in low cost sanitation and crematoria schemes.
- (3) Provision of proper conveying system and a common effluent treatment plant at Panipat in Haryana to treat the industrial effluents from large number of small-scale industries of the city.
- (4) Identifying the extent of damage to the sewerage system of Delhi and cost required to renovate it. This will be a major step towards restoring the water quality of Yamuna River.
- (5) Augmentation of sewage treatment capacity in Delhi to meet the gap between the generation of sewage and present installed capacity.
- (6) Identifying the extent of pollution created by the slums located in the riverbed of Yamuna in Delhi and to assess the cost involved in their rehabilitation.
- (7) Provision of suitable disinfection system in all the STPs constructed under YAP-I and to be constructed under YAP-II.
- (8) Provision for public participation and awareness to make the programme sustainable by involving active participation of local bodies.
- (9) Provision of institutional strengthening of agencies responsible for execution of plan and operation and management of infrastructures to make the program self-sustainable.

The execution of Phase-II plan will help conserving hygienic environment in River Yamuna and its basin in particular and subsequently will help improving the water quality of River Ganga in general.

CHAPTER 4 DONOR AND NGO'S ACTIVITIES

There are three projects in the Study area supported by grants/loans from donor countries and are presented in Table 4.1.

Table 4.1 Part of the Project Carried out under External Assistance

Project	Date of Start	Date of Completion	Grant Amount (Billion Rs.)
A. Dutch Assistance (under GAP-II)			
1. GAP Support Project in Kanpur	October, 1997	December, 2004	1.05
B. British Assistance (DFID), UK			
1. Cost Benefit Analysis of GAP-I	February, 1996	February, 1997	0.00572
2. Pollution Abatement Works in Lucknow under Gomati Action Plan	September, 1995	January, 1999	0.209
C. Japanese Assistance (OECF)			
1. Yamuna Action Plan (YAP)	December, 1992	February, 2003	4.01

4.1 THE ROYAL GOVERNMENT OF NETHERLANDS

According to basic principal of grant aid project in India, the Royal Government of Netherlands will assist the GAP-I and GAP-II projects on national level. During past few years, the Royal Government of Netherlands has assisted to implement interception, diversion and STP project along the Ganga River. Total support from the Royal Government of Netherlands amounts to INR 1.05 billion (INR 105 crore). The remaining activities to be covered under this grant are to intercept, divert or install STP in the southern city of Kanpur flowing to Pandu River, tributary of Ganga, and include 200 MLD sewerage treatment, low cost sanitation, solid waste management and water supply renovation.

Apart from STP project, Royal Government of the Netherlands carried out the study report on "Hazardous Waste Disposal at Rooma" for chromium removal measure. It will continue to assist the implementation of project till year 2004 and subsequently will shift their support to the states of Andhra Pradesh, Kerala and Gujarat.

4.2 THE UNITED STATE OF AMERICA

The USA funded preparation of the Feasibility Study Report of the Sewerage Project in Varanasi City in May 1997. However, it was not approved by the government. The proposed components consisted of gravitational sewer along Ganga and Varuna Rivers and so called Advanced Integrated Wastewater Ponding System (AIWPS).

4.3 THE UNITED KINGDOM

The Government of United Kingdom provided grant assistance aid to the Government of India especially in four states mainly for environmental and/or sanitary development study. Under this aid programme, DFID has formulated the master plan named "Urban Environmental Services Master Plan for Lucknow" in the year 1997. However, DFID has been eventually obliged to change their aid strategy for the Uttar Pradesh State due to some management matters and it has not implemented any scheme ever since 1997.

4.4 THE GOVERNMENT OF JAPAN

The implementation of Yamuna Action Plan Phase-I (YAP-I) has eventually completed in March 2003 with the extension of soft component, i.e., non-sewerage scheme undertaken by JBIC, Government of Japan. Further YAP Phase-II is planned by the Government of Japan. For implementation of YAP-II, loan agreement has been extended by JBIC in March 2003.

4.5 OTHER COUNTRIES / INTERNATIONAL AGENCY

(1) World Bank

The World Bank (WB) has loaned a part of the Ganga Action Plan Phase-I from December 1987 to March 1996 for priority pollution control works in the states of Uttar Pradesh, Bihar and West Bengal. This project also included procurement of equipments for pollution abatement and training of staff of GPD and its implementing agencies. The World Bank is also aiding preparation of Environmental Report in Uttar Pradesh in order to understand the current status of various components of environment. The Final report is due to be submitted in 2003 to the NRC, MoEF and Ministry of Urban Development (MoUD) UP State. In addition, WB is also planning to support the organization of seminars, workshops, activities related to Public Participation and Public Awareness in Lucknow in the near future.

(2) ADB

According to its strategy, ADB has actively financed for several states in the southern part of India. However, there does not seem to be any sewerage project or non-sewerage scheme being supported by ADB in Ganga River basin especially for four cities. However, there are possibilities of ADB co-financing project with international funding agency such as JBIC and WB in the near future for development works in Ganga Basin. Therefore, it is important to observe and follow the ADB's trend with time for soft loan towards the implementation of Ganga River Basin Project.

4.6 NGOs

In this country, there are many Non-Government Organizations (NGOs) for working on various scheme and several NGOs are good at implementing the hard field of sewerage project as well as soft field like organization of workshops, seminars, activate people participation, etc. The following sections describe in brief about various NGOs dealing with few activities related to the Ganga river basin.

(1) Sankat Mochan Foundation (SMF)

SMF, located in the Varanasi City, has been involved with the USAID project in the Varanasi city. SMF together with some expert recommended the typical treatment system for domestic wastewater for the improvement of sewerage system in the city of Varanasi.

(2) Sulabh International

This NGO body, Sulabh International is mainly carrying out the operation and maintenance (O&M) of LCS and/or public toilet facilities. Sulabh International had good experience of construction of LCS in India especially through YAP-1 project.

(3) Other NGOs

Few dedicated NGOs have been involved with the maintenance of bathing Ghats in Varanasi city and Dhobi Ghats in Lucknow city on their own. However, there does not seem to be any on-going project related to such activities in the Ganga River Basin in Uttar Pradesh State.