सत्यमेव जयते
Government of India

National Mission for Clean Ganga
Ministry of Jal Shakti
Department of Water Resources, River Development & Ganga Rejuvenation
Government of India

UTTARAKHAND
RIVER ATLAS

August 2021

cGanga
Centre for Ganga River Basin Management and Studies

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National Mission for Clean Ganga (NMCG)

NMCG is the implementation wing of National Ganga Council which was setup in October 2016 under the River Ganga Authority order 2016. Initially NMCG was registered as a society on 12th August 2011 under the Societies Registration Act 1860. It acted as implementation arm of National Ganga River Basin Authority (NGRBA) which was constituted under the provisions of the Environment (Protection) Act (EPA) 1986. NGRBA has since been dissolved with effect from the 7th October 2016, consequent to constitution of National Council for Rejuvenation, Protection and Management of River Ganga (referred to as National Ganga Council).

www.nmcg.in

Centre for Ganga River Basin Management and Studies (cGanga)

cGanga is a think tank formed under the aegis of NMCG, and one of its stated objectives is to make India a world leader in river and water science. The Centre is headquartered at IIT Kanpur and has representation from most leading science and technological institutes of the country. cGanga's mandate is to serve as think-tank in implementation and dynamic evolution of Ganga River Basin Management Plan (GRBMP) prepared by the Consortium of 7 IITs. In addition to this, it is also responsible for introducing new technologies, innovations, and solutions into India.

www.cganga.org

Acknowledgment

This river atlas document is a collective effort of a number of experts, institutions and organisations, some who had been associated with preparing the Ganga River Basin Management Plan (GRBMP) submitted to the Government of India in 2015, and others who joined later with their own independent expertise and enthusiasm. Contributions to the photographs and images for this document by individuals are gratefully acknowledged.

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PREFACE

The Centre for Ganga River Basin Management and Studies (cGanga) was established in the year 2016 as a comprehensive think-tank for river restoration and to assist the National Mission for Clean Ganga (NMCG), Jal Shakti Ministry, GoI, for "continual scientific support in the implementation and dynamic evolution of the Ganga River Basin Management Plan" for conservation of National River Ganga. In keeping with this goal, cGanga has been actively developing detailed knowledge capsules, tools and procedures to enable comprehensive and early rejuvenation of the Ganga river network across the whole basin. While a river basin approach is essential for analyzing and comprehending the Ganga river's status and needs to regain her wholesomeness, the implementation strategies of the required interventions must keep in mind the role and individuality of each State. Thus, it is necessary to focus on state-level sub-strategies of natural resource management for holistic revival of River Ganga.

The present document attempts to provide a comprehensive picture of the Ganga river network that entirely covers the State of Uttarakhand. This River Atlas for the state was created entirely by cGanga, with original mapping of all identifiable rivers of the state, and with selective additional information culled from different sources for completeness. Many of the rivers and maps given here are not readily available elsewhere, and we expect them to prove useful to the many Central, State and other organisations engaged in river, water or natural resource management in the state.

In preparing this document dedicated members of cGanga spent a lot of time in diligently studying, analysing, acquiring and compiling diverse information from diverse sources. Many people and organisations outside cGanga also helped in its preparation, which aided in its comprehensiveness. We are grateful to one and all of them.

VINOD TARE
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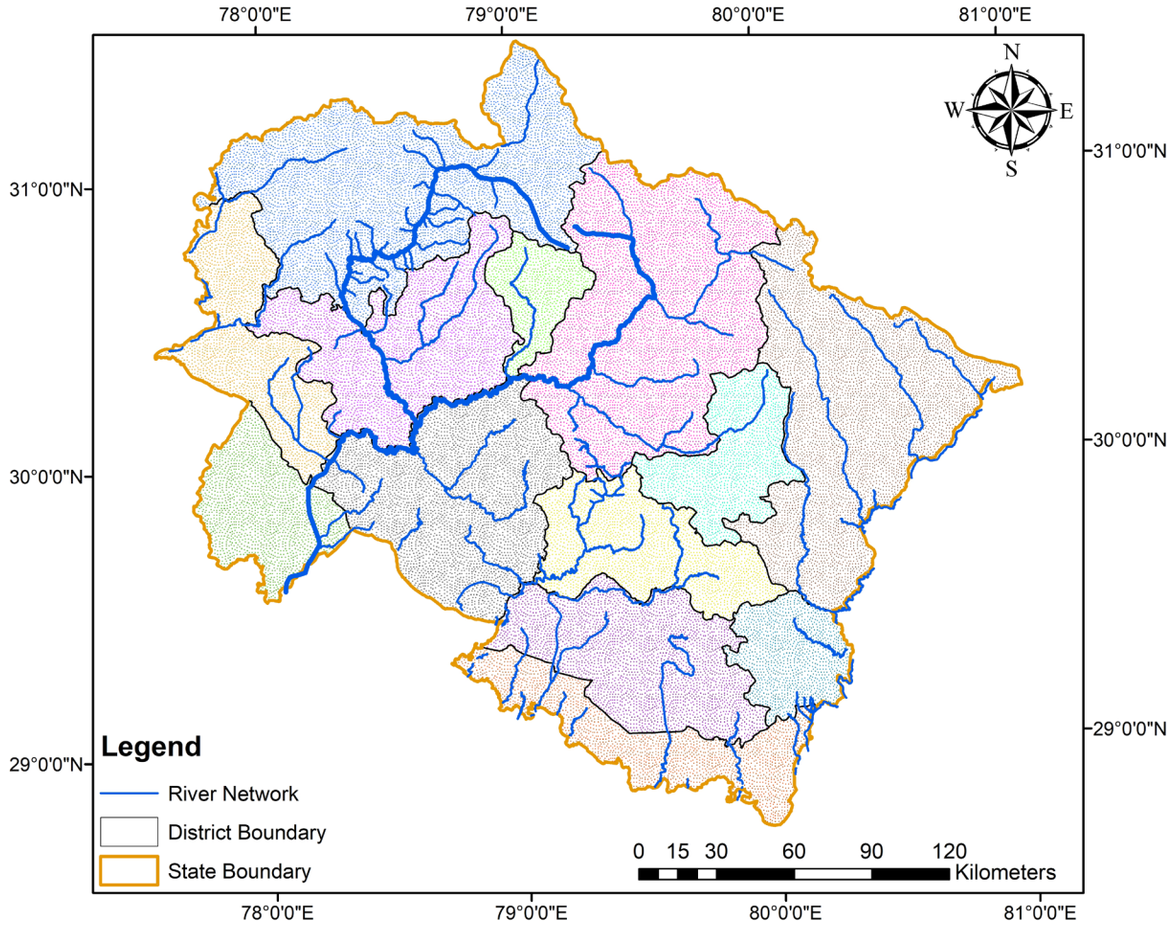
CONTENTS

ACRONYMS AND ABBREVIATIONS

BCM	:	Billion Cubic Meter
cGanga	:	Centre for Ganga River Basin Management and Studies
Cumec	:	Cubic meter per second
CWC	:	Central Water Commission
DEM	:	Digital Elevation Model
GIS	:	Geographic Information System
GRBMP	:	Ganga River Basin Management Plan
HE	:	Hydroelectric
JPVL	:	Jaiprakash Power Ventures Ltd
Km	:	Kilometer
L & T	:	Larsen and Toubro
LULC	:	Land Use/ Land Cover
m	:	Meter
MCM	:	Million Cubic Meter
mm	:	Millimeter
MW	:	Mega Watt
NHPC	:	National Hydroelectric Power Corporation
SoI	:	Survey of India
Sq. Km.	:	Square Kilometer
SWAT	:	Soil & Water Assessment Tool
THDC	:	Tehri Hydro Development Corporation
UJVNL	:	Uttarakhand Jal Vidyut Nigam Ltd
UK	:	Uttarakhand

INTRODUCTION

The state of Uttarakhand nestled in the Western Himalayas is unique for its mountainous terrain, temperate to freezing climate, verdant greenery, rich wildlife, speeding rivers, and opulent lakes and springs. The present volume is a first attempt to map the rich river network of Uttarakhand in as fine a detail as possible. Much of the information contained in this River Atlas is not available in any other document and was created in original from available earth images with appropriate data and image processing tools and software on GIS platform. Naturally, there may be shortcomings in some of the maps herein, including missing small streams, which can be expected to be duly refined and included in later versions. Also, a river atlas is often useful in conjunction with other natural resource and anthropogenic information such as the distribution of rainfall and other climatic data, other waterbodies, forest cover, elevations, soil types, other physiographic information, land use, tourist and pilgrimage centres, and infrastructure including roads and highways. Such other relevant information are also expected to be processed, assembled and included later in a fuller version of this Atlas. In the meanwhile, it is hoped that this Atlas will provide a useful window to Uttarakhand's river resources.

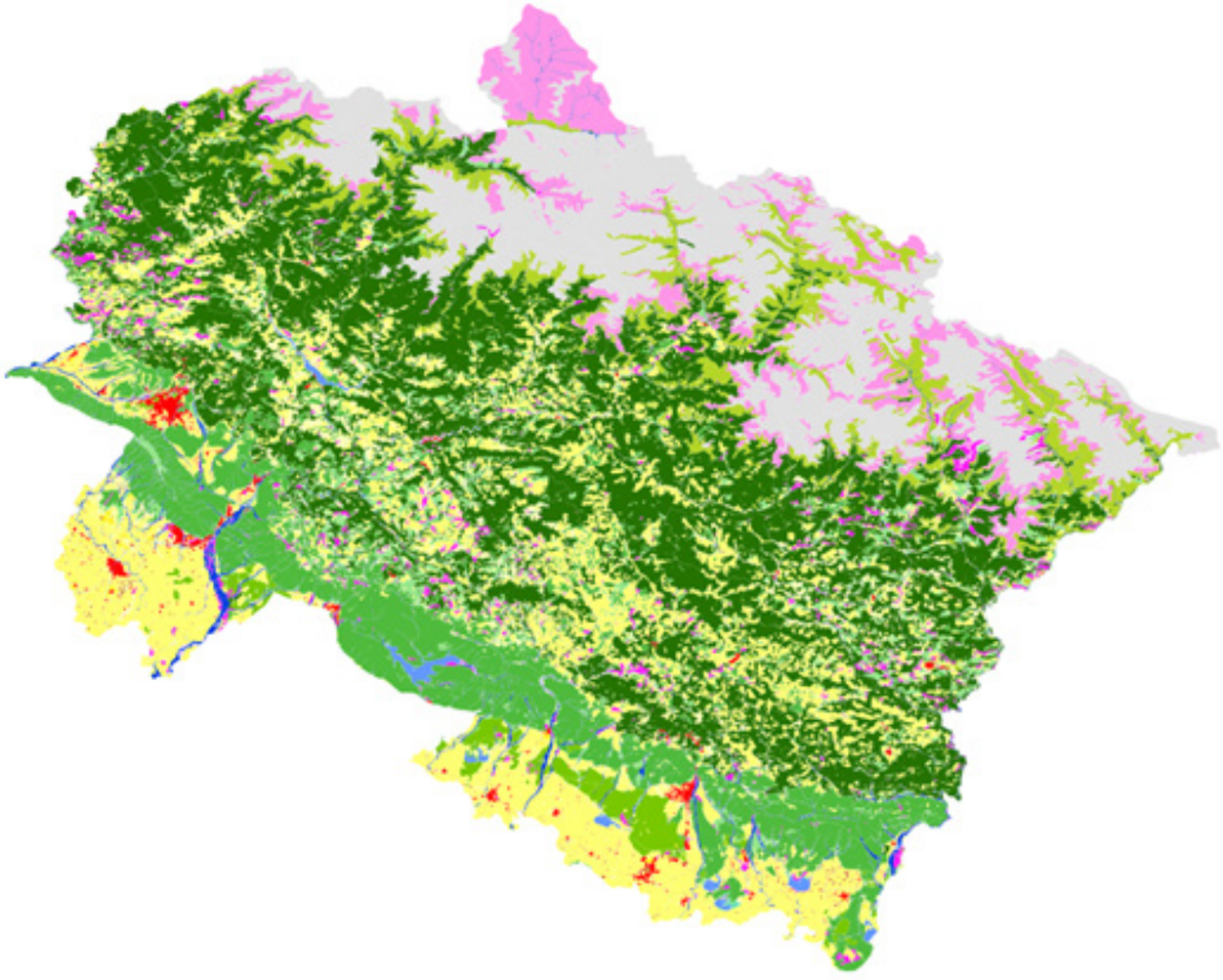


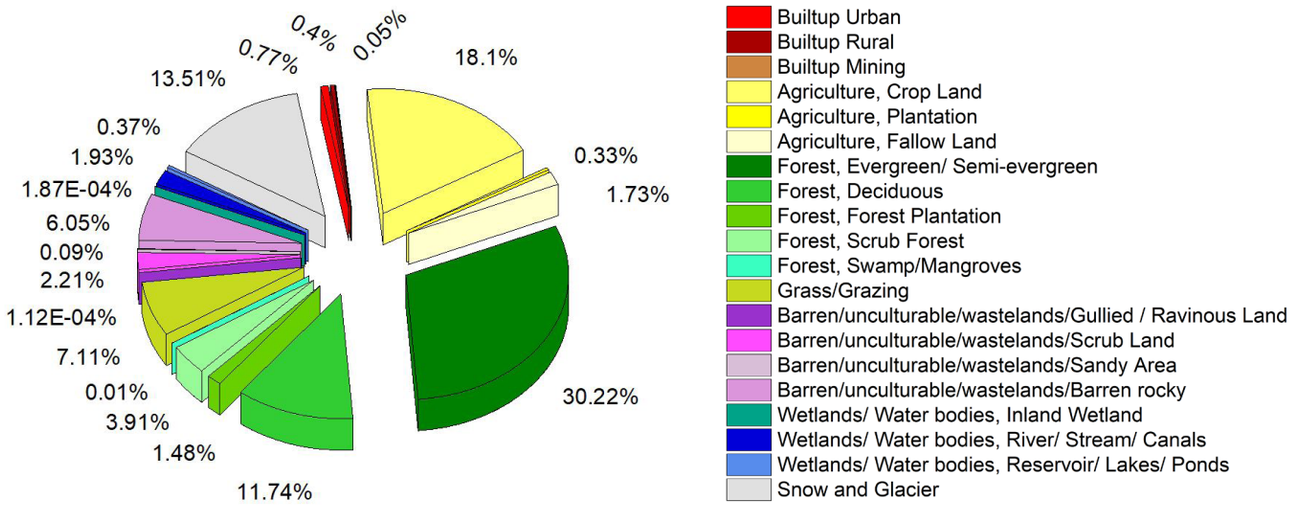
Uttarakhand districts and river network

UTTARAKHAND: SALIENT FEATURES

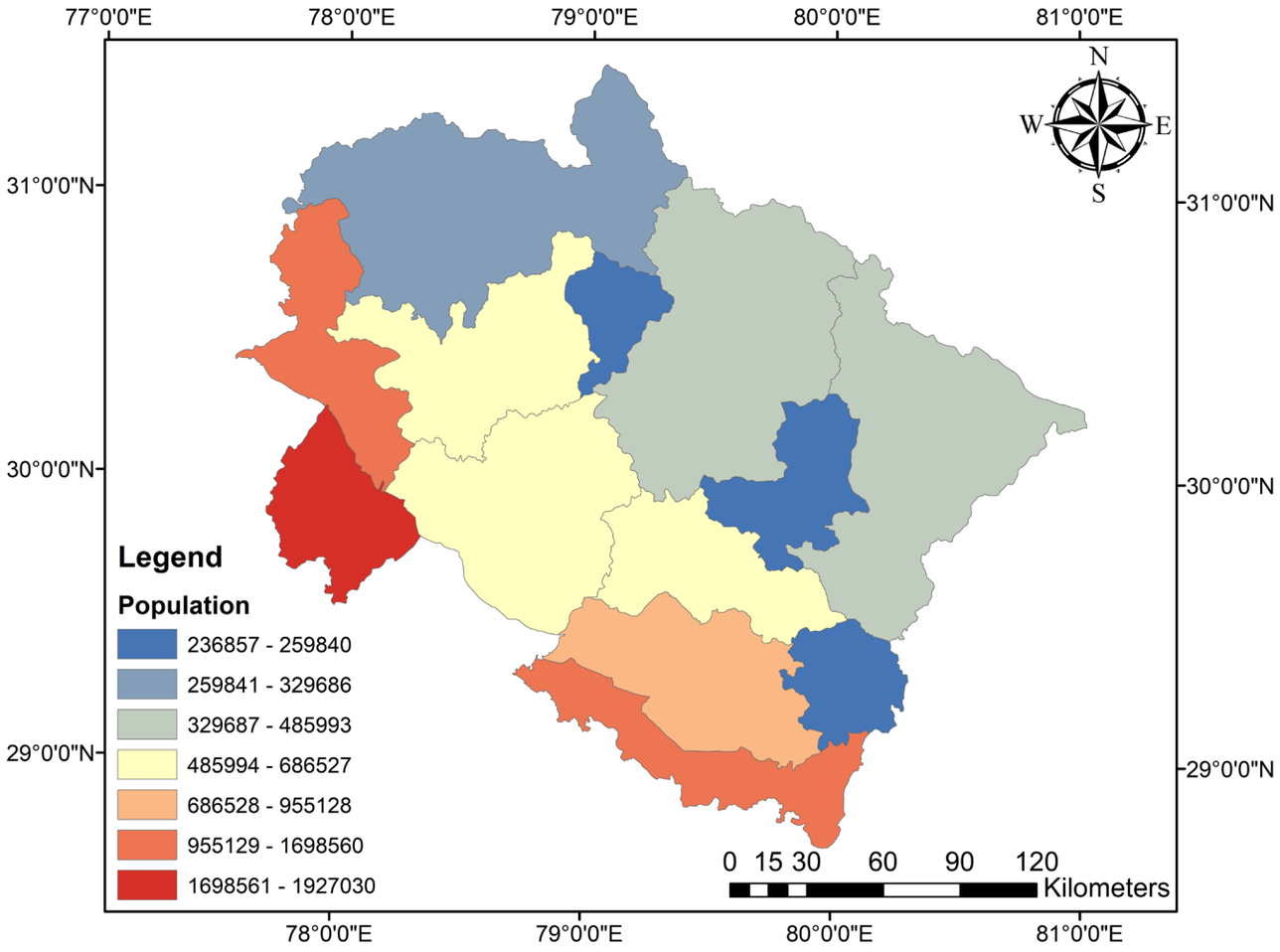
S No	Particulars	Details
1	State Extent	Latitude: 28° 43′ & 31° 27′ N and Longitude: 77° 34′ & 81° 02′ E
2	Total Geographical Area (sq. km.)	53,483
2.1	Hill Area (Reference Year 2018) (sq. km.)	46,035
2.2	Plain (Reference Year 2018) (sq. km.)	7,448
3	Forest Area (Reference Year 2018) (sq. km.)	30,000
4	Area contributing to Ganga Basin (sq. km.)	53,483
5	Percentage area contributing to Ganga Basin (%)	6.2
6	Districts (Census 2011)	13
7	Towns (Census 2011)	(Class I: 06; Class II: 06; Class III: 19; Class IV: 33; Class V: 37; Class VI: 15)
8	Total Population (Census 2011)	10,086,292
9	Percentage population contribution in Ganga Basin	2.05
10	Gram Panchayats	7,954
11	Census Villages (Census 2011)	16,793
12	Average Annual Rainfall (mm)	1,631
13	Average Temperature Range (°C)	-3.4 – 40.8
14	Major Rivers (Inter and Intra-state)	Inter State Rivers: Ganga, Yamuna, Ramganga, Sharada/Ghaghara Intra State Rivers: Alaknanda, Bhagirathi, Bhilangana, Pinder, Nandakini, Mandakini, Saraswati, Rawasan, Malin, Nayar, Rishiganga, Dhauliganga
15	Number of Major Basins (4th or above order river basins)	07
16	Number of Water Resources Structures	(Dams: 15, Barrages: 15, Weir: 03, Anicuts, Lifts, Power houses)
17	Highest Dam	Tehri Dam: 260.5 m
18	Longest Dam	Nanak Sagar Dam: 19,200 m
19	Highest Barrage	Banbassa Barrage: 603.5 m
20	Longest Barrage	Asan Barrage: 395.95 m
21	Total Storage Capacity of Projects (MCM/BCM) (Completed and Under Construction Projects)	--
22	Number of HE Projects (> 25 MW)	19
23	Number of Ground Water Observation wells	167
24	Number of CWC Sites	31
25	Water Tourism and Water Sports Sites	Sattal, Rishikesh, Champawat, Munsiyari, Naukuchiatal, Tehri Lake, Fun Valley etc.

Land Use/ Land Cover: (Source: Resourcesat-2 LISS III Multi-temporal Satellite Data is used for year 2015-16 to produce LULC map by NRSC, Hyderabad)





Uttarakhand District-wise Demography Map
(Source: Office of the Registrar General & Census Commissioner, Ministry of Home Affairs, India)



UK DISTRICT: AREA, POPULATION, RIVERS

S No	District	Area (sq. km.)	Population (Census 2011)	Growth Rate (%)	Population Density	Rivers
1	Haridwar	2,360	1,890,422	30.63	801	Ganga, Saloni, Piti, Rawasana, Kotwali Rao
2	Dehradun	3,088	1,696,694	32.33	549	Ganga, Yamuna, Tons, Asan, Kharasot, Chandrabhaga, Song, Binj Rao, Bindal Rao, Pabbar
3	Udham Singh Nagar	2,542	1,648,902	33.45	649	Garra, Fica, Dhela, Saryu, Kosi
4	Nainital	4,251	954,605	25.13	225	Kosi, Dhela
5	Pauri Garhwal	5,329	687,271	-1.41	129	Ganga, Alaknanda, Ramganga, Rawasan, Malin, Palain, Bhagirathi, Mandal, Pashchimi Nayar, Hiyuni, Machlad, Pawai Gad, Bhairam, Khoh, Bhainsgadhi
6	Almora	3,144	622,506	-1.28	198	Ramganga, Saryu, Gomati, Pinar, Tarag Gadhera, Gagas, Kosi
7	Tehri Garhwal	3,642	618,931	2.35	170	Ganga, Bhagirathi, Dharamganga, Bhilangana, Aglar, Alaknanda, Badiyar Gad, Bal Ganga, Assi Ganga, Chandrabhaga, Hiyuni, Song, Yamuna, Khara Sot
8	Pithoragarh	7,090	483,439	4.58	68	Ramgar, Saryu, Gomati, Kosi
9	Chamoli	8,030	391,605	5.74	49	Alaknanda, Pindar, Ramganga, Nandakini, Birahiganga, Rishiganga, Dhauliganga, Laxman Ganga, Juma Gad, Duii Gadhera, Kalpa Ganga, Semkora, Pai Gadhera, Bal Khila River, Bani Gad, Chufala Gad, Mola Gad, Karni Gadhera, Jetha Gad, Nagal Gad, Kail Ganga, Pranmati, Chor Gad, Simlin Gad, Khuna Gad, Sari Gad, Ghurgut, Maigur Khansar
10	Uttarkashi	8,016	330,086	11.89	41	Bhagirathi, Yamuna, Tons, Sian Gad, Assi Ganga, Syansu Gad, Hiyuni
11	Bageshwar	2,241	259,898	4.18	116	Saryu, Gomti, Pindar, Ramgar, Kaphni Gad, Sunderdhunga, Baura Gad
12	Champawat	1,766	259,648	15.63	147	Saryu, Sarda, Panar, Lohawati, Ladhiya, Kalounia, Machlad, Ramgar
13	Rudraprayag	1,984	242,285	6.53	122	Alaknanda, Mandakini, Lastar Gad, Markandaganga, Mandakiniganga, Kaliganga, Vasukiganga, Madhya Maheshwar Ganga, Lan Gad, Basti Daamar Gad, Chak Gad, Khuna Gad

Magical views of landscape of Bhagirathi River near Tehri Dam, Chamba, Uttarakhand, India. Tehri Dam is the highest dam in India. Green mountains

MAJOR RIVER BASINS OF INDIA AS LISTED BY CWC

Basin Code	Basin Name
1	Indus (Up to Indian Border)
2a	Ganga
2b	Brahmaputra
2c	Barak and others
3	Godavari
4	Krishna
5	Cauvery
6	Subernarekha
7	Brahmani and Baitarni
8	Mahanadi
9	Pennar
10	Mahi
11	Sabarmati
12	Narmada
13	Tapi
14	West flowing rivers from Tapi to Tadri
15	West flowing rivers from Tadri to Kanyakumari
16	East flowing rivers between Mahanadi and Pennar
17	East flowing rivers between Pennar and Kanyakumari
18	West flowing rivers of Kutch and Saurashtra including Luni
19	Area of inland drainage in Rajasthan
20	Minor rivers draining into Myanmar (Burma and Bangladesh)

Source: River Basin Atlas of India, Ministry of Water Resources, GoI (October 2012)

Source: River Basin Atlas of India, Ministry of Water Resources, GoI (October 2012)

MAJOR DAMS ON RIVER GANGA AND HER TRIBUTARIES IN UTTARAKHAND

S. No.	State	District	Name	Latitude	Longitude	River	Status	Type	Length (m)	Max ht abv foundation	Yr start	Yr comp	Total vol (cumec)	Design flood (cumec)	Purpose
1	Uttarakhand	Udham Singh Nagar	Dhora Dam	28.93	79.58	Kiccha	Completed	Earthen	9610	14.63		1960		549	Irrigation
2		Udham Singh Nagar	Nanak Sagar Dam	28.95	79.83	Deoha	Completed	Earthen	19200	16.5		1962	209690	1600	Irrigation,Drinking / Water Supply
3		Udham Singh Nagar	Baur Dam	29.13	79.30	Kakrala	Completed	Earthen	9500	17.98		1967	8252	1416.43	Irrigation
4		Udham Singh Nagar	Baigul Dam	28.88	79.63	Baigul and Sukhi	Completed	Earthen	15300	13.7		1968	85000	567	Irrigation
5		Udham Singh Nagar	Tumaria Dam	29.32	78.93	Phika	Completed	-	10000	15.29		1970	2024		Irrigation
6		Dehradun	Ichari Dam	30.61	77.79	Tons	Completed	Gravity & Masonry	155	59.25		1972	181.9	13500	Hydroelectric
7		Garhwal	Ramganga Dam	29.52	78.76	Ramganga	Completed	Earthen	630	127.5	1961	1974	10000	12121	Hydroelectric, Irrigation
8		Udham Singh Nagar	Haripura Dam	29.11	79.33	Bhakhara	Completed	Earthen	7980	10.98		1975	2546	878.18	Irrigation
9		Nainital	Bhimtal Dam	29.34	79.56		Completed	Gravity & Masonry	137	16.16		1883		45	Irrigation
10		Uttarkashi	Maneri Dam	30.73	78.52	Bhagirathi	Completed	Gravity & Masonry	127	39		1984	13.7	7500	Hydroelectric
11		Tehri Garhwal	Tehri Dam	30.38	78.48	Bhagirathi	Completed	Earthen / Gravity & Masonry	575	260.5		2005	27980	15540	Hydroelectric, Irrigation
12		Pithoragarh	Dhauliganga Dam	29.97	80.57	Dhauli-ganga	Completed	Rockfill		56		2005	980		Hydroelectric
13		Tehri Garhwal	Koteshwar Dam	30.26	78.49	Bhagirathi	Completed	Gravity & Masonry	300.5	97.5		2011-12	560	13240	Hydroelectric
14		Dehradun	Lakhwar Dam	30.51	77.94	Yamuna	Under Construction	Earthen / Gravity & Masonry	451	204			4166	8000	Hydroelectric, Irrigation
15		Nainital	Jamrani Dam	29.27	29.27	Gola/ Gaula	Proposed	Gravity & Masonry	465	130.6				4200	Irrigation

Source: http://india-wris.nrsc.gov.in

MAJOR BARRAGES AND WEIRS ON RIVER GANGA AND HER TRIBUTARIES IN UTTARAKHAND

S No	State	District	Name	Type	River	Nearest City	Status	Yr_ Commensemt	Completion Year	Length (m)	Height upto Crest (m)	Pond level (m)	Design flood discharge (cumec)	Purpose
1	Uttarakhand	Champawat	Banbasa	Barrage	Sarada	Khatima	Completed	1921	1928	603.5	9.146	223.11	19821	
2		Udham Singh Nagar	Kiccha	Barrage	Kiccha	Kichha	Completed	1962	1964	91.25		202.23	1982.18	
3		Dehradun	Asan	Barrage	Asan	Dehradun	Completed	1965	1976	281.25	395.95	401.5	4500	
4		Dehradun	RishiKesh	Barrage	Ganga	Dehradun	Completed		1980	312	11.5	337	13200	
5		Hardwar	Bhimgoda	Barrage	Ganga	Haridwar	Completed	1982	1986	453.5		293.7	193000	
6		Champawat	Tanakpur	Barrage	Sarada	Khatima	Completed		1992	475.3	22.5	246.7	19824	
7		Chamoli	Vishnu Prayag	Barrage	Alaknanda	Joshimath	Completed		2006	63	17	2275	65	
8		Uttarkashi	Joshiyara	Barrage	Bhagirathi	Bhatwari	Completed		2007	81	39	1108		
9		Dehradun	Bhatta	Weir	Bhatta	Dehradun	Completed			21.5		1370.5		
10		Almora	Dhela	Barrage	Dhela	Ranikhet	Completed			140.78		258.93	1048	
11		Nainital	Gola	Barrage	Gola	Nainital	Completed			81	4.2	510.75	3250	
12		Dehradun	Katha Pathar	Barrage	Yamuna	Dehradun	Proposed			196	8	514	8000	
13		Udham Singh Nagar	Katna	Weir	Katna	Govindpur	Completed							Irrigation
14		Nainital	Kosi	Barrage	Koshi	Kashipur	Completed			138.5		351.8	5097	
15		Nainital	Kota Trench	Weir	Dabka	Kashipur				20			482	
16		Udham Singh Nagar	Nangla	Weir	Kiccha		Completed							Irrigation
17		Nainital	Phika	Barrage	Phika	Kashipur	Completed			107.87		262.43	524	
18		Chamoli	Tamak Lata	Barrage	Dhauliganga	Joshimath	Completed			62.5	16	2423	2950	
19		Chamoli	Tapovan Vishnugad	Barrage	Dhauliganga	Joshimath	Completed			113	26	1803.5	4100	

Source: http://india-wris.nrsc.gov.in

MAJOR HYDROELECTRIC PROJECTS ON RIVER GANGA AND HER TRIBUTARIES IN UTTARAKHAND

S No	Project Name	Yr of comm	State	Districts	River	Basin	Hydroelectric Region	Total Installed Capacity (MW)	Type of Project	Hydroelectric Project Status	Purpose	Owner	Owner Name
1	Yamuna Hydroelectric Project	YHES (dakpathar barrage)	Himachal Pradesh, Uttarakhand	Dehradun	Yamuna	Ganga	Northern HE Region	474.75	Major (> 25 MW)	Completed	Hydroelectric	State	UJVNL
2	Dhauliganga Hydroelectric Project	2005	Uttarakhand	Pithoragarh	Dhauli Ganga	Ganga	Northern HE Region	280	Major (> 25 MW)	Completed	Hydroelectric	Central	NHPC
3	Galogi Hydroelectric Project	1907	Uttarakhand	Dehradun	Yamuna	Ganga	North HE Region	3	Small (3-25 MW)	Completed	Hydroelectric	State	UJVNL
4	Garhwal Rishikesh Chilla Hydroelectric Project	Chilla project	Uttarakhand	Pauri Garhwal	Ganga	Ganga	North HE Region	144	Major (> 25 MW)	Completed	Hydroelectric	State	UJVNL
5	Khatima Hydroelectric Project	1955	Uttarakhand	Udham Singh Nagar	Sharda	Ganga	North HE Region	41.4	Major (> 25 MW)	Completed	Hydroelectric	State	UJVNL
6	Koteshwar Hydroelectric Project	2011	Uttarakhand	Tehri Garhwal	Bhagirathi	Ganga	North HE Region	400	Major (> 25 MW)	Completed	Hydroelectric	Central	THDC India ltd
7	Maneri Bhali - I Hydroelectric Project	1984	Uttarakhand	Uttarkashi	Bhagirathi	Ganga	North HE Region	90	Major (> 25 MW)	Completed	Hydroelectric	State	UJVNL
8	Maneri Bhali Stage - II Hydroelectric Project	2008	Uttarakhand	Uttarkashi	Bhagirathi	Ganga	North HE Region	304	Major (> 25 MW)	Completed	Hydroelectric	State	UJVNL
9	Mohammudpur Hydroelectric Project	1952	Uttarakhand	Haridwar	Ganga Canal	Ganga	North HE Region	9.3	Small (3-25 MW)	Completed	Hydroelectric	State	UJVNL
10	Patheri Hydroelectric Project	1955	Uttarakhand	Haridwar	Ganga Canal	Ganga	North HE Region	20.4	Small (3-25 MW)	Completed	Hydroelectric	State	UJVNL

Source: http://india-wris.nrsc.gov.in

S No	Project Name	Yr of comm	State	Districts	River	Basin	Hydroelectric Region	Total Installed Capacity (MW)	Type of Project	Hydroelectric Project Status	Purpose	Owner	Owner Name
11	Ramganga Hydroelectric Project	1975	Uttarakhand	Pauri Garhwal	Ramganga	Ganga	North HE Region	198	Major (> 25 MW)	Completed	Hydroelectric	State	UJVNL
12	Singoli Bhatwari Hydroelectric Project	2020	Uttarakhand	Rudaraprayag	Mandakini	Ganga	North HE Region	99	Major (> 25 MW)	Completed	Hydroelectric	Private	L & T
13	Tanakpur Hydroelectric Project	1992	Uttarakhand	Nainital	Sarda	Ganga	Northern HE Region	120	Major (> 25 MW)	Completed	Hydroelectric	Central	NHPC
14	Tehri Hydroelectric Project	2006	Uttarakhand	Tehri Garhwal	Bhagirathi	Ganga	Northern HE Region	2000	Major (> 25 MW)	Completed	Hydroelectric	Central	THDC
15	Vishnuprayag Hydroelectric Project	2006	Uttarakhand	Chamoli	Alaknanda	Ganga	North HE Region	400	Major (> 25 MW)	Completed	Hydroelectric	Private	JPVL
16	Dhakrani HPS	1965	Uttarakhand	Dehradun	Yamuna	Ganga	North HE Region	33.75	Major (> 25 MW)	Completed	Irrigation	State	UJVNL
17	Dhalipur HPS	1965	Uttarakhand	Dehradun	Yamuna	Ganga	North HE Region	51	Major (> 25 MW)	Completed	Irrigation	State	UJVNL
18	Chibro (Yamuna) HPS	1975	Uttarakhand	Dehradun	Tons	Ganga	North HE Region	240	Major (> 25 MW)	Completed	Irrigation	State	UJVNL
19	Kulhal HPS	1975	Uttarakhand	Dehradun	Asan	Ganga	North HE Region	30	Major (> 25 MW)	Completed	Hydroelectric	State	UJVNL
20	Chilla HPS	1980	Uttarakhand	Dehradun	Ganga	Ganga	North HE Region	144	Major (> 25 MW)	Completed	Hydroelectric	State	UJVNL
21	Khodri HPS	1984	Uttarakhand	Dehradun	Tons	Ganga	North HE Region	120	Major (> 25 MW)	Completed	Hydroelectric	State	UJVNL
22	Srinagar HPS	2015	Uttarakhand	Pauri Garhwal	Alaknanda	Ganga	North HE Region	330	Major (> 25 MW)	Completed	Hydroelectric	State	UJVNL

Source: http://india-wris.nrsc.gov.in

UK: SUMMARY OF HYDROELECTRIC PROJECTS

Overview of Hydroelectric Projects in Uttarakhand									
S No	Basin	Existing Hydro Projects		Under Construction Hydro Projects		Proposed Hydro Projects		Total Hydro Projects	
		No of Projects	Capacity, MW	No of Projects	Capacity, MW	No of Projects	Capacity, MW	No of Projects	Capacity, MW
1	Alaknanda	33	786.97	16	1291.1	74	5199.25	122	6947.32
2	Bhagirathi	13	1851.10	13	1084.75	22	801.9	48	3737.75
3	Ganga Sub-basin	4	173.80	2	1.75	–	–	6	175.55
4	Ramganga	12	210.85	–	–	20	408.5	32	619.35
5	Sharda	28	427.75	8	0.375	48	12022.28	84	12450.405
6	Yamuna	9	478.195	2	0.14	33	2780.85	44	3259.185
	TOTAL	**99**	**3928.665**	**41**	**2378.115**	**197**	**21212.78**	**336**	**27189.56**

Summary of Existing Hydroelectric Projects in Uttarakhand									
S No	Basin	Large Hydro Projects (above 25 MW)		Small Hydro Projects (above 1 - 25 MW)		Mini - Micro Hydro Projects (below 1 MW)		Total Hydro Projects	
		No of Projects	Capacity, MW	No of Projects	Capacity, MW	No of Projects	Capacity, MW	No of Projects	Capacity, MW
1	Alaknanda	2	730	10	54.75	21	2.22	33	786.97
2	Bhagirathi	4	1794	5	56.7	4	0.4	13	1851.1
3	Ganga-Sub basin	1	144	2	29.7	1	0.1	4	173.8
4	Ramganga	1	198	2	11.8	9	1.05	12	210.85
5	Sharda	3	415.6	4	7.7	21	4.45	28	427.75
6	Yamuna	5	474.75	1	3	3	0.445	9	478.195
	TOTAL	**16**	**3756.35**	**24**	**163.65**	**59**	**8.665**	**99**	**3928.67**

Source: http://india-wris.nrsc.gov.in

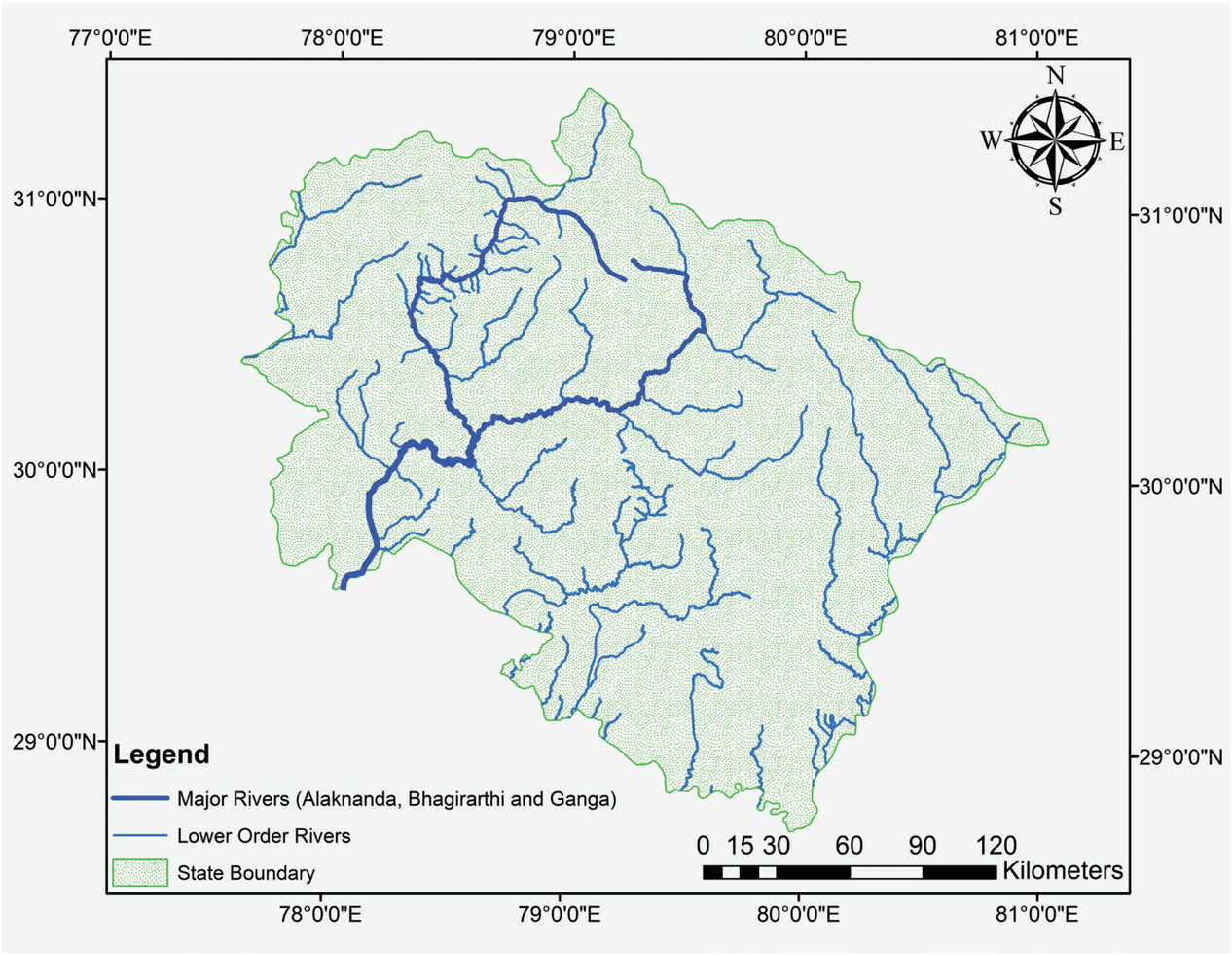
Overview of Proposed Hydropower Projects in Uttarakhand									
S No	Basin	Large Hydro Projects (above 25 MW)		Small Hydro Projects (above 1 - 25 MW)		Mini - Micro Hydro Projects (below 1 MW)		Total Hydro Projects	
		No of Projects	Capacity, MW	No of Projects	Capacity, MW	No of Projects	Capacity, MW	No of Projects	Capacity, MW
1	Alaknanda	29	4823	43	375.6	2	0.65	74	5199.25
2	Bhagirathi	5	675	13	125.5	4	1.4	22	801.9
3	Ramganga	6	314	12	93.5	2	1	20	408.5
4	Sharda	26	11920	16	101.95	6	0.33	48	12022.28
5	Yamuna	17	2670	13	110.3	3	0.55	33	2780.85
	Total	**83**	**20402**	**97**	**806.85**	**17**	**3.93**	**197**	**21212.78**

Source: http://india-wris.nrsc.gov.in

INDIA CURRENTLY has 197 hydropower plants above 25 MW, plus nine pumped storage stations and ranks fifth in the world for potential hydropower capacity. - IHA hydropower status report 2018

UTTARAKHAND STATE AND ITS RIVER NETWORK

Number of rivers- 221 Total Length of rivers- 10,913 km.



Methodology: The method adopted, in brief, to obtain the river network are stepwise as follows:

Step 1 : Tracing of river streams using Google Earth (.kmz file)

Step 2 : Vetting of the stream maps with 30 m resolution DEM generated streams using SWAT. DEM is downloaded from USGS.

Step 3 : Streams' verification from Survey of India (SoI) toposheets.

Step 4 : Post-processing and cleaning of data for preparation of stream network maps.

Step 5 : Preparation of stream network map on GIS platform using ArcMAP 10.5.

Disclaimer: The accuracies of the maps generated by the above method are subject to the limitations of the data processing tools and software used for the particular geographical regions as represented in Google Earth images, and are subject to future refinement.

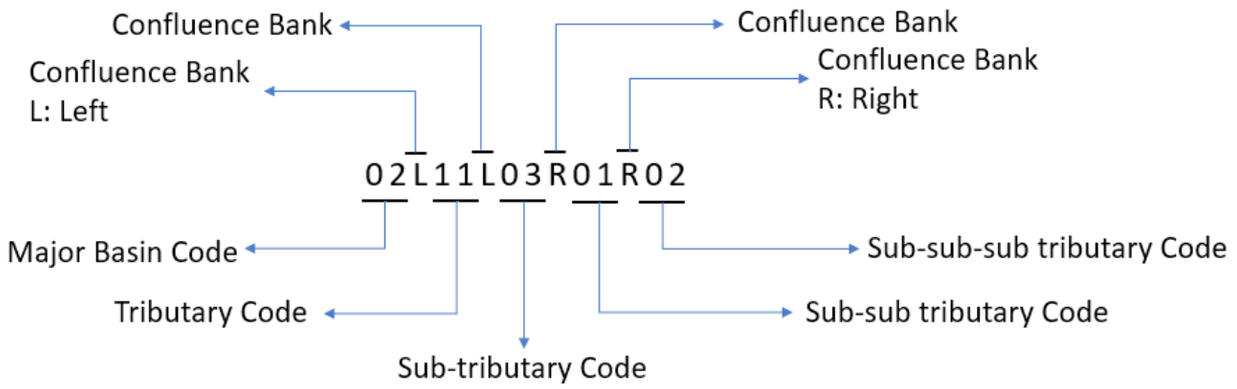
RIVER CODIFICATION SYSTEM

In the present Atlas alphanumeric characters are used for coding the river systems within natural and administrative boundaries. Each sub step in codification system is assigned a digit which reflects the length of the code up to that sub step. The coding has been done for the two different types of compartmentalizing river basins as stated below.

a) Codification system based on natural delineation
b) Codification system based on administrative delineation

The natural delineation approach is better suited to study and understand the basin area as a natural ecological unit while administrative delineation is good for determining specific interventions and fixing responsibilities in the implementation of any project relevant to rivers. Both approaches are important for their own reasons and, therefore, it was decided to develop the codification system for both natural as well as administrative delineations.

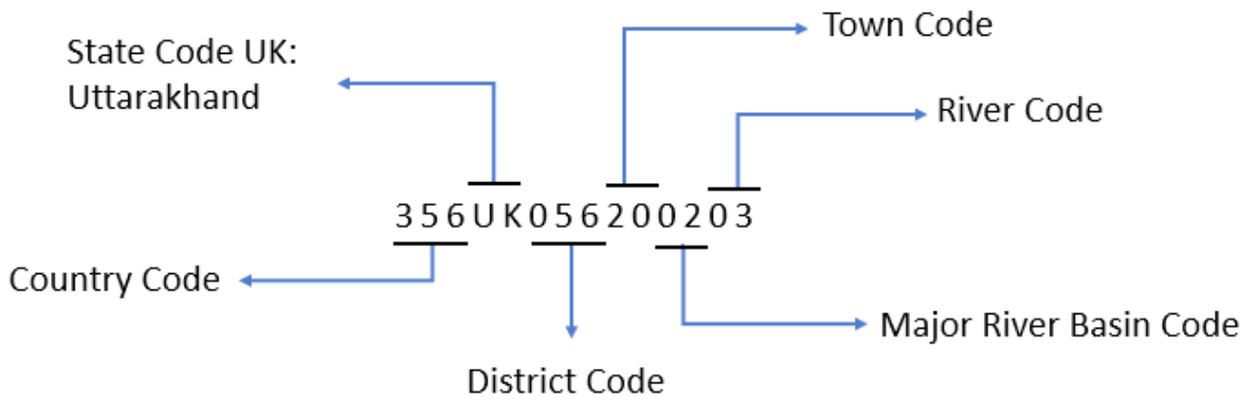
a) Codification system based on natural delineation: In the natural delineation approach, major basin codes given by CWC in River Basin Atlas of India, jointly published by CWC and NRSC, ISRO in October 2012, have been adopted here. These codes are accepted at regional level. In the second step, tributary code is given based on their confluence bank and their sequential number from the origin of the major river. R and L represents Right Bank and Left Bank, respectively, for the confluence bank in this code. For example, L11 in the code represents the 11th tributary (from the head of the major river) joining the major river at the left bank. In steps 3, 4, 5, etc. the same coding procedure as in step 2 is followed for sub-tributaries joining the tributaries and so on. Thus, the code can be extended without any alteration until it reaches down to the lowest order river.



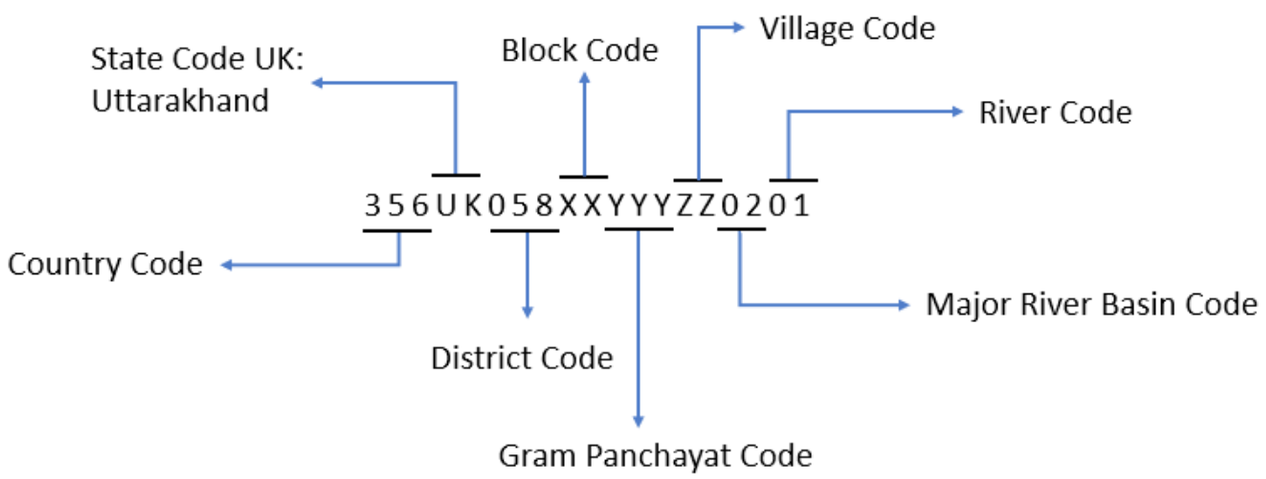
b) Codification system based on administrative delineation: In administrative delineation codes are generated separately for areas coming under urban and rural jurisdictions as further described.

Codification system based on administrative delineation–Urban: In administrative delineation-urban the first 3 digits of the code represent the country code adopted from ISO 3166-1. The next 5 digits give the state code and district code. State code is taken from transportation department

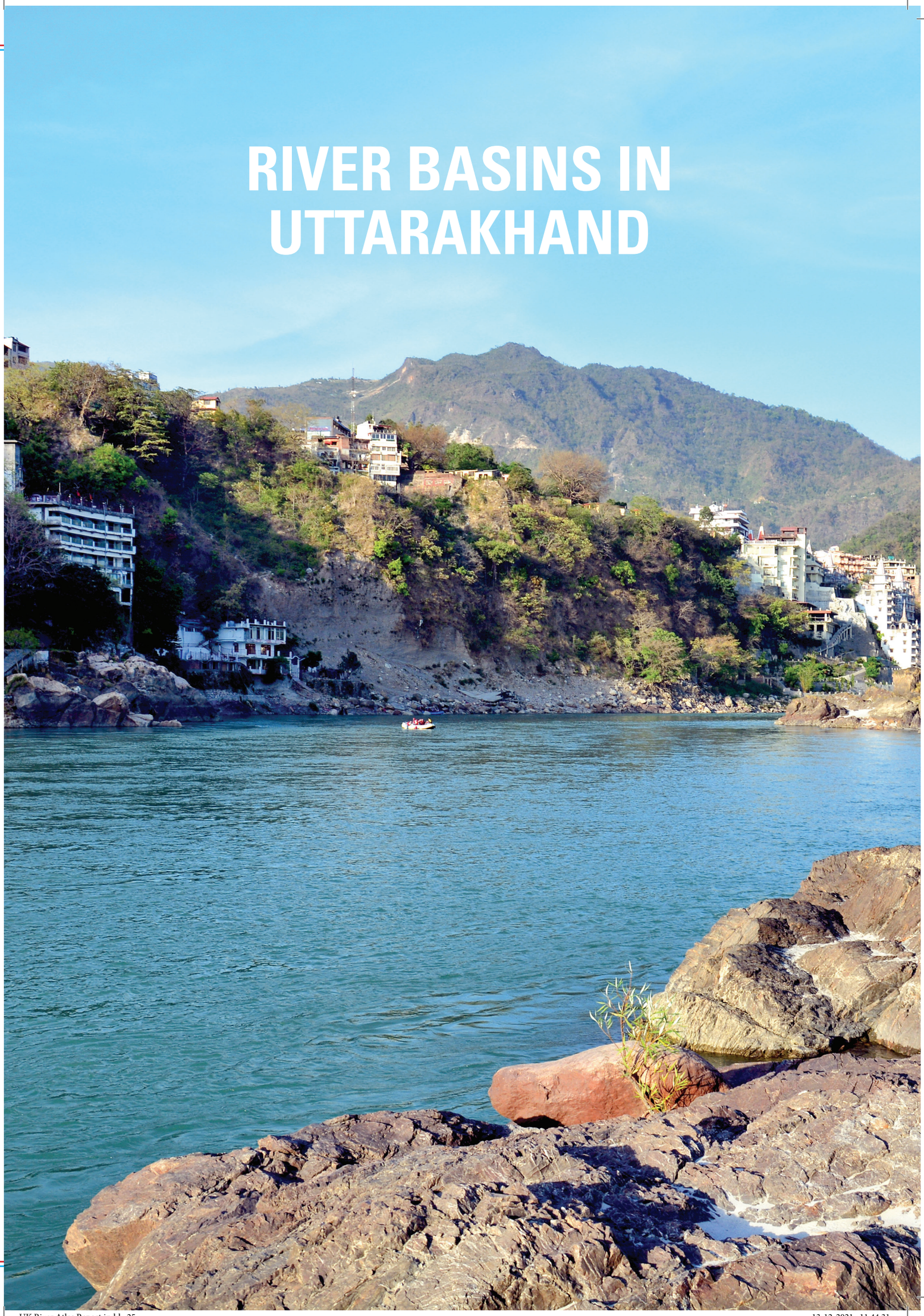
and district code is adopted from Census codes. The next 2 digits represent the town, which adopted from the census town codes. In the next step, 2 digits are assigned for major river basins and the codes are adopted from River Basin Atlas of India given by CWC. The last 2 digits of the code represent the river based on higher to lower river order approach, and if there are more than one river of the same order then code is allotted in alphabetical order.



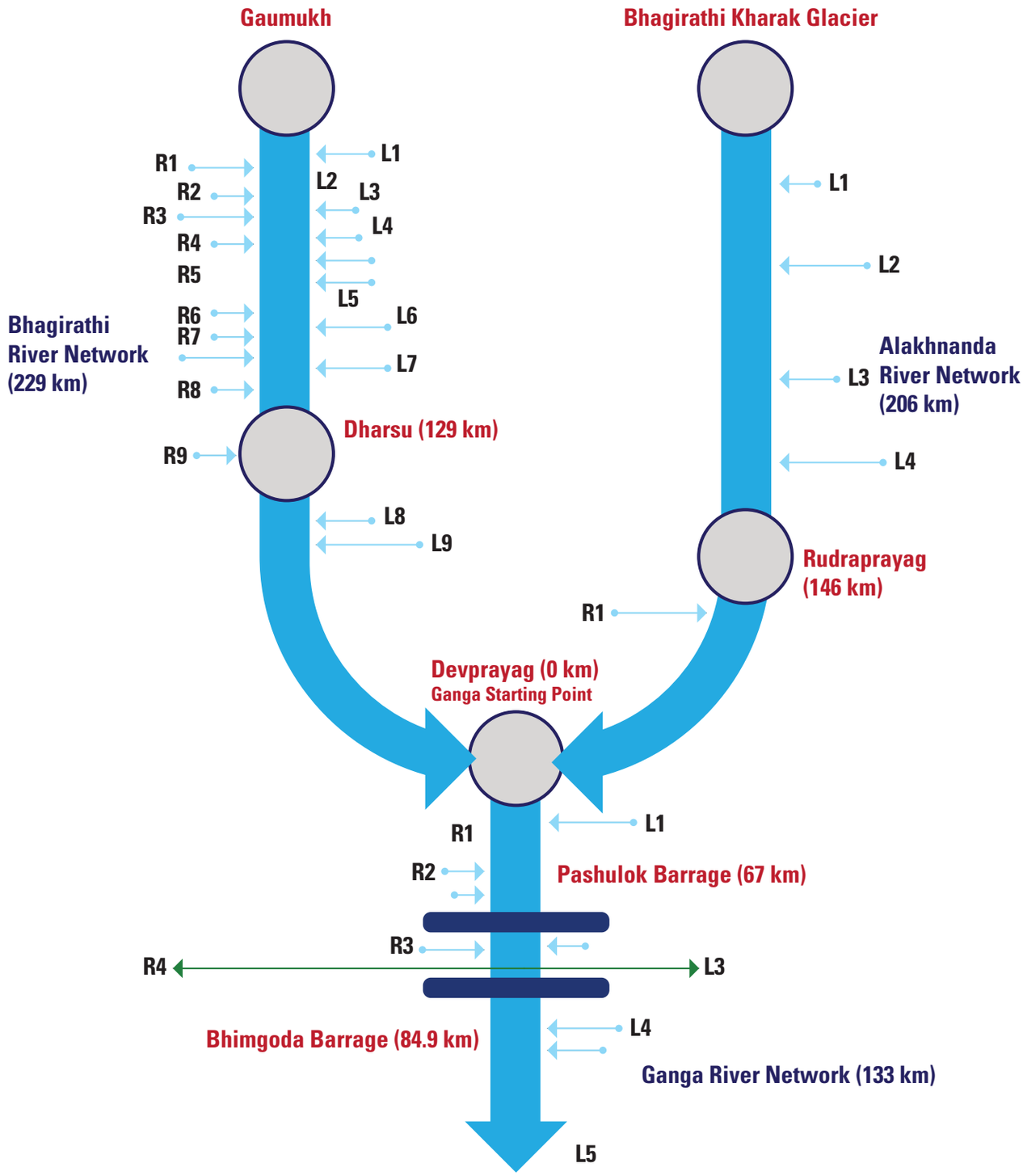
Codification system based on administrative delineation-Rural: In administrative delineation-rural the first 3 digits of the code represent the country code adopted from ISO 3166-1. The next 5 digits give the state code and district code. State code is taken from transportation department and district code is adopted from Census codes. Block, Gram Panchayat and Village codes are further generated based on district codes. In the next step, 2 digits are assigned for major river basin as per the River Basin Atlas of India given by CWC. The last 2 digits of the code represent the river code based on higher to lower river order approach, and if there be more than one river of same order then the code is allotted in alphabetical order.



RIVER BASINS IN UTTARAKHAND



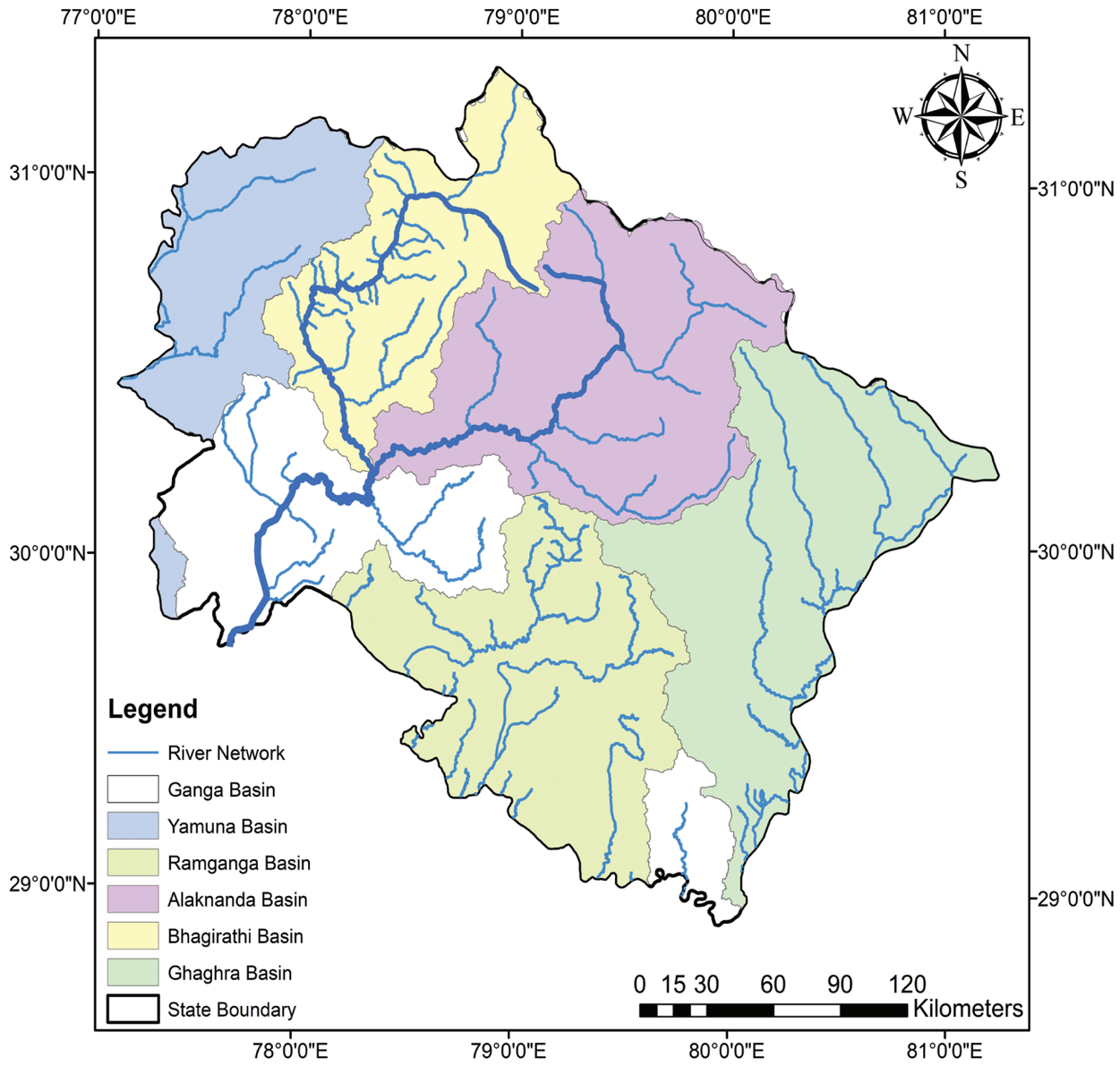
FLOW DIAGRAM: GANGA RIVER NETWORK IN UTTARAKHAND



UTTARAKHAND STATE: MAJOR RIVER BASINS

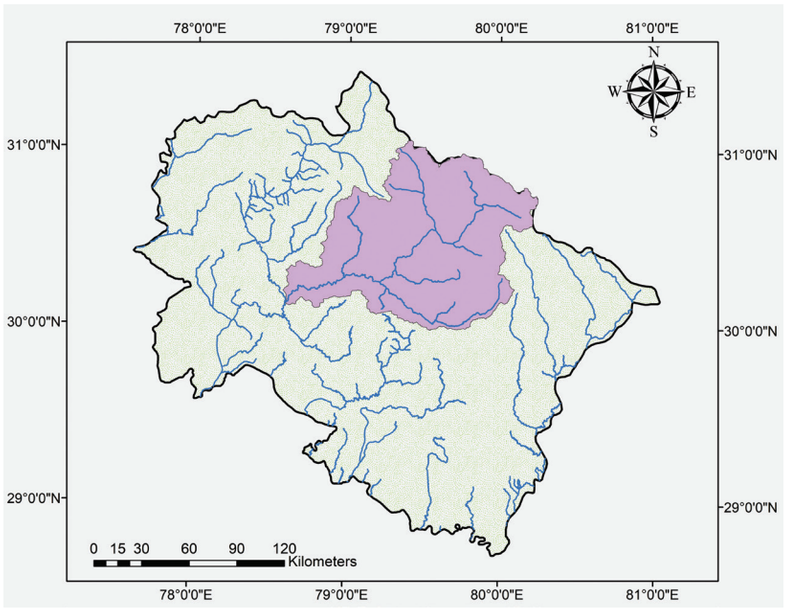
The major river basins of the state are:–

- Alaknanda basin,
- Bhagirathi basin,
- Sharda basin,
- Ramganga basin,
- Ganga basin, and
- Yamuna basin



ALAKNANDA BASIN AND ITS RIVER NETWORK

Alaknanda River UID Code: 02L01
Total length of rivers- 1,817 km.
Number of rivers- 93



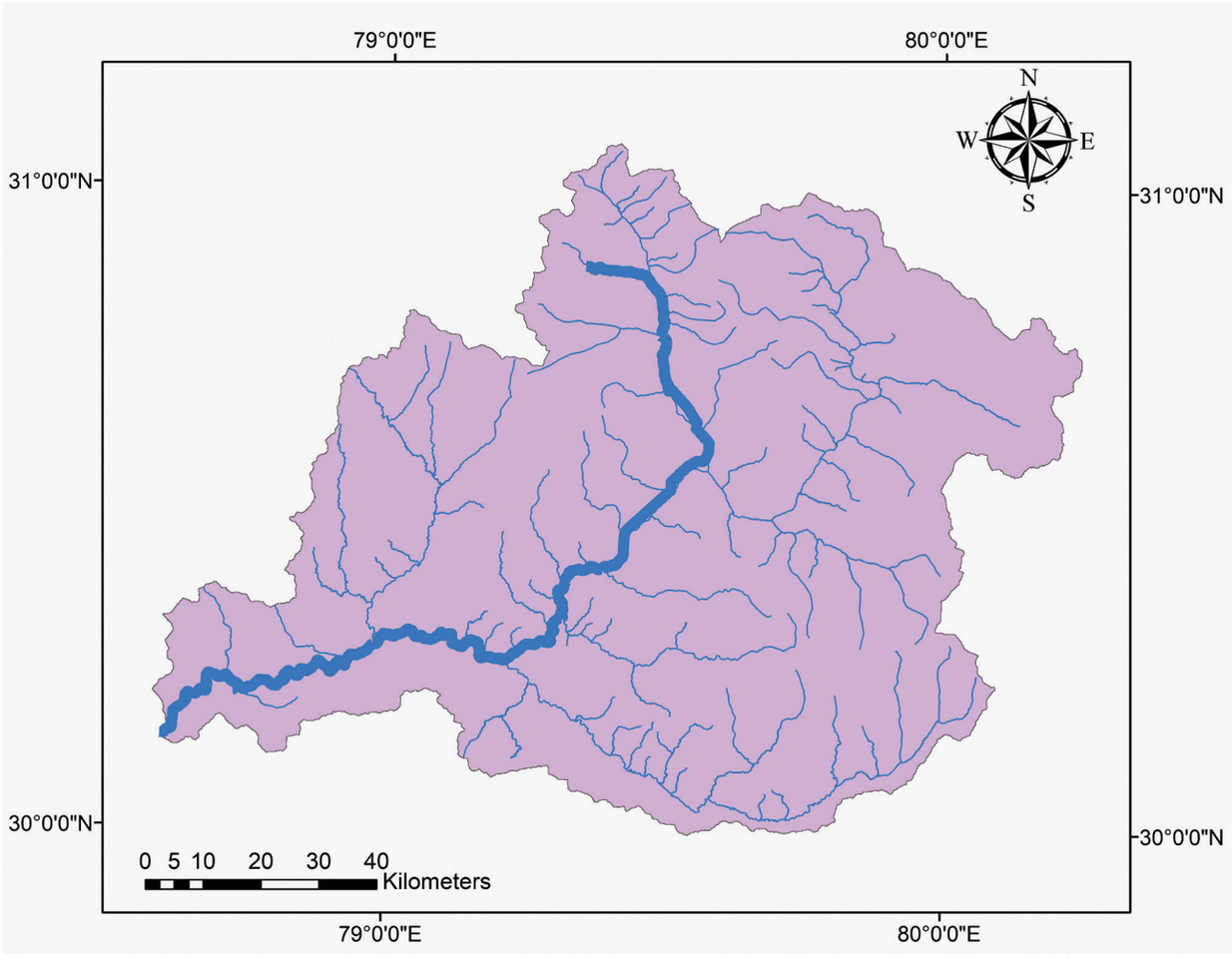
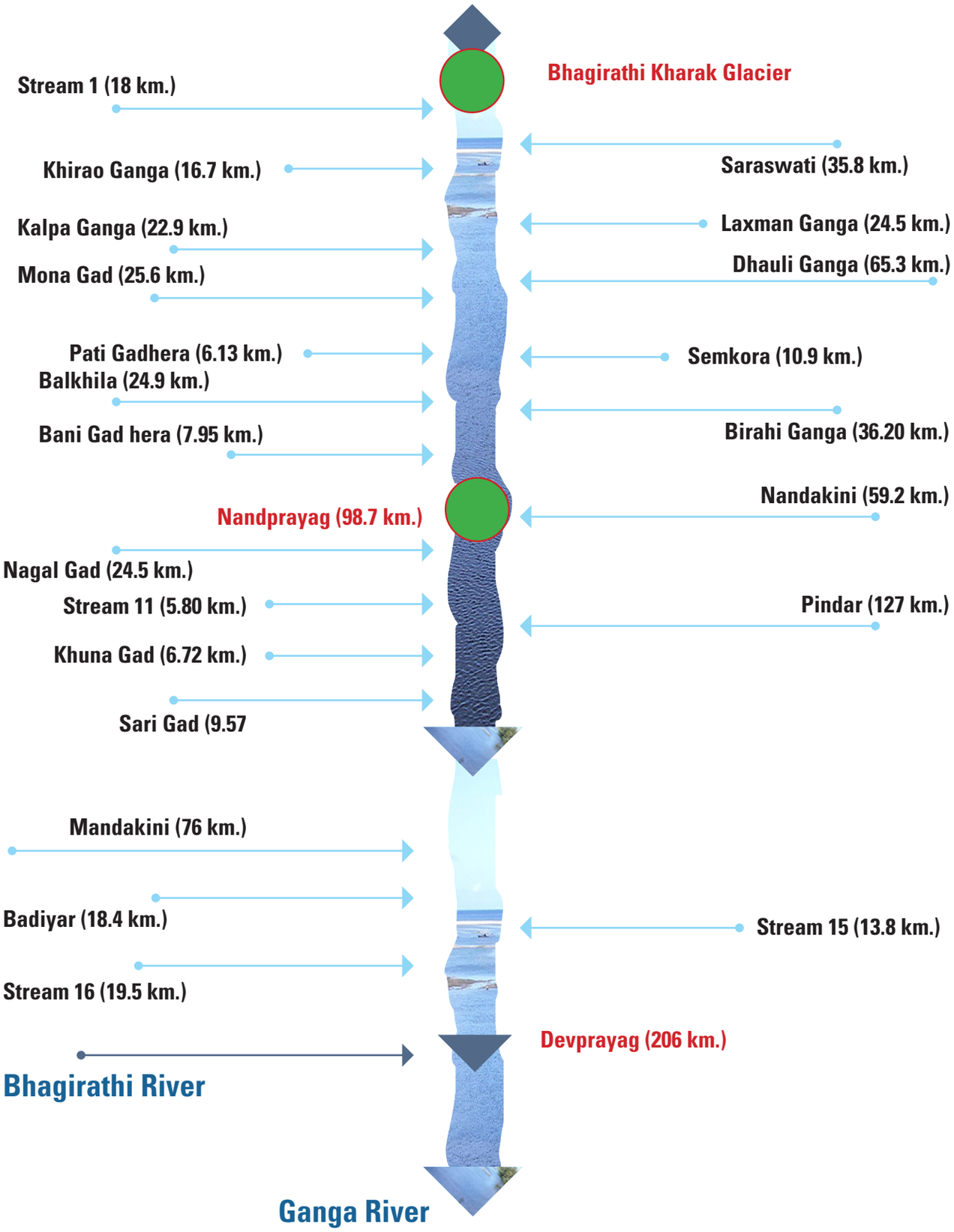


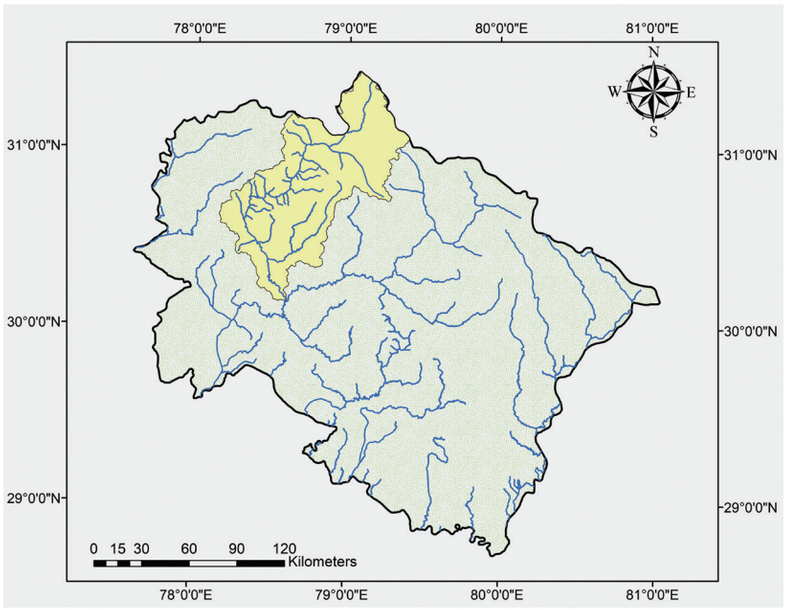
Figure: Alaknanda river network in Uttarakhand

FLOW DIAGRAM: ALAKNANDA RIVER AND HER TRIBUTARIES



BHAGIRATHI BASIN AND ITS RIVER NETWORK

Bhagirathi River UID Code: 02R01
Total length of rivers- 1,132.46 km.
Number of rivers- 48



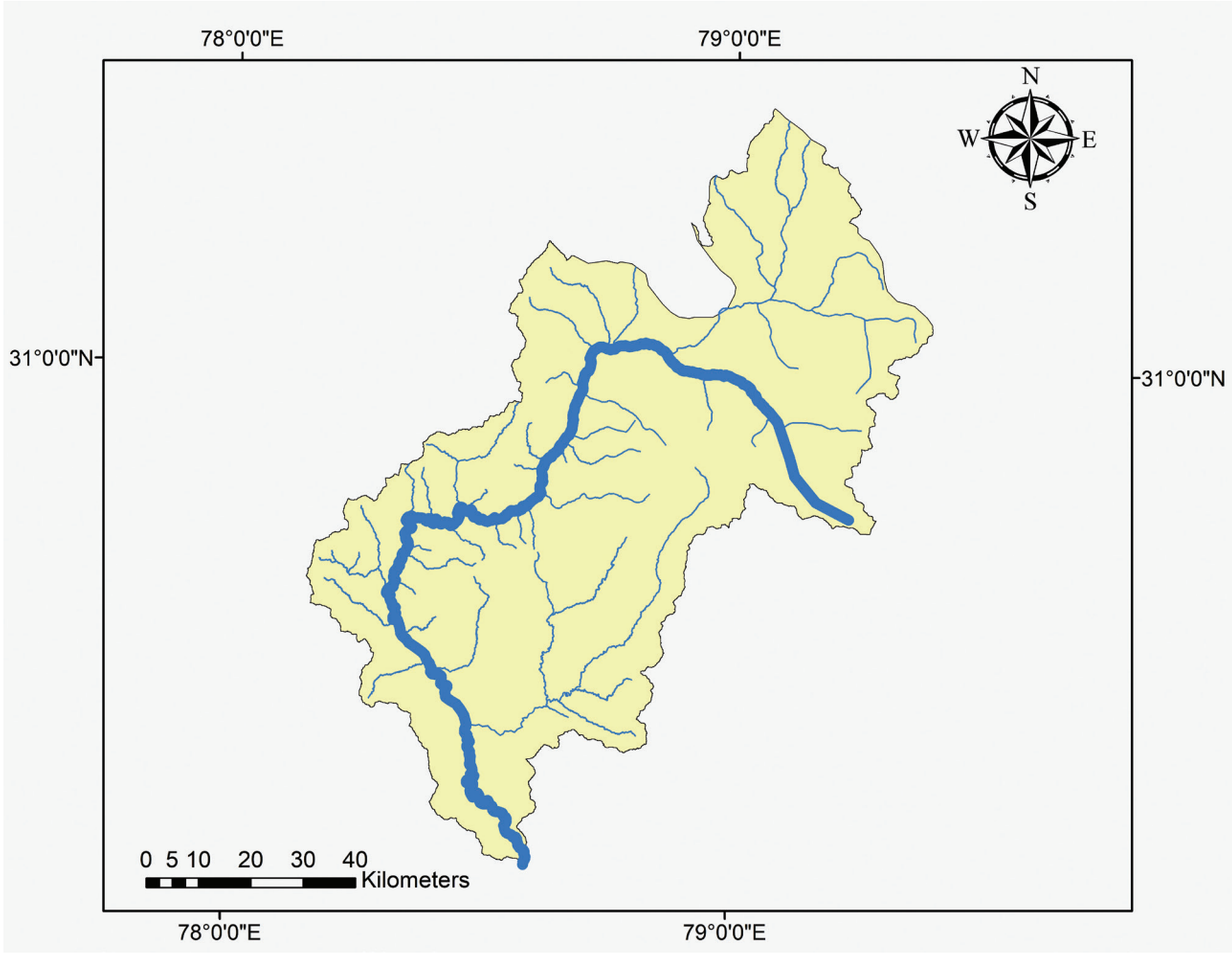
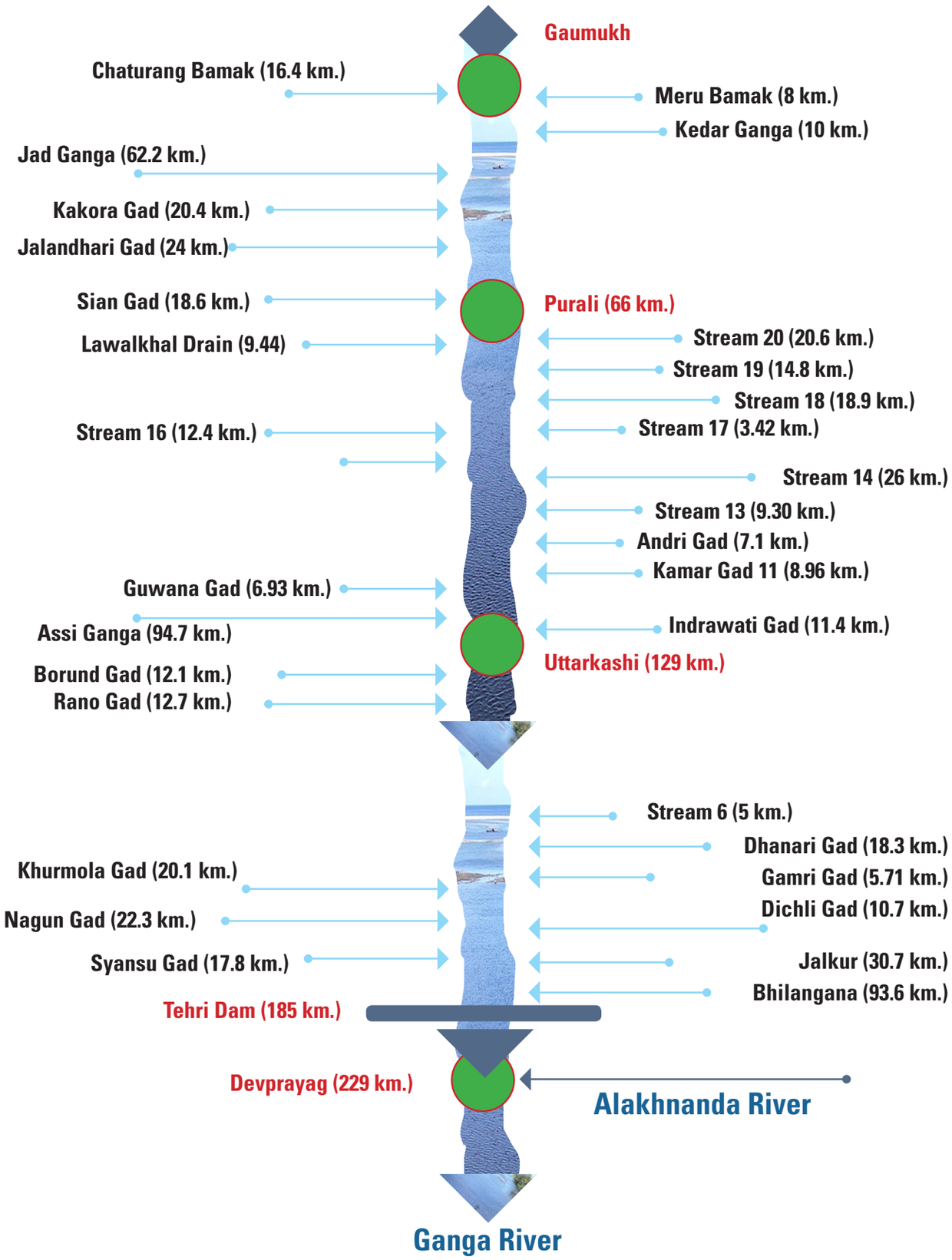


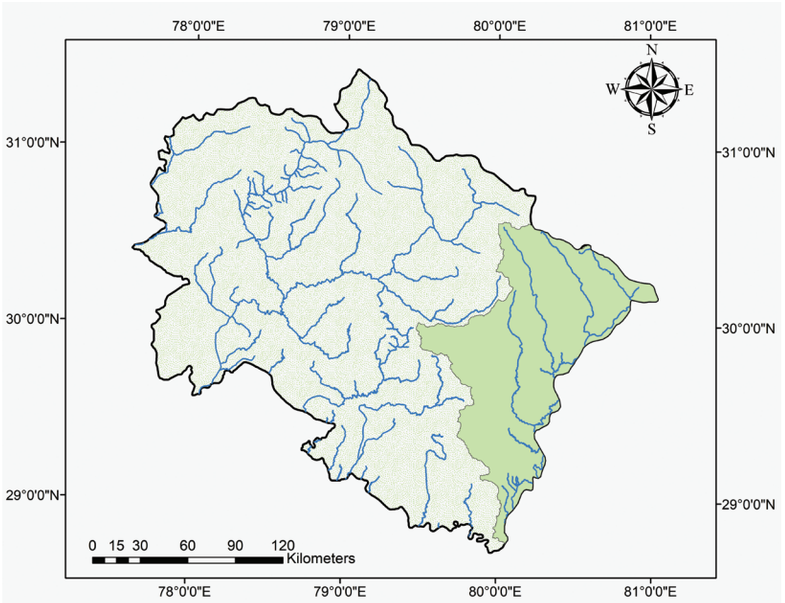
Figure: Bhagirathi river network in Uttarakhand

FLOW DIAGRAM: BHAGIRATHI RIVER AND HER TRIBUTARIES



SHARDA BASIN AND ITS RIVER NETWORK

Sharda River UID Code: 02L49R09
Total length of rivers- 702 km.
Number of rivers- 16



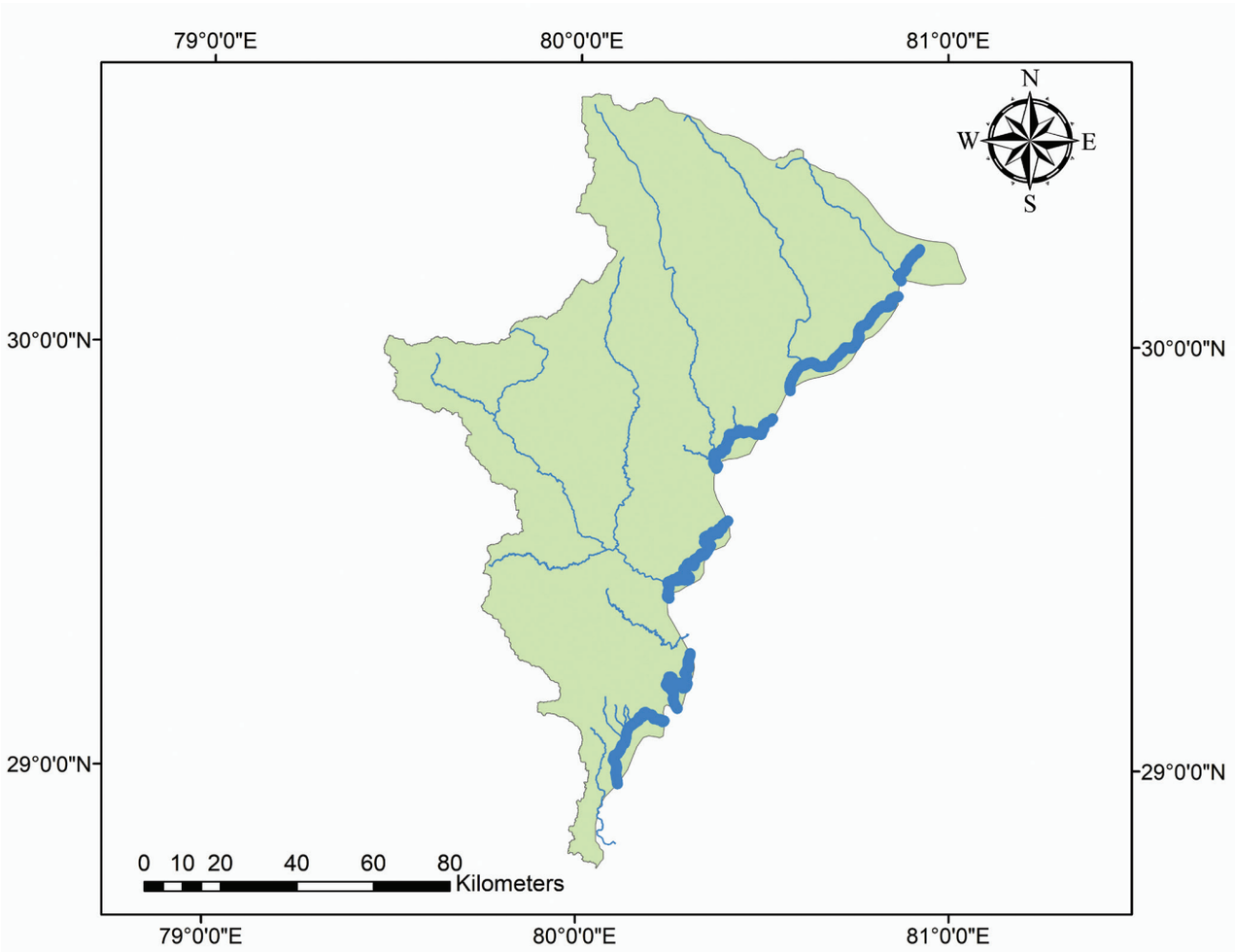
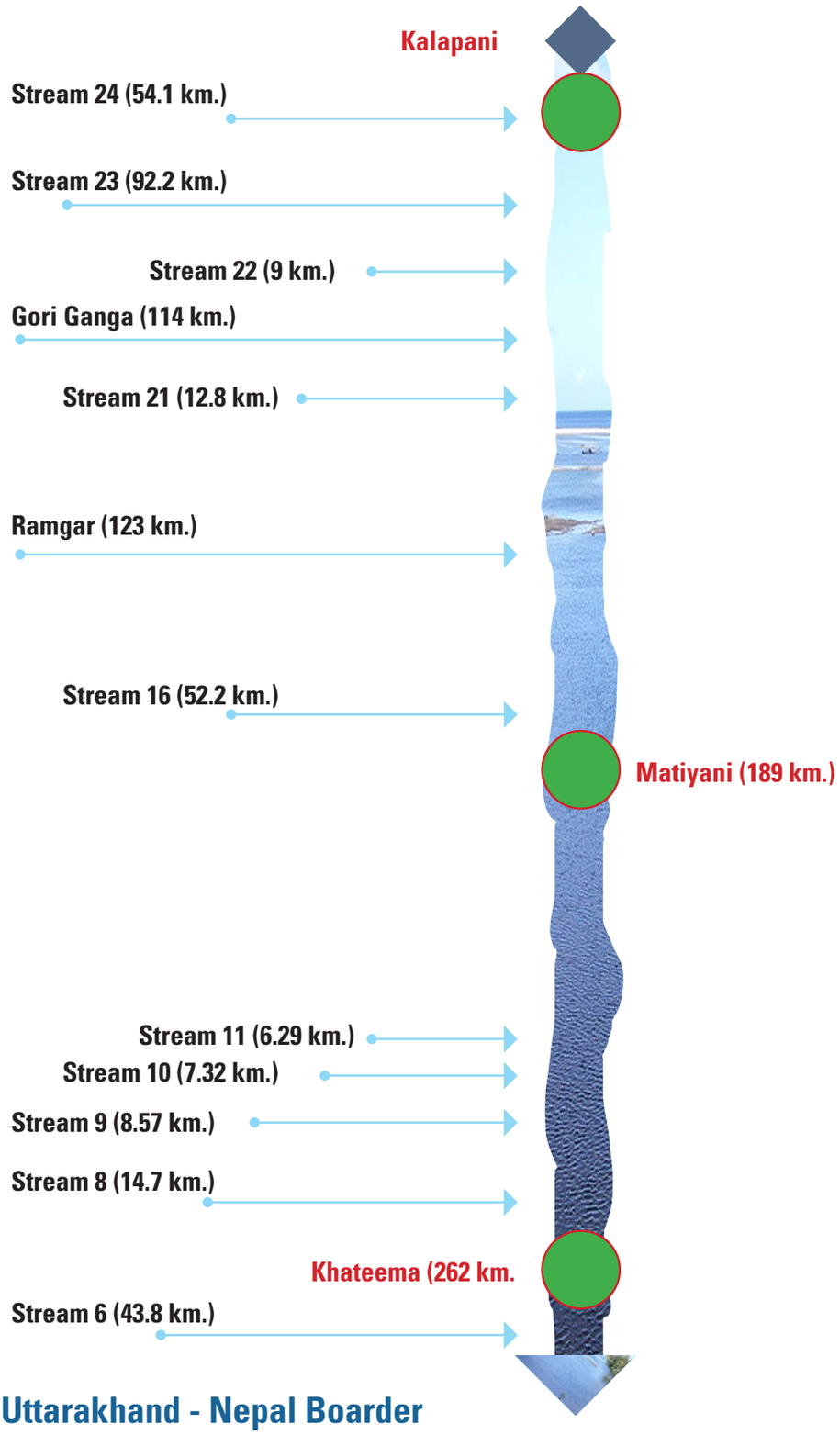


Figure: Sharda river network in Uttarakhand

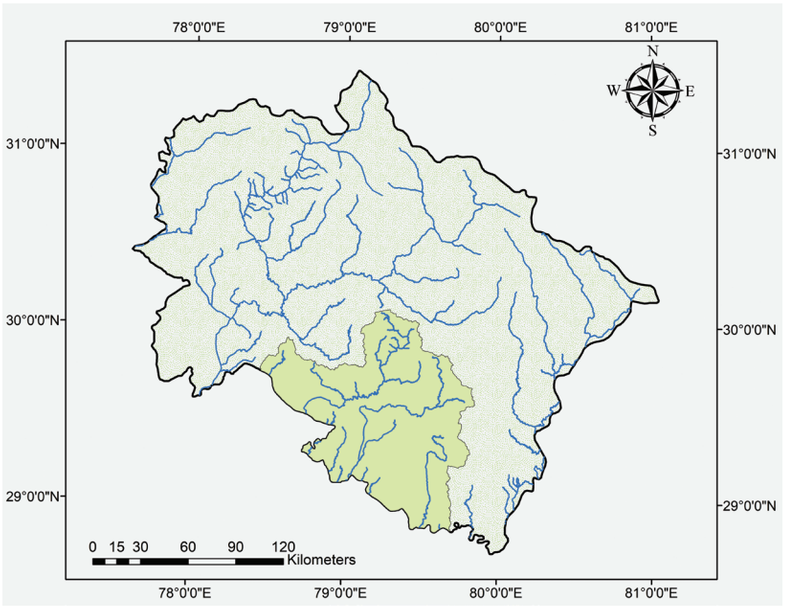
FLOW DIAGRAM: SHARDA RIVER AND HER TRIBUTARIES

* All tributaries from left bank are coming from Nepal and confluences with Sharda at IND-Nepal Border



RAMGANGA BASIN AND ITS RIVER NETWORK

Ramganga River UID Code: 02L21
Total length of rivers- 991 km.
Number of rivers- 24



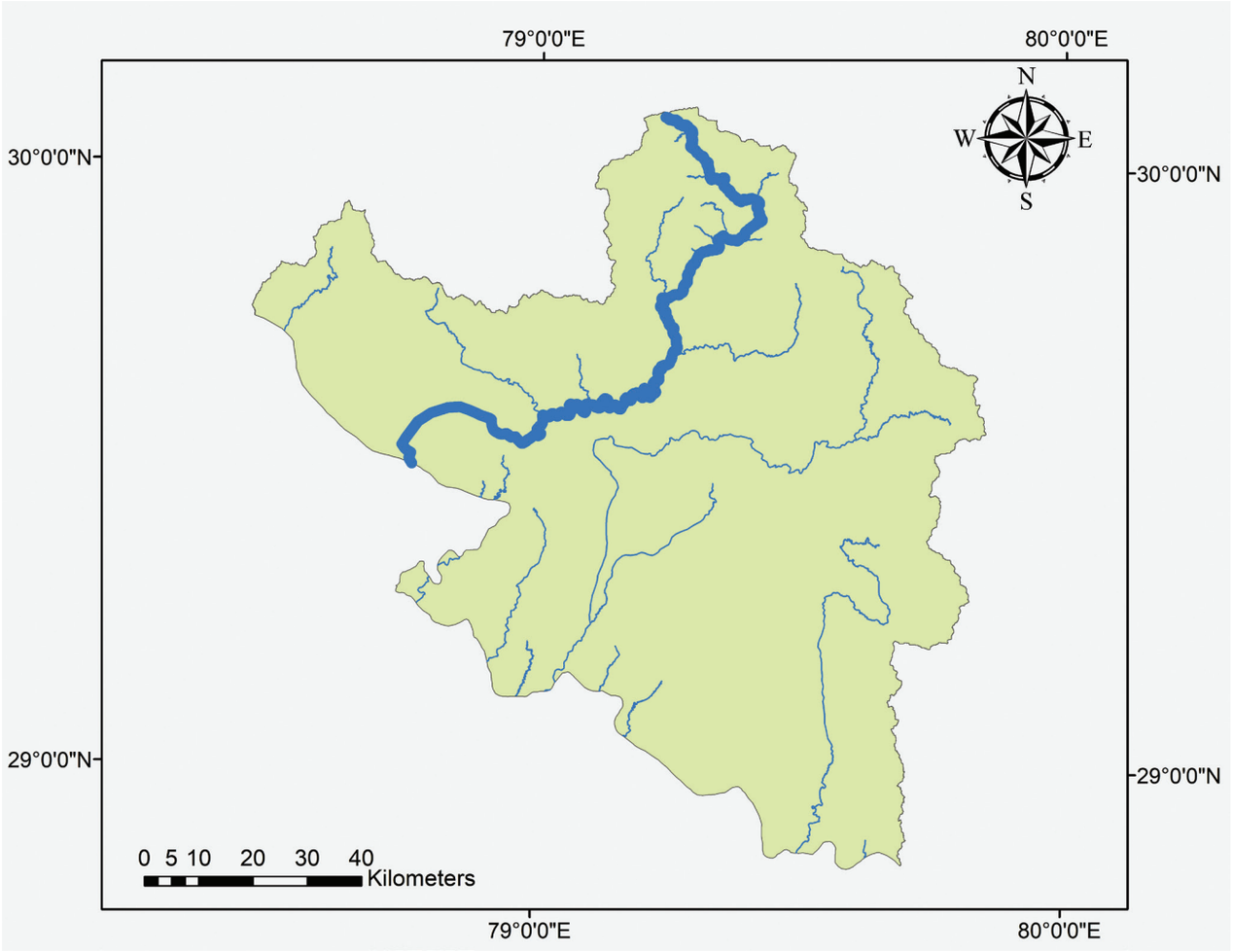
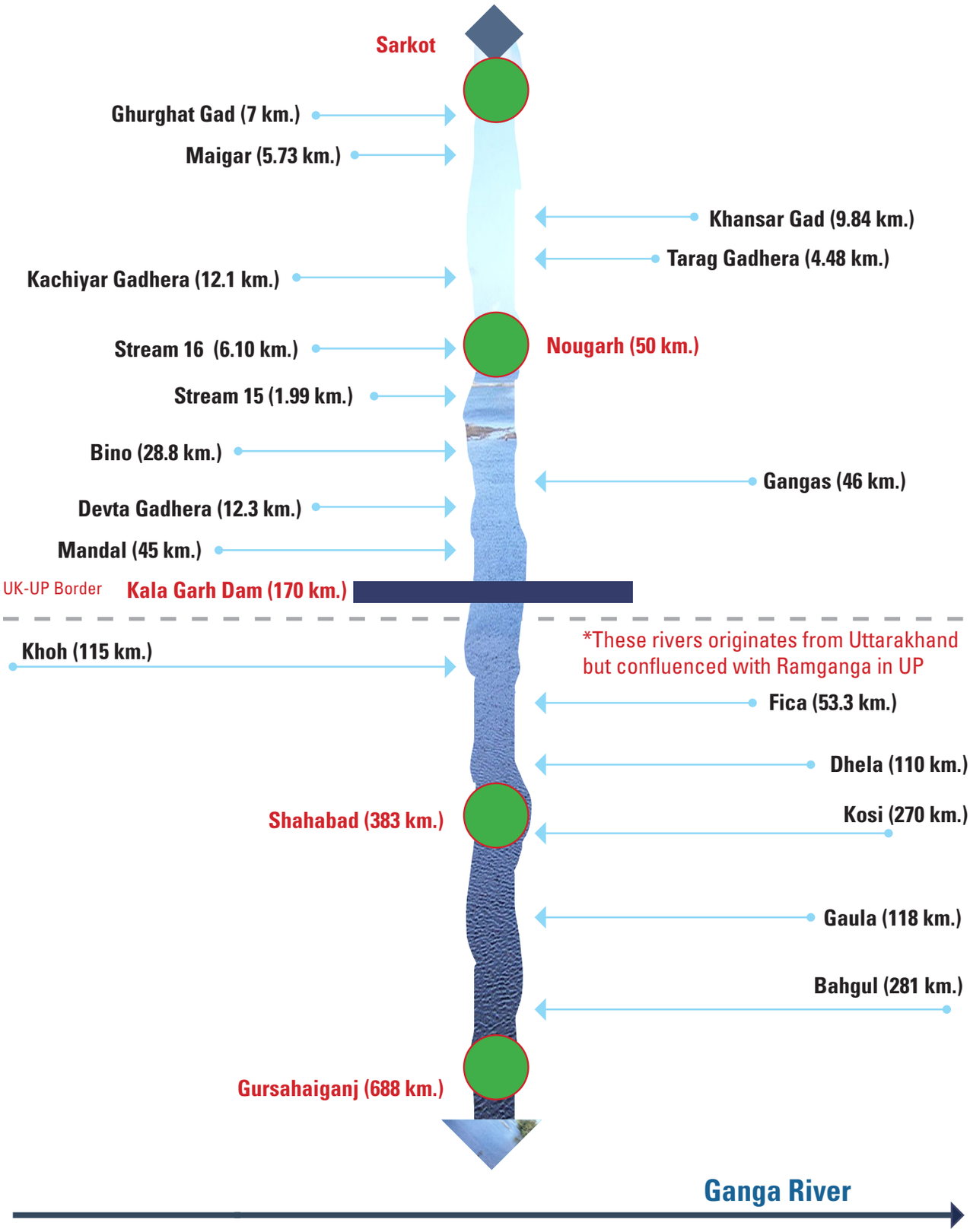


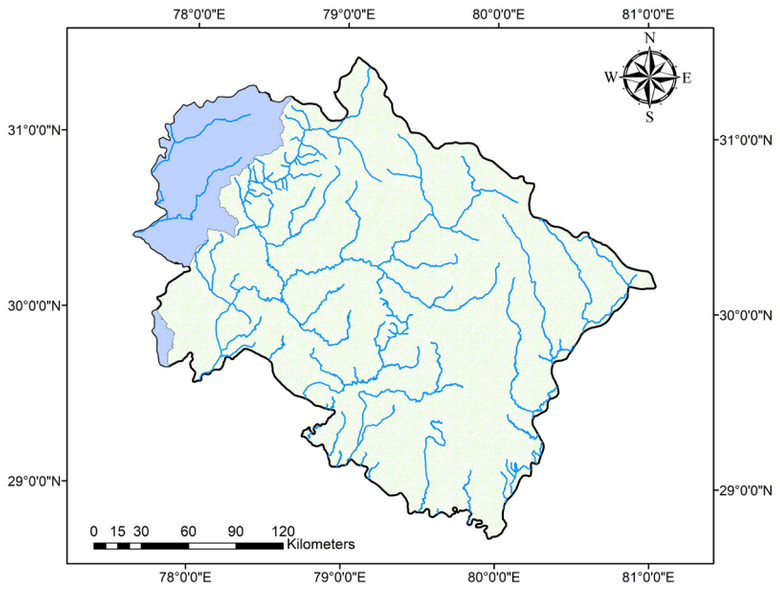
Figure: Ramganga river network in Uttarakhand

FLOW DIAGRAM: RAMGANGA RIVER AND HER TRIBUTARIES



YAMUNA BASIN AND ITS RIVER NETWORK

Yamuna River UID Code: 02R38
Total length of rivers- 648 km.
Number of rivers- 09



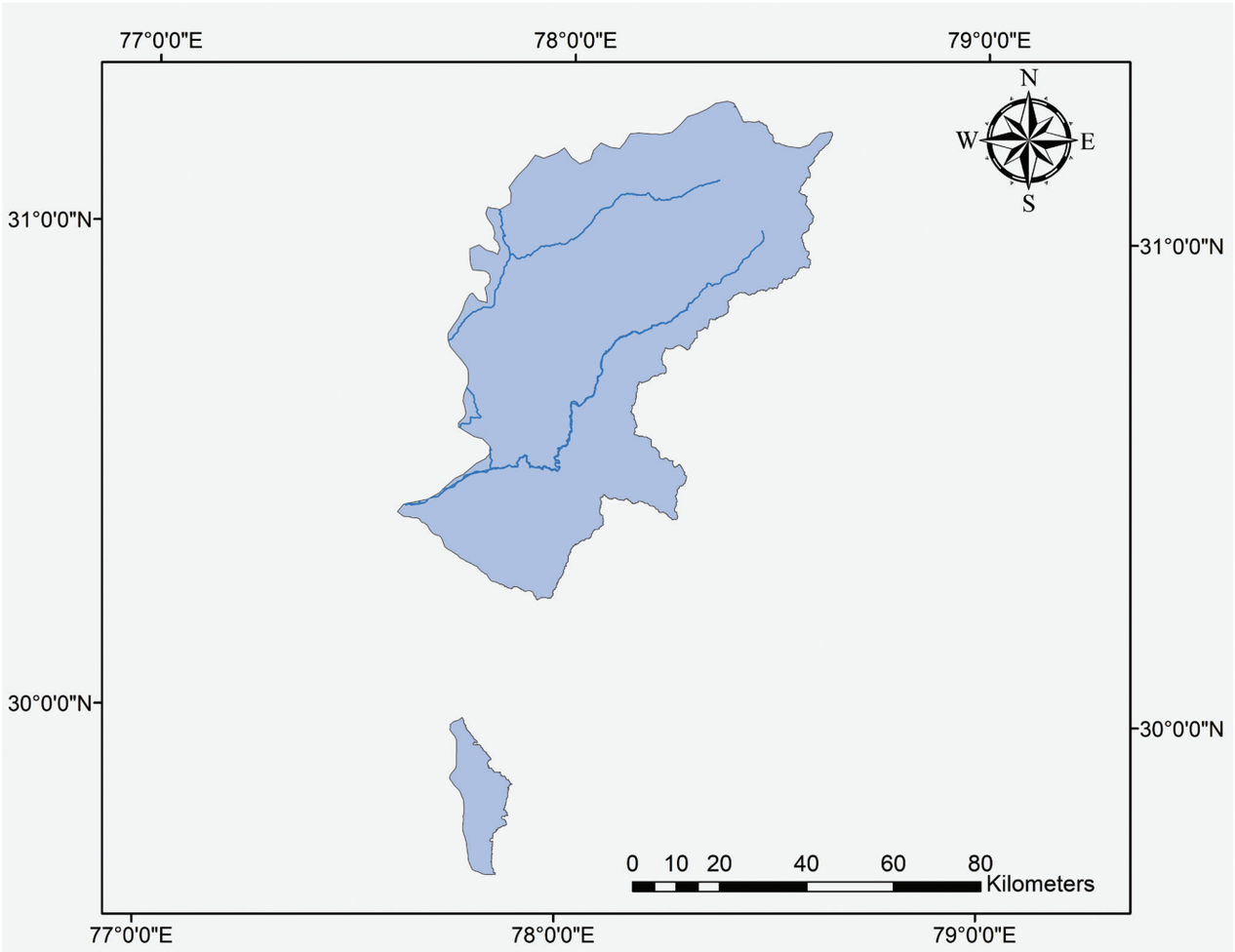
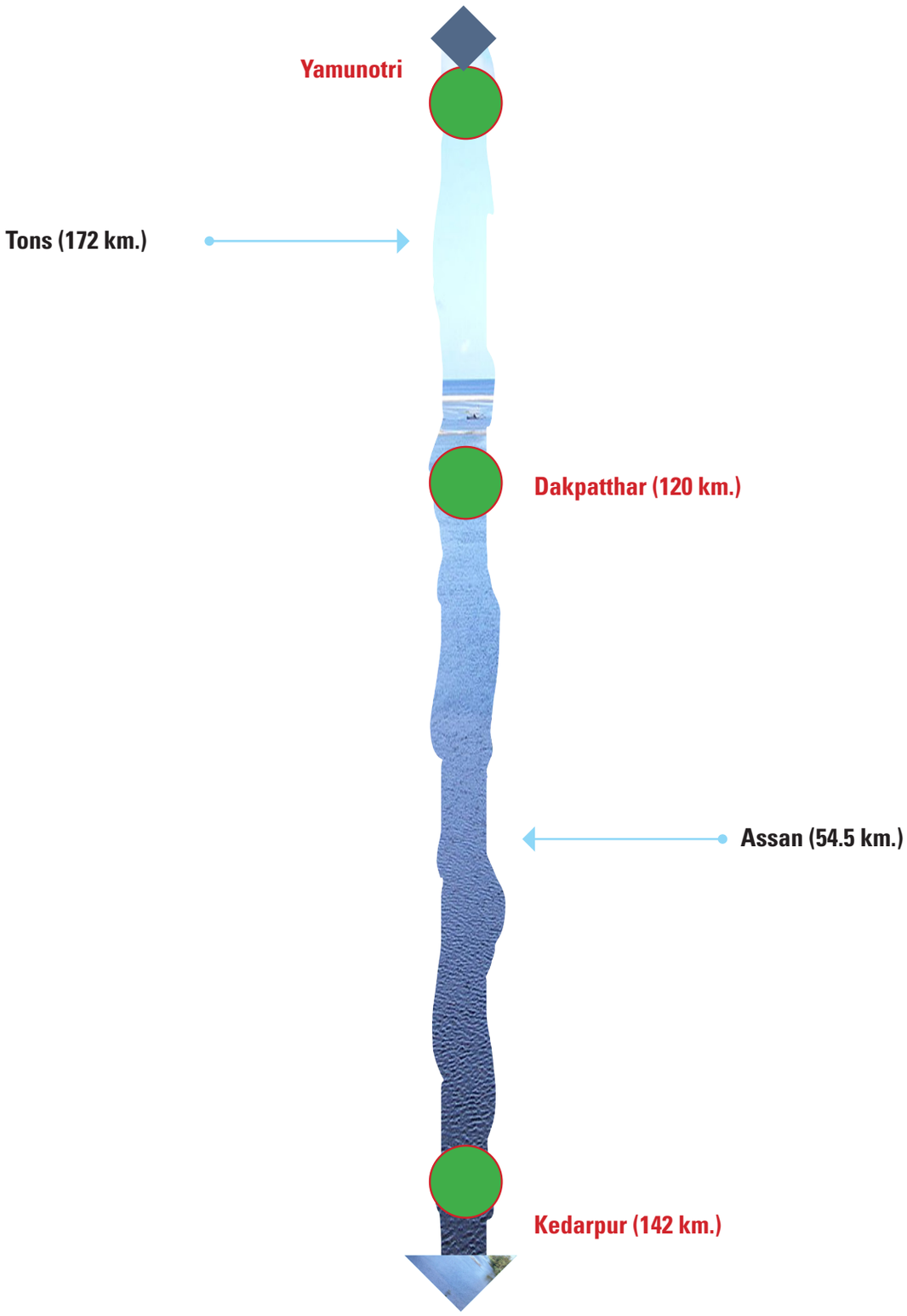
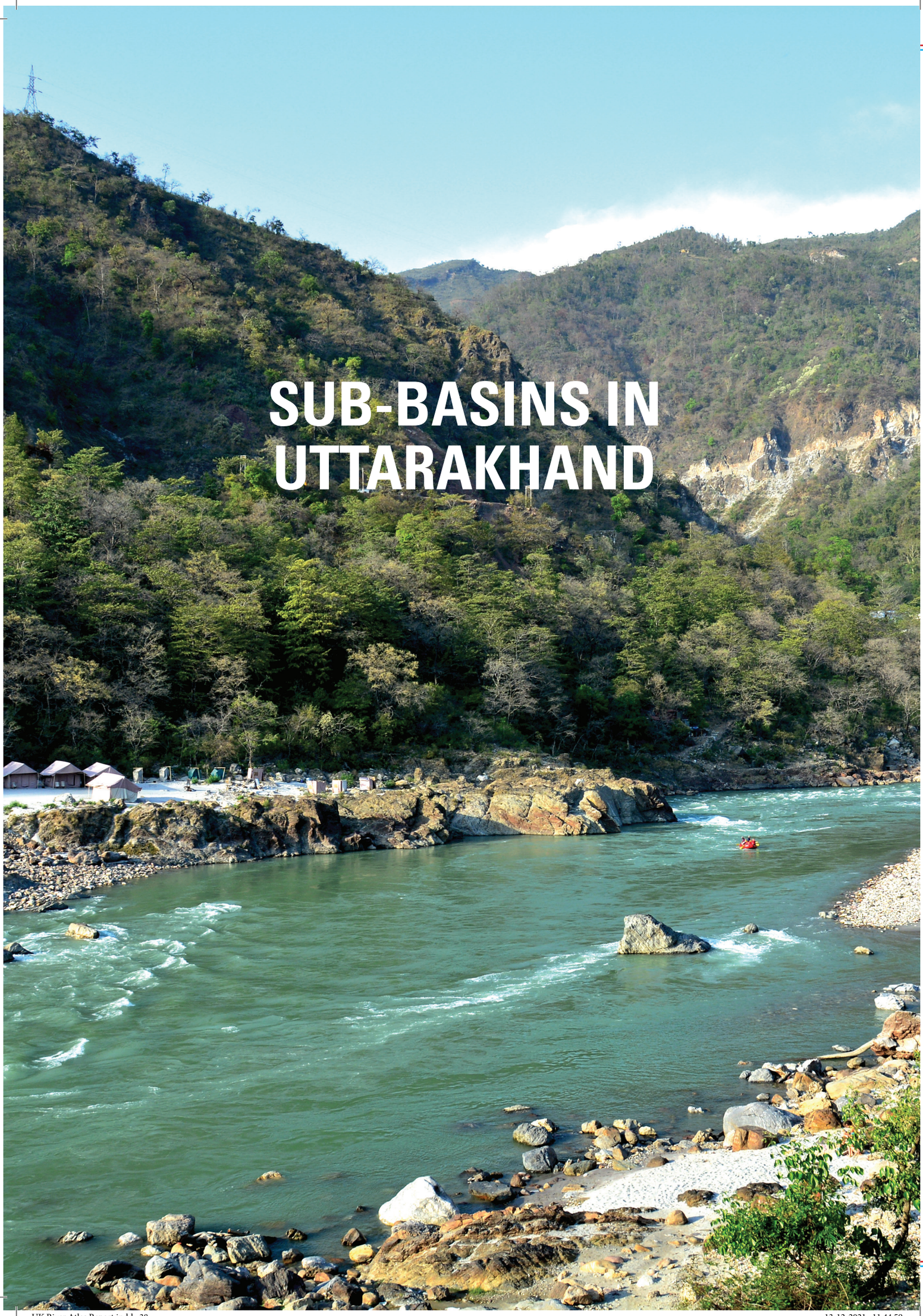


Figure: Yamuna river network in Uttarakhand

FLOW DIAGRAM: YAMUNA RIVER AND HER TRIBUTARIES



UK - HP - UP Boarder

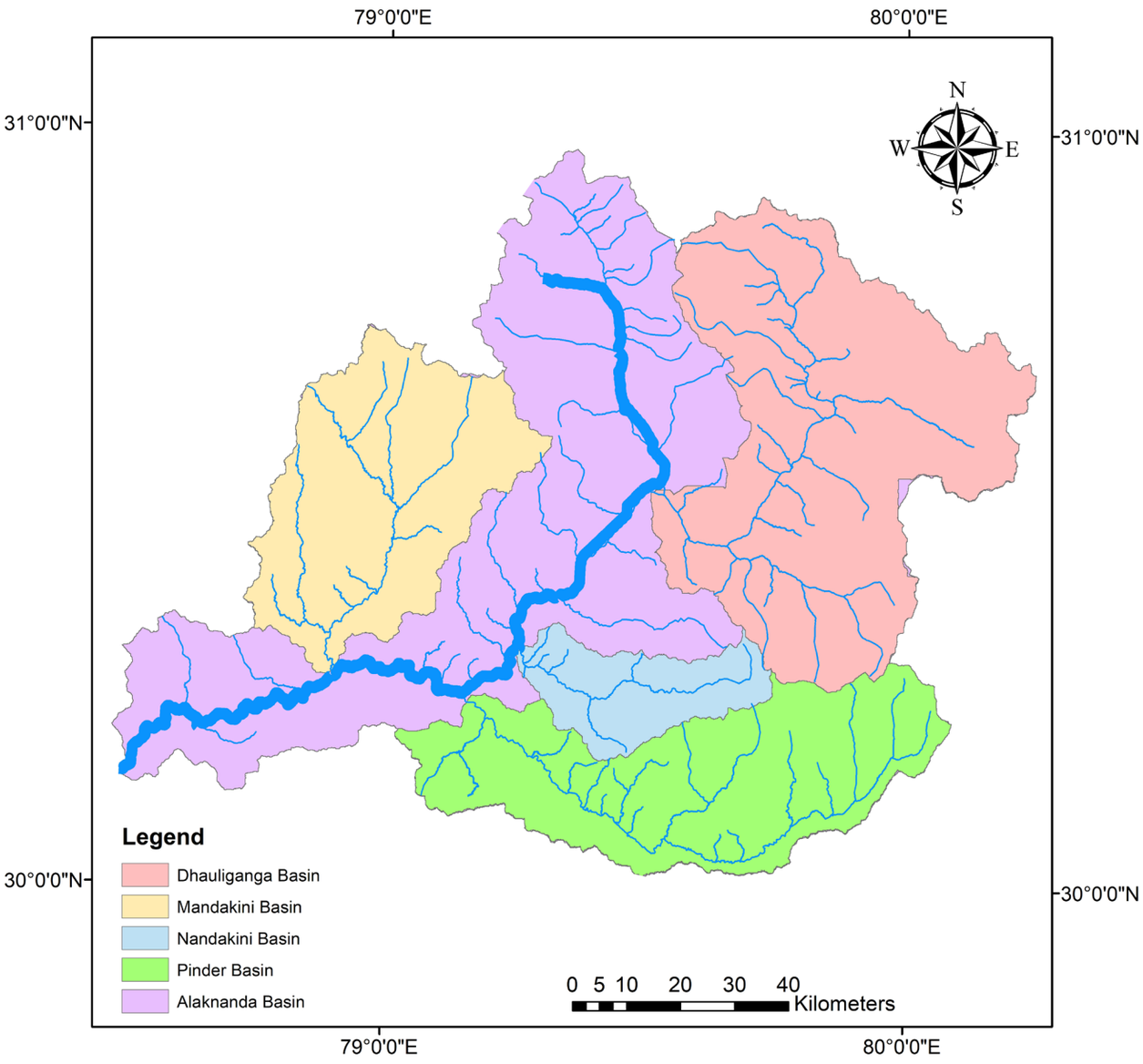


SUB-BASINS IN UTTARAKHAND

ALAKNANDA : MAJOR SUB-BASINS

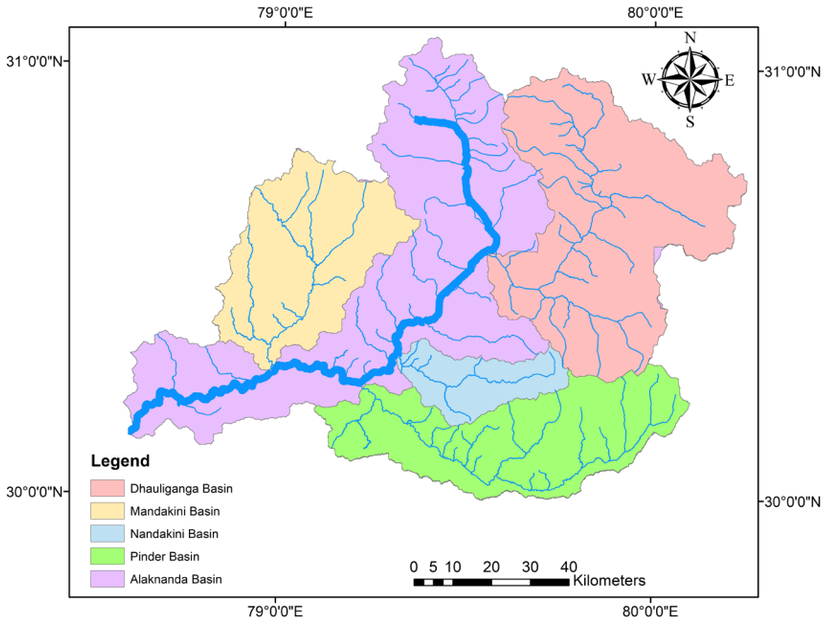
Major sub-basins of Alaknanda River are:

Nandakini basin
Pinder basin
Mandakini basin
Dhauliganga basin



NANDAKINI BASIN

Nandakini River UID Code: 02L01L06
Total length of river- 101 km.
Number of rivers - 07



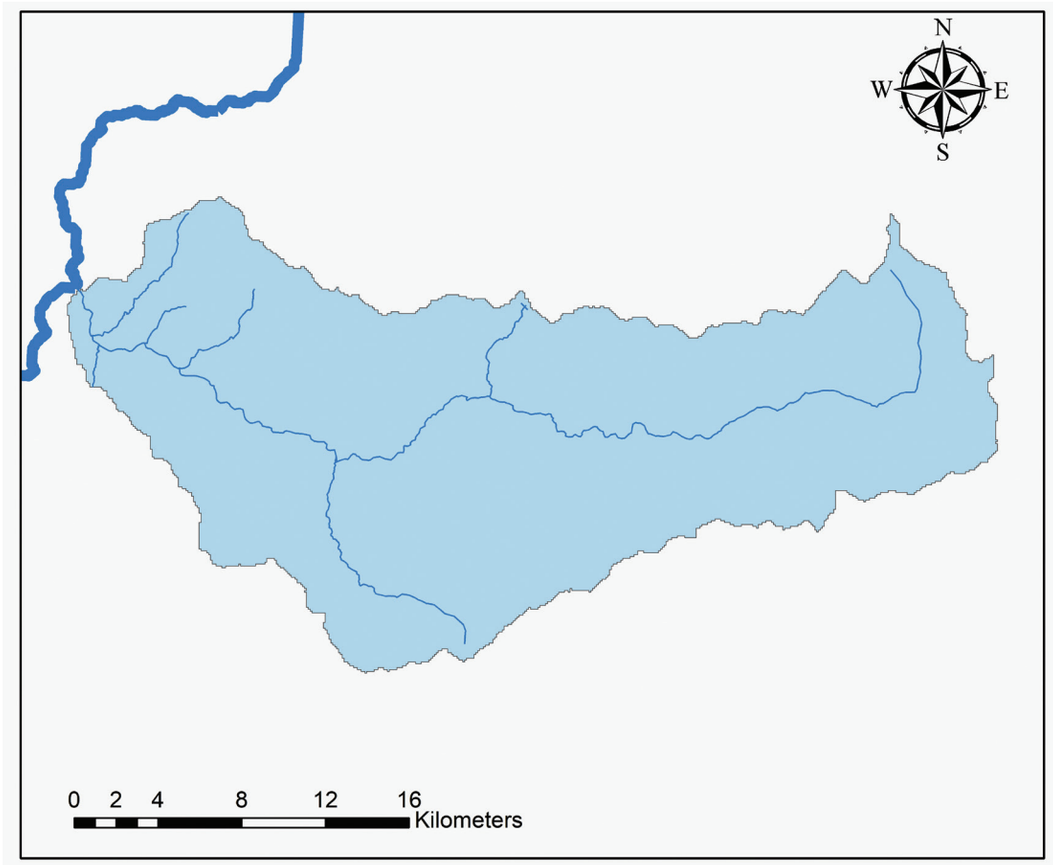
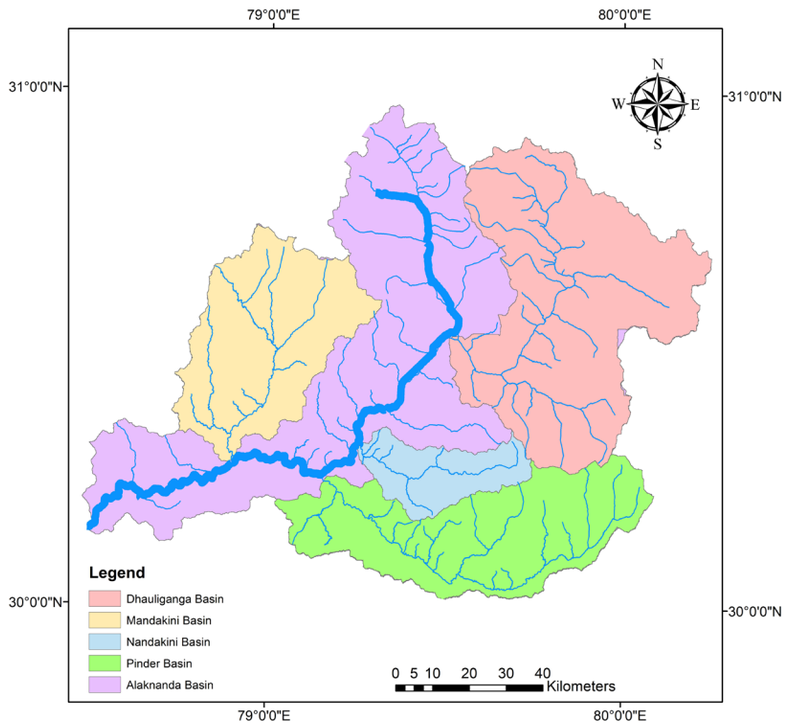


Figure: Nandakini river network in Alaknanda basin

PINDAR BASIN

Pindar River UID Code: 02L01L07
Total length of rivers- 357 km.
Number of rivers- 18



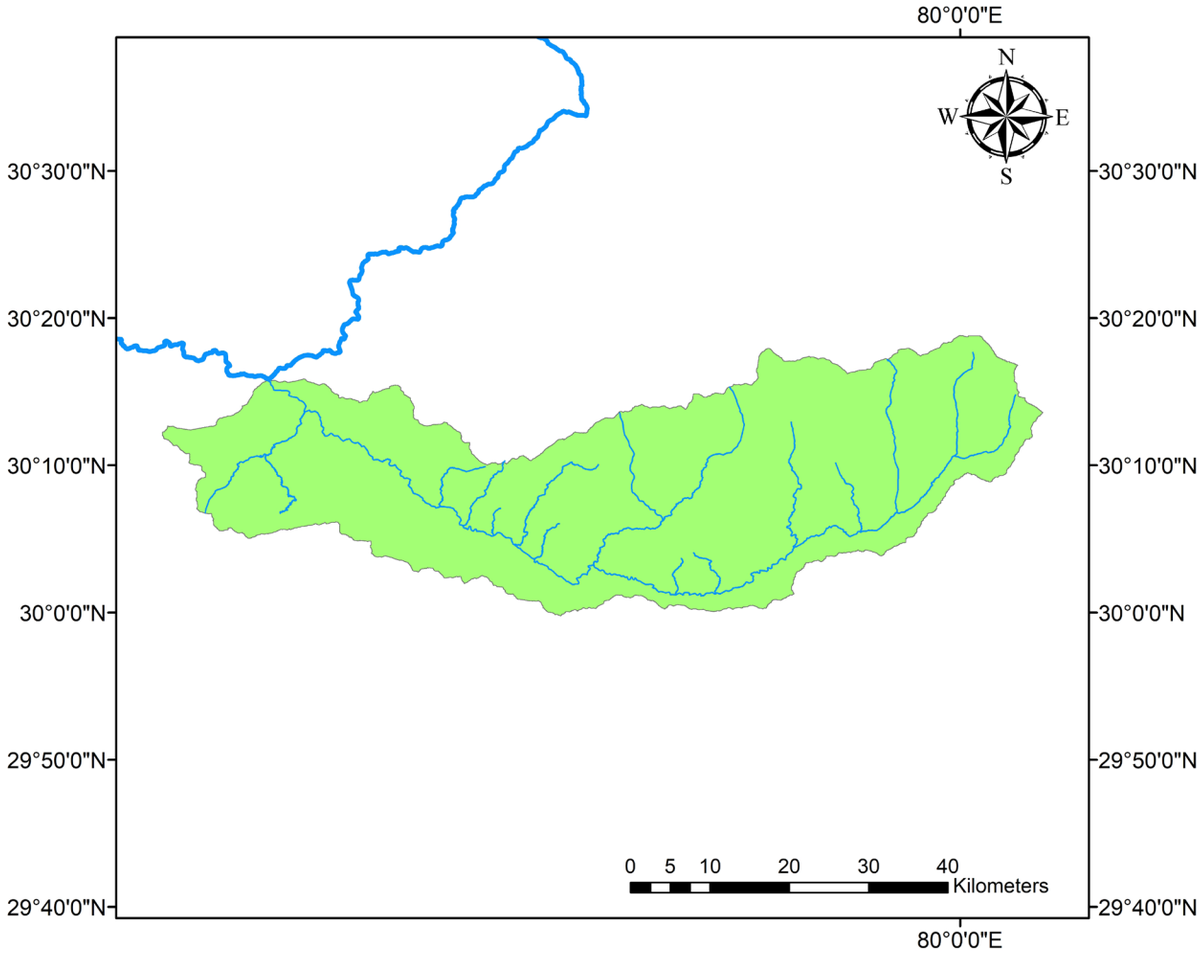
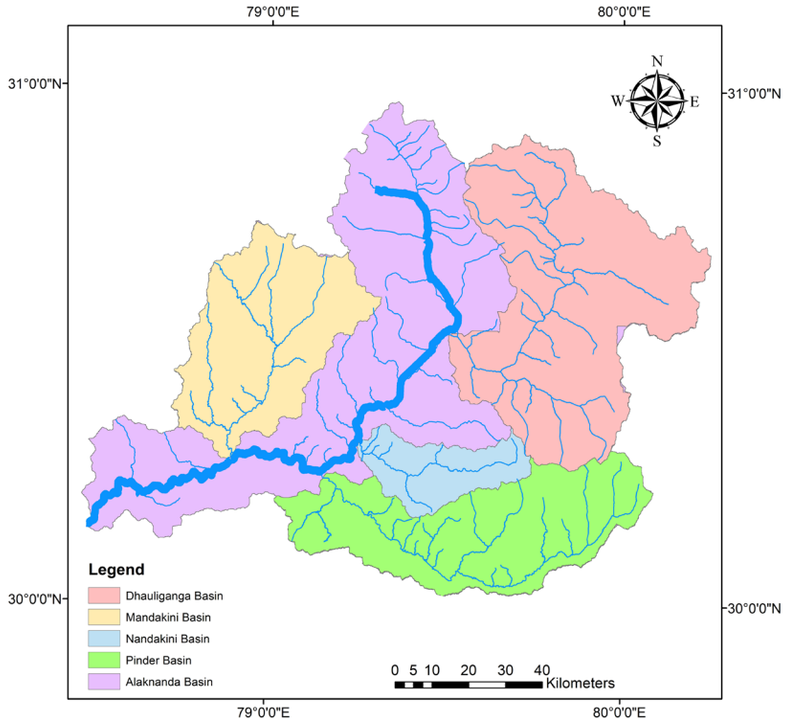


Figure: Pindar river network in Alaknanda basin

MANDAKINI BASIN

Mandakini River UID Code: 02L01R12
Total length of river- 252 km.
Number of rivers- 10



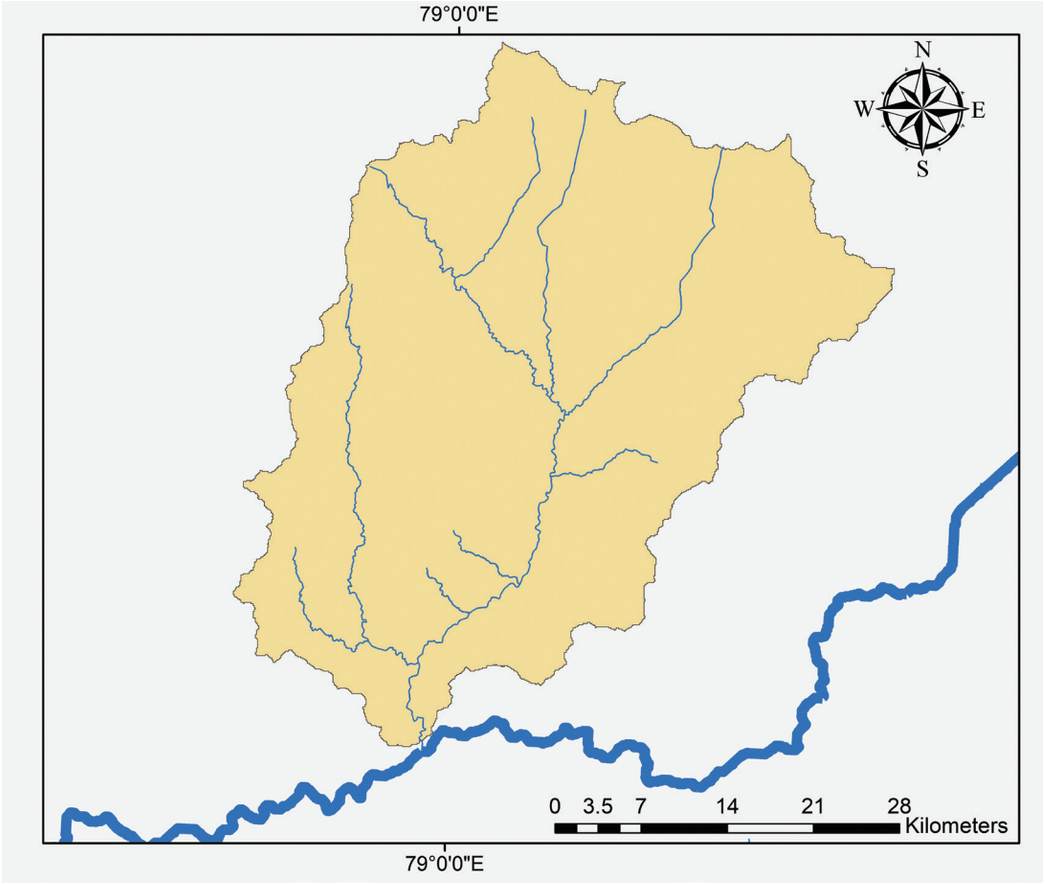
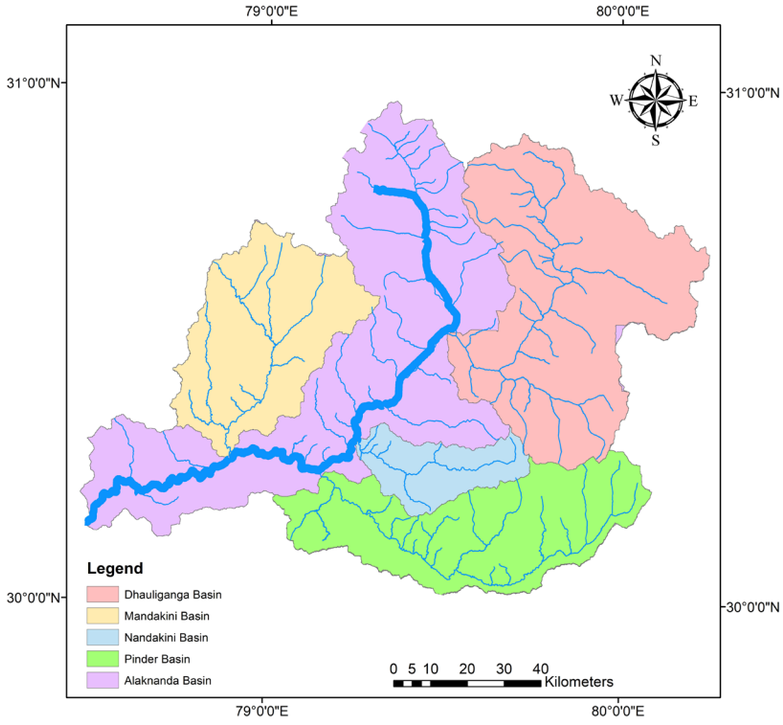


Figure: Mandakini river network in Alaknanda basin

DHAULIGANGA BASIN

Dhauliganga River UID Code: 02L01L03
Total length of rivers- 444 km.
Number of rivers- 27



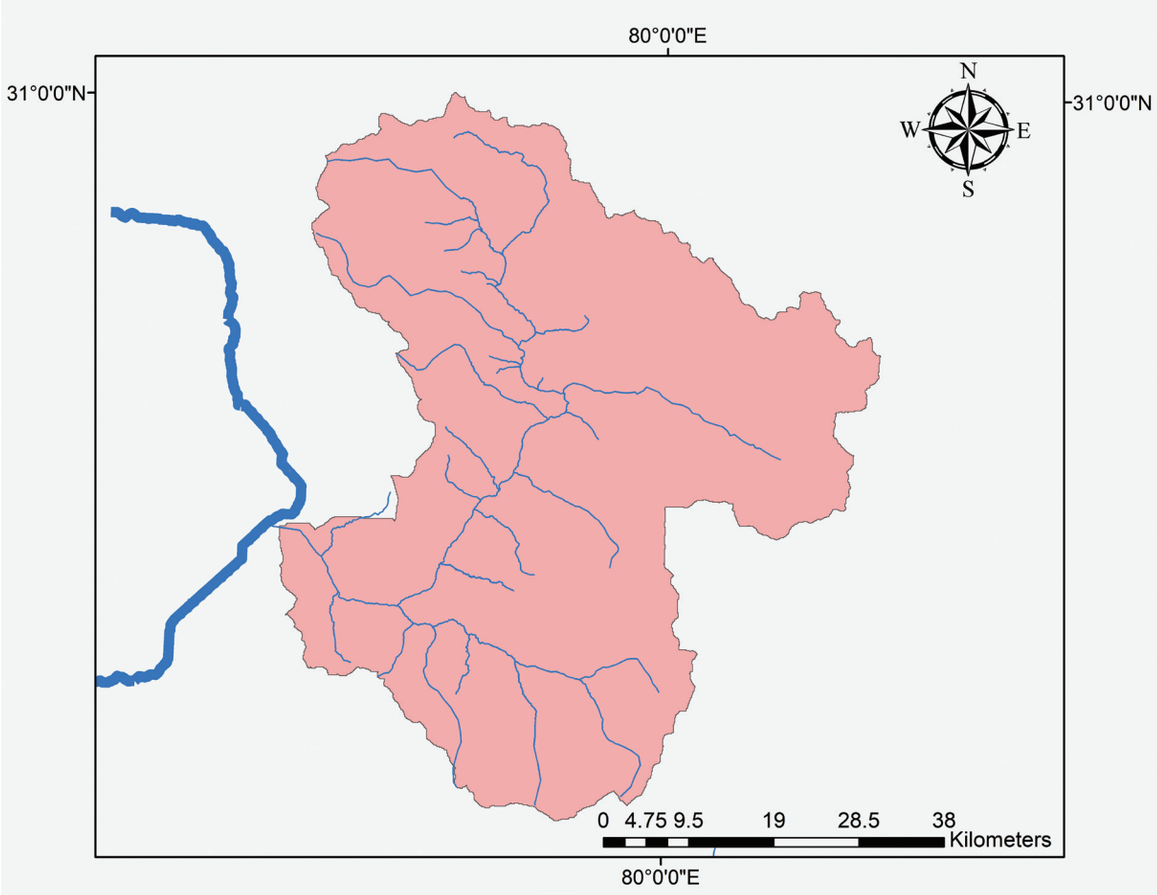
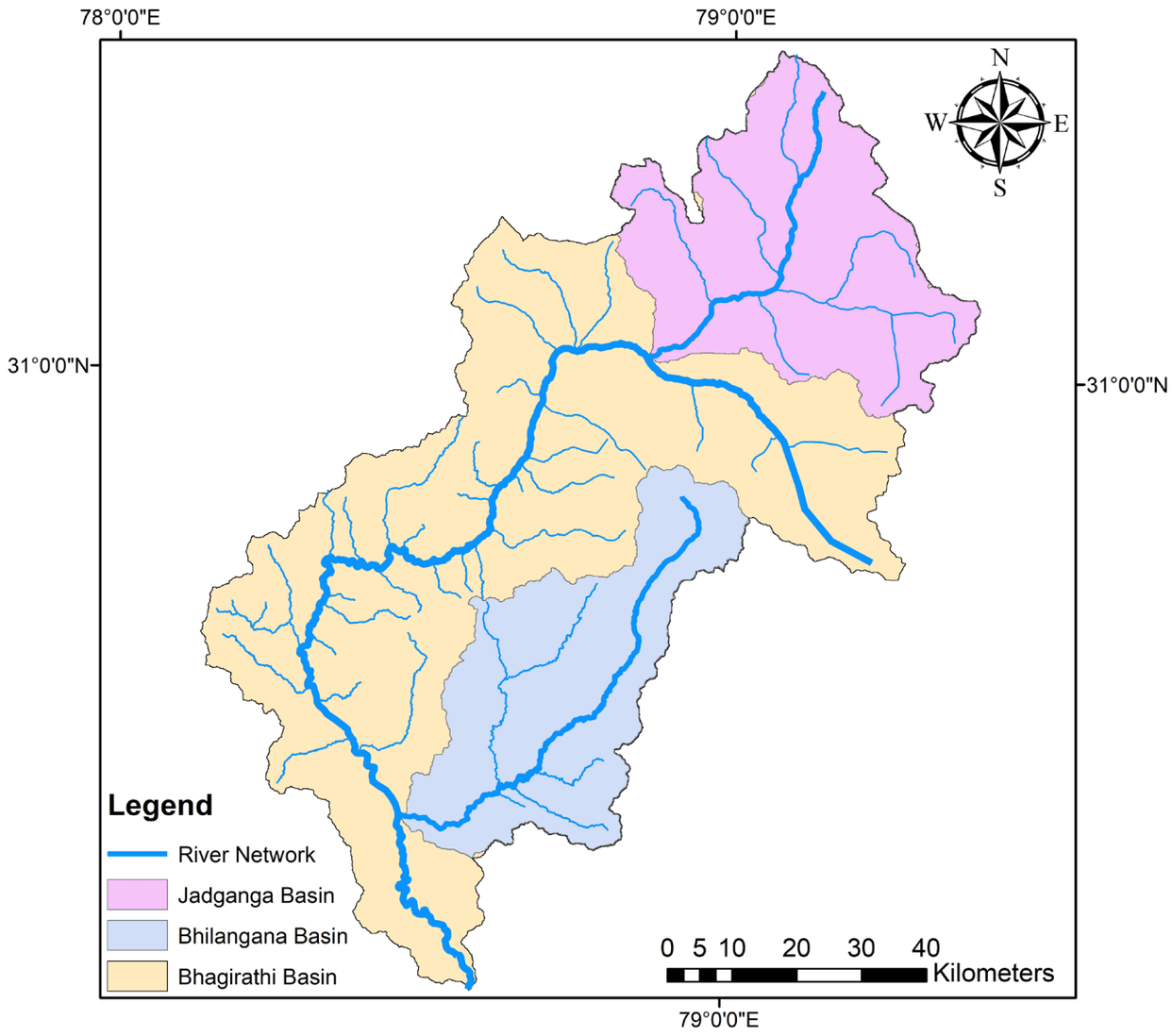


Figure: Dhauliganga river network in Alaknanda basin

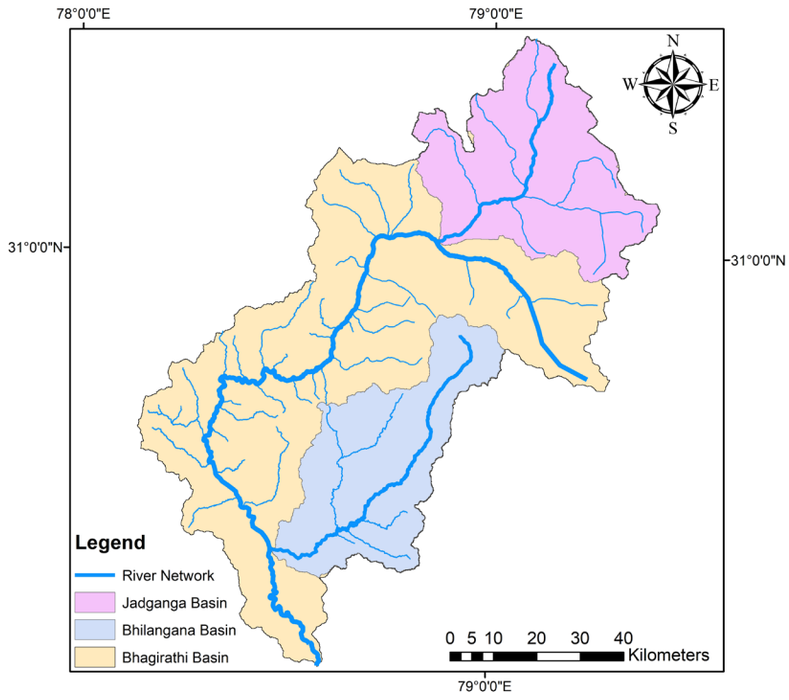
BHAGIRATHI: MAJOR SUB-BASINS

Major sub-basins of Bhagirathi River are as follows:
Bhilangana basin
Jadganga basin



BHILANGNA BASIN

Bhilangna River UID Code: 02R01L17
Total length of rivers- 201 km.
Number of rivers- 06



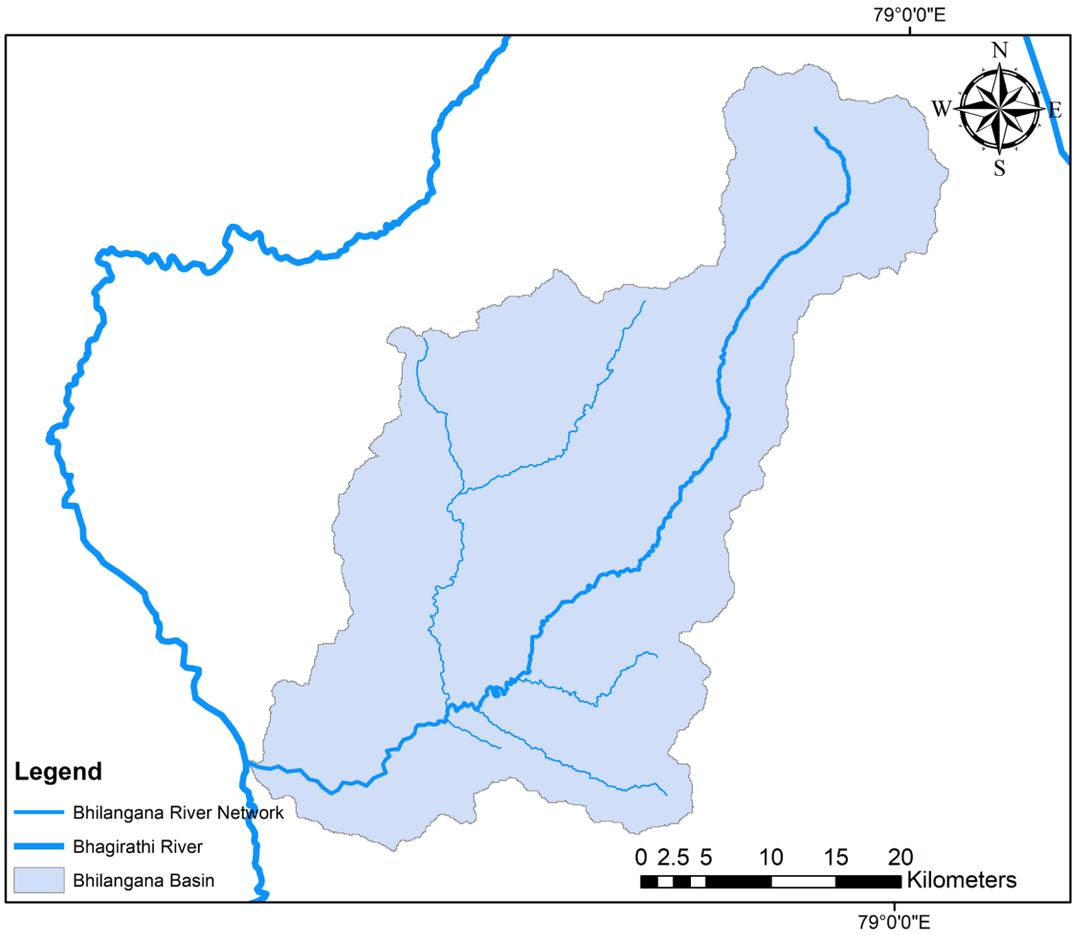
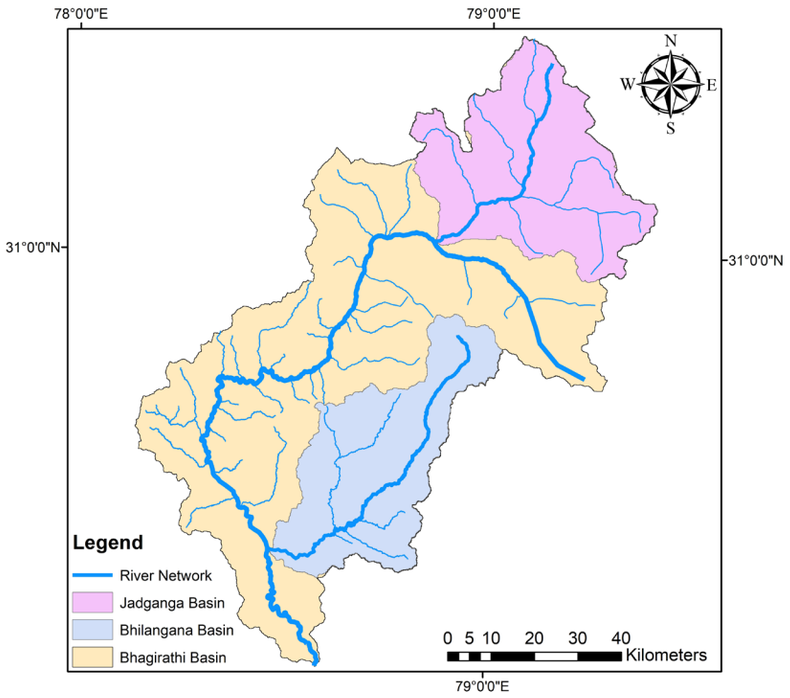


Figure: Bhilangna river network in Alaknanda basin

JADGANGA BASIN

Jadganga River UID Code: 02R01R02
Basin area: 1,698.03 sq. km.
Number of rivers- 08
Total length of rivers- 236.7 km.



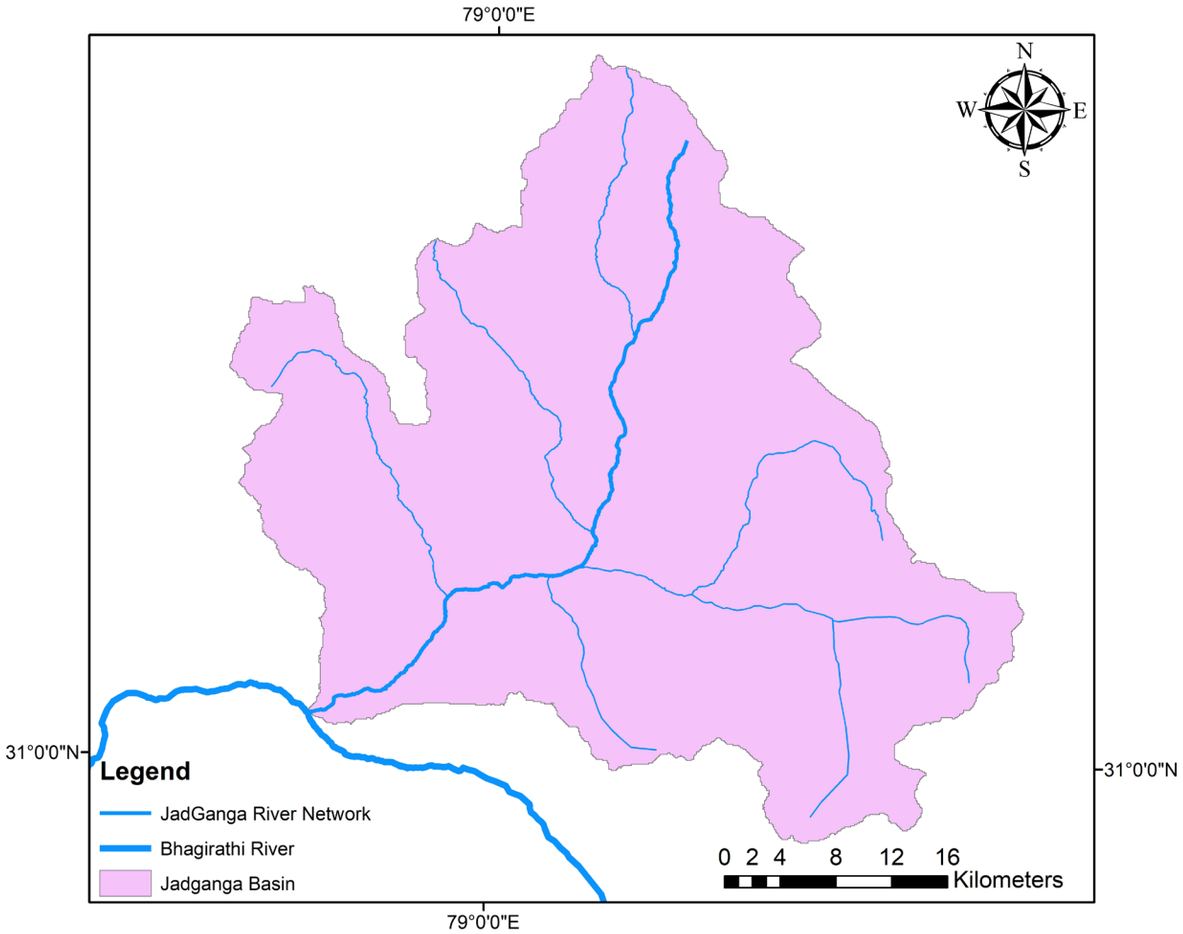
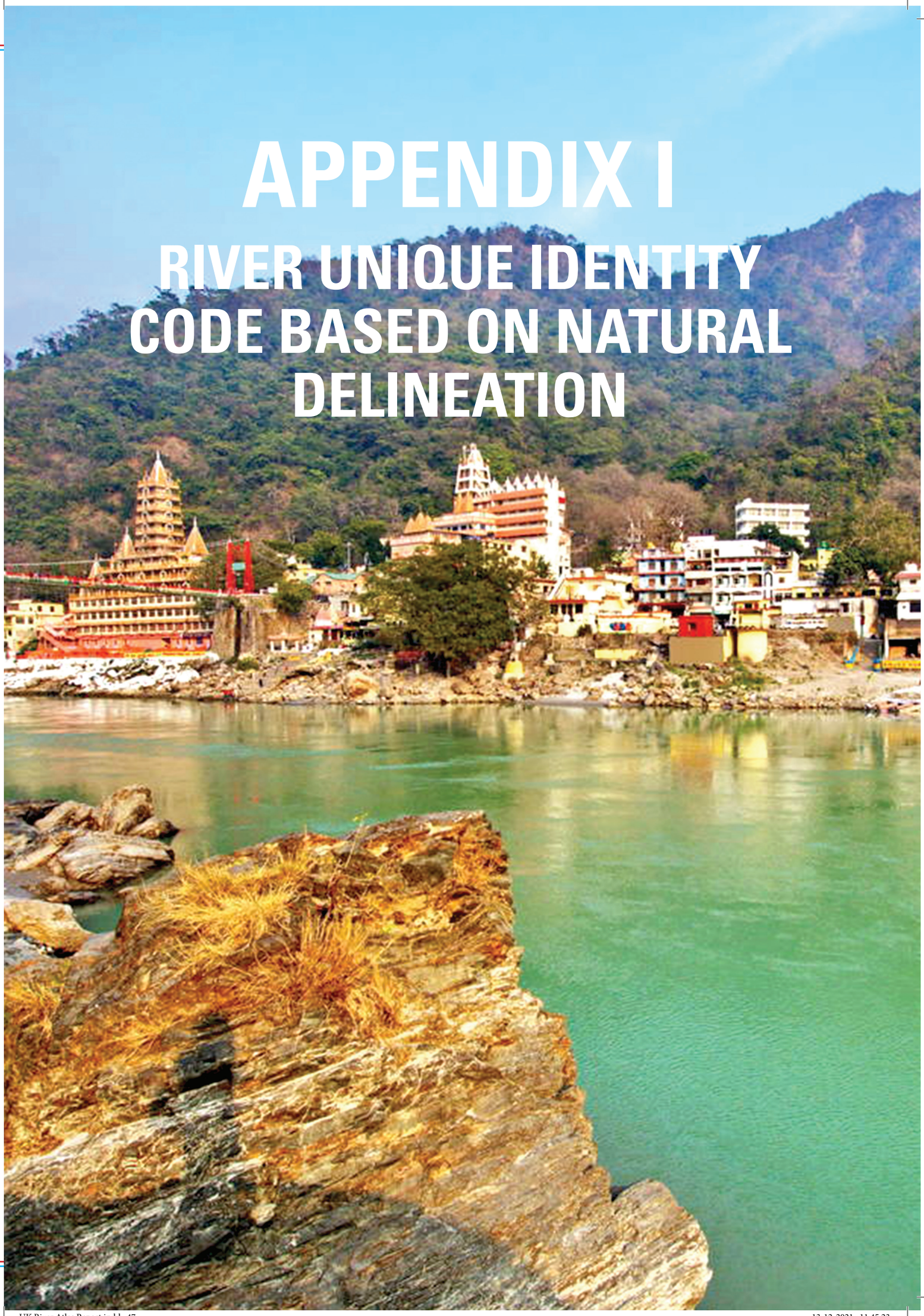


Figure: Bhilangna river network in Alaknanda basin



APPENDIX I

RIVER UNIQUE IDENTITY CODE BASED ON NATURAL DELINEATION

RIVER UNIQUE IDENTITY CODE BASED ON NATURAL DELINEATION

	River Code	Origin Data			Confluence Data				
S.No	Unique Identification Number	Co-ordinate		Ele (m)	Co-ordinate		Ele (m)	Confluence with	Length Of the river (km.)
		Lat	Long		Lat	Long			
1	02L01	30.819	79.266	4822	30.145	78.598	471	Ganga	206
2	02L01R01	30.711	79.248	5946	30.778	79.412	3922	Alakhnanda	18
3	02L01L01	31.022	79.334	5428	30.771	79.494	3159	Alakhnanda	35.8
4	02L01L01L01	30.789	79.623	4744	30.796	79.496	3456	Saraswati	15
5	02L01L01L02	30.828	79.589	5500	30.807	79.494	3522	Saraswati	14
6	02L01L01L03	30.820	79.578	5400	30.832	79.490	3739	Saraswati	9.36
7	02L01L01R01	30.915	79.306	5427	30.861	79.465	4016	Saraswati	19.1
8	02L01L01L04	30.940	79.591	5920	30.881	79.466	4099	Saraswati	17.2
9	02L01L01L05	30.903	79.516	5397	30.889	79.463	4187	Saraswati	6
10	02L01L01L06	30.981	79.537	6091	30.925	79.451	4559	Saraswati	11.9
11	02L01L01L07	30.974	79.473	5767	30.948	79.430	4611	Saraswati	5.6
12	02L01L01R02	30.946	79.382	5288	30.956	79.414	4682	Saraswati	3.97
13	02L01L01L08	31.021	79.495	6011	30.962	79.413	4723	Saraswati	10.9
14	02L01L01L09	31.007	79.445	5668	30.969	79.409	4754	Saraswati	6.84
15	02L01L01L10	31.060	79.416	5552	30.994	79.382	3935	Saraswati	9.58
16	02L01R02	30.660	79.388	4882	30.685	79.507	2377	Alakhnanda	16.7
17	02L01L02	30.769	79.699	5089	30.622	79.562	1777	Alakhnanda	24.5
18	02L01L03	30.934	79.603	6495	30.563	79.575	1446	Alakhnanda	102
19	02L01L03R01	30.874	79.718	5315	30.877	79.779	4474	Dhauli Ganga	6.38
20	02L01L03R02	30.845	79.741	5146	30.865	79.785	4101	Dhauli Ganga	5.55
21	02L01L03L01	30.959	79.750	5139	30.842	79.809	3876	Dhauli Ganga	25.4
22	02L01L03R03	30.826	79.761	4911	30.812	79.805	3790	Dhauli Ganga	5.18
23	02L01L03R04	30.813	79.791	4357	30.810	79.801	3780	Dhauli Ganga	1.1
24	02L01L03L02	30.782	79.905	4733	30.764	79.848	3384	Dhauli Ganga	7.86
25	02L01L03R05	30.862	79.591	5680	30.751	79.828	3239	Dhauli Ganga	30.3
26	02L01L03R06	30.737	79.797	5361	30.731	79.831	3136	Dhauli Ganga	3.88
27	02L01L03L03	30.724	79.801	5087	30.729	79.831	3114	Dhauli Ganga	3.36
28	02L01L03L04	30.719	79.857	3924	30.707	79.851	3027	Dhauli Ganga	1.55

	River Code	Origin Data			Confluence Data				
S.No	Unique Identification Number	Co-ordinate		Ele (m)	Co-ordinate		Ele (m)	Confluence with	Length Of the river (km.)
		Lat	Long		Lat	Long			
29	02L01L03L05	30.629	80.159	4510	30.703	79.883	2925	Dhauliganga	33.7
30	02L01L03L06	30.656	79.927	4877	30.685	79.884	2896	Dhauliganga	5.14
31	02L01L03R07	30.741	79.688	5486	30.676	79.863	2818	Dhauliganga	23.1
32	02L01L03L07	30.528	79.938	4960	30.623	79.825	2619	Dhauliganga	18
33	02L01L03R08	30.668	79.744	5264	30.604	79.807	2538	Dhauliganga	10.3
34	02L01L03R09	30.639	79.748	4647	30.595	79.785	2452	Dhauliganga	7.58
35	02L01L03L08	30.520	79.850	5383	30.585	79.779	2390	Dhauliganga	12.2
36	02L01L03L09	30.504	79.826	4712	30.530	79.741	2172	Dhauliganga	10.6
37	02L01L03L10	30.403	79.996	4740	30.488	79.691	1937	Dhauliganga	37.4
38	02L01L03L10L01	30.298	79.952	5743	30.413	79.906	3985	Rishi Ganga	17
39	02L01L03L10L02	30.288	79.853	6382	30.433	79.829	3483	Rishi Ganga	17.3
40	02L01L03L10L03	30.399	79.760	5282	30.458	79.775	2984	Rishi Ganga	8.22
41	02L01L03L10L04	30.305	79.762	5693	30.466	79.732	2332	Rishi Ganga	20.2
42	02L01L03L10L05	30.415	79.669	4801	30.471	79.709	2126	Rishi Ganga	7.95
43	02L01L03L11	30.430	79.637	4116	30.501	79.622	1780	Dhauliganga	9.66
44	02L01L03R10	30.602	79.681	4930	30.537	79.602	1687	Dhauliganga	12.9
45	02L01R03	30.648	79.384	5285	30.527	79.506	1299	Alakhnanda	22.9
46	02L01L04	30.458	79.564	3483	30.491	79.475	1200	Alakhnanda	10.9
47	02L01R04	30.623	79.351	4986	30.464	79.431	1220	Alakhnanda	25.6
48	02L01L05	30.339	79.693	4887	30.408	79.389	1040	Alakhnanda	36.2
49	02L01R05	30.451	79.345	2771	30.408	79.358	995	Alakhnanda	6.13
50	02L01R06	30.562	79.290	4570	30.388	79.320	940	Alakhnanda	24.9
51	02L01R07	30.391	79.261	2271	30.360	79.311	922	Alakhnanda	7.95
52	02L01L06	30.346	79.720	3410	30.332	79.316	858	Alakhnanda	59.3
53	02L01L06R01	30.326	79.543	3044	30.287	79.524	1668	Nandakini	5.56
54	02L01L06L01	30.179	79.513	2689	30.258	79.448	1309	Nandakini	14
55	02L01L06R02	30.332	79.406	1952	30.298	79.370	1040	Nandakini	7.84
56	02L01L06R03	30.324	79.372	1794	30.308	79.352	994	Nandakini	3.1
57	02L01L06L02	30.289	79.326	1345	30.307	79.329	951	Nandakini	2.26
58	02L01L06R04	30.364	79.373	2592	30.311	79.326	925	Nandakini	8.84
59	02L01R08	30.466	79.209	2243	30.320	79.299	840	Alakhnanda	24.5

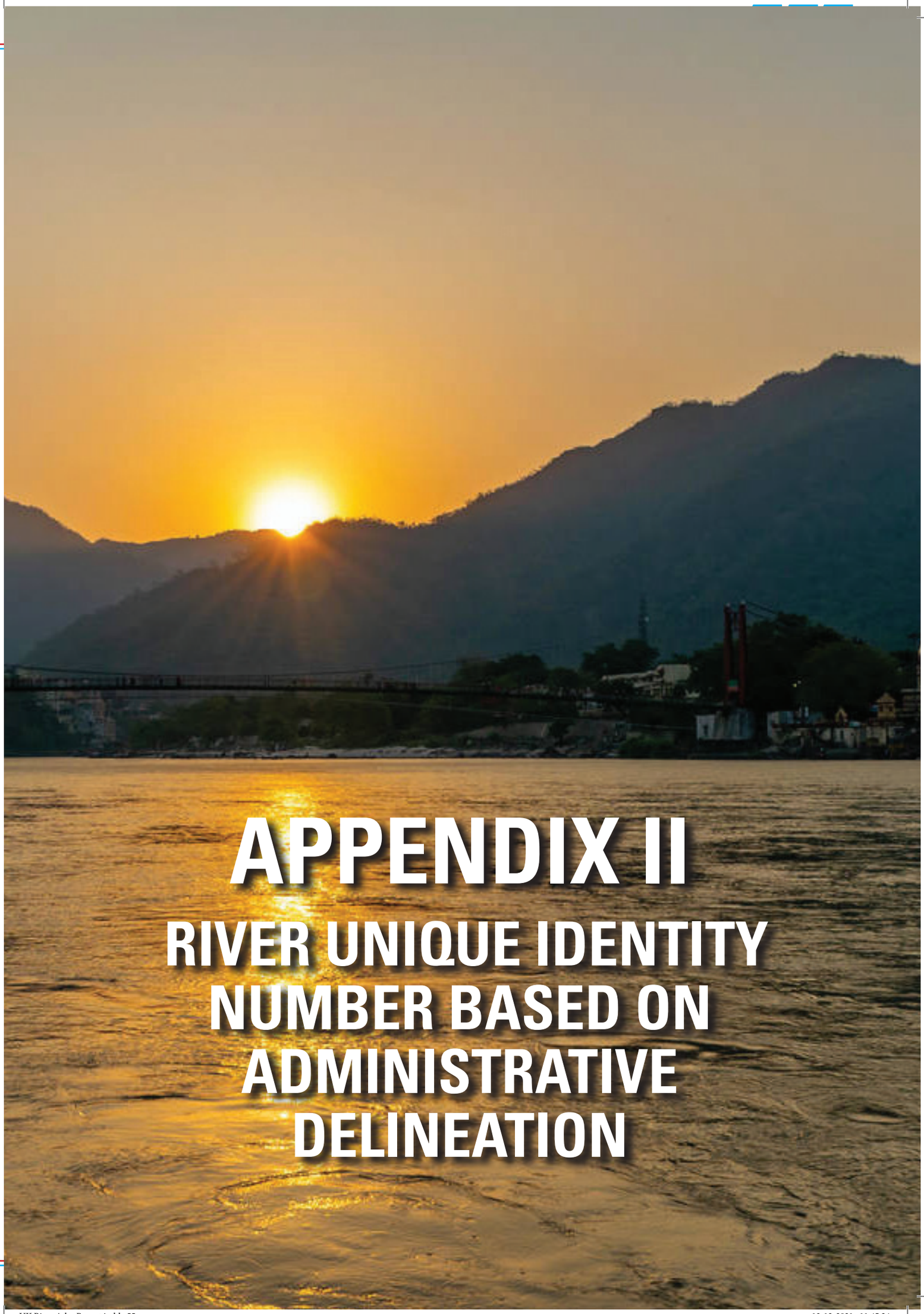
	River Code	Origin Data			Confluence Data				
S.No	Unique Identification Number	Co-ordinate		Ele (m)	Co-ordinate		Ele (m)	Confluence with	Length Of the river (km.)
		Lat	Long		Lat	Long			
60	02L01R09	30.316	79.244	1821	30.279	79.236	782	Alakhnanda	5.8
61	02L01L07	30.297	80.015	3591	30.263	79.216	766	Alakhnanda	127
62	02L01L07R01	30.247	80.063	5317	30.177	79.996	2599	Pindar	12.7
63	02L01L07R02	30.287	79.917	5524	30.114	79.928	2019	Pindar	20.8
64	02L01L07R03	30.163	79.873	4157	30.091	79.888	1913	Pindar	10.5
65	02L01L07R04	30.217	79.808	4880	30.074	79.811	1650	Pindar	19.7
66	02L01L07R05	30.068	79.697	3181	30.022	79.723	1472	Pindar	7.68
67	02L01L07R06	30.062	79.684	2816	30.021	79.679	1395	Pindar	5.52
68	02L01L07R07	30.255	79.739	5002	30.054	79.584	1229	Pindar	35.9
69	02L01L07R07R01	30.226	79.614	3022	30.104	79.663	1616	Stream 8	16
70	02L01L07R08	30.100	79.546	2328	30.061	79.519	1228	Pindar	6.66
71	02L01L07R09	30.168	79.591	3201	30.077	79.495	1192	Pindar	19.2
72	02L01L07R09R01	30.118	79.480	2518	30.122	79.517	1157	Pindar	5.46
73	02L01L07R10	30.118	79.480	2421	30.088	79.472	1171	Pindar	4.42
74	02L01L07R11	30.172	79.484	2697	30.098	79.438	1117	Pindar	11.1
75	02L01L07R12	30.165	79.462	2634	30.120	79.410	1055	Pindar	10.4
76	02L01L07R13	30.211	79.414	2329	30.172	79.343	937	Pindar	11.1
77	02L01L07L01	30.112	79.230	1655	30.227	79.257	834	Pindar	21
78	02L01L07L01L01	30.112	79.144	2785	30.179	79.213	1125	Stream 1	12.2
79	02L01R10	30.323	79.211	2051	30.282	79.171	734	Alakhnanda	6.72
80	02L01R11	30.341	79.183	1408	30.294	79.148	706	Alakhnanda	9.57
81	02L01R12	30.753	79.063	3837	30.288	78.979	631	Alakhnanda	76
82	02L01R12R01	30.715	78.926	4482	30.635	79.000	1731	Mandakini	15.7
83	02L01R12L01	30.759	79.109	4816	30.548	79.082	1155	Mandakini	26.9
84	02L01R12L02	30.734	79.226	5406	30.536	79.095	1093	Mandakini	28.5
85	02L01R12L03	30.502	79.174	2003	30.491	79.084	983	Mandakini	10.7
86	02L01R12R02	30.577	78.975	3249	30.458	79.075	902	Mandakini	21.7
87	02L01R12R03	30.450	79.003	1893	30.411	79.059	827	Mandakini	8.72
88	02L01R12R04	30.422	78.980	1408	30.390	79.017	774	Mandakini	6.52
89	02L01R12R05	30.629	78.913	3618	30.353	78.975	714	Mandakini	42.4
90	02L01R12R05R01	30.435	78.869	2114	30.368	78.932	850	Stream 1	15

	River Code	Origin Data			Confluence Data				
S.No	Unique Identification Number	Co-ordinate		Ele (m)	Co-ordinate		Ele (m)	Confluence with	Length Of the river (km.)
		Lat	Long		Lat	Long			
91	02L01R13	30.345	78.800	2087	30.261	78.921	608	Alakhnanda	18.4
92	02L01L08	30.202	78.844	1448	30.216	78.741	523	Alakhnanda	13.8
93	02L01R14	30.370	78.671	2266	30.232	78.707	512	Alakhnanda	19.5
94	02R01	30.748	79.233	4995	30.145	78.598	467	Ganga	229
95	02R01R01	30.903	79.256	5443	30.908	79.101	4301	Bhagirathi	16.4
96	02R01L01	30.872	79.045	5399	30.923	79.077	4161	Bhagirathi	8
97	02R01L02	30.898	78.948	4309	30.994	78.939	3072	Bhagirathi	11.9
98	02R01R02	31.403	79.143	4300	31.029	78.867	2712	Bhagirathi	62.2
99	02R01R02R01	31.453	79.100	5108	31.276	79.106	4148	Jad Ganga	23.6
100	02R01R02R02	31.365	78.948	5589	31.149	79.076	3654	Jad Ganga	31.5
101	02R01R02L01	30.967	79.245	5577	31.125	79.070	3585	Bhagirathi	34.9
102	02R01R02L01R01	31.055	79.362	5591	31.093	79.261	4564	Stream 1	14.4
103	02R01R02L01R02	31.146	79.296	5612	31.110	79.153	3892	Stream 1	26.3
104	02R01R02L01L01	31.008	79.128	6724	31.116	79.044	3534	Jad Ganga	16.3
105	02R01R02L01R03	31.238	78.833	5124	31.105	78.968	3280	Jad Ganga	27.5
106	02R01R03	31.189	78.806	4791	31.036	78.748	2492	Bhagirathi	20.4
107	02R01R04	31.175	78.628	4308	31.037	78.747	2525	Bhagirathi	24
108	02R01R05	31.183	78.607	5059	31.035	78.718	2469	Bhagirathi	25.8
109	02R01R06	30.966	78.608	3538	30.973	78.697	2303	Bhagirathi	11.3
110	02R01L03	30.872	78.866	5139	30.961	78.696	2259	Bhagirathi	20.6
111	02R01L04	30.901	78.751	3224	30.889	78.674	1973	Bhagirathi	8.51
112	02R01L05	30.860	78.816	4225	30.876	78.663	1862	Bhagirathi	19
113	02R01L06	30.834	78.672	3262	30.860	78.653	1768	Bhagirathi	3.99
114	02R01R07	30.907	78.598	3636	30.842	78.628	1704	Bhagirathi	12.4
115	02R01R08	30.834	78.563	3179	30.824	78.618	1700	Bhagirathi	6.16
116	02R01L07	30.788	78.836	3790	30.784	78.619	1519	Bhagirathi	26
117	02R01L08	30.688	78.607	2899	30.763	78.593	1457	Bhagirathi	9.34
118	02R01L09	30.698	78.590	2966	30.753	78.574	1429	Bhagirathi	7
119	02R01L10	30.689	78.572	2277	30.736	78.522	1295	Bhagirathi	8.97
120	02R01R09	30.814	78.525	2872	30.752	78.472	1222	Bhagirathi	10.1
121	02R01R10	30.940	78.570	4286	30.758	78.456	1168	Bhagirathi	17.7

	River Code	Origin Data			Confluence Data				
S.No	Unique Identification Number	Co-ordinate		Ele (m)	Co-ordinate		Ele (m)	Confluence with	Length Of the river (km.)
		Lat	Long		Lat	Long			
122	02R01L11	30.671	78.542	2448	30.725	78.439	1144	Bhagirathi	13.8
123	02R01R11	30.847	78.384	2610	30.736	78.409	1093	Bhagirathi	14.7
124	02R01R12	30.830	78.339	2759	30.740	78.360	1030	Bhagirathi	12
125	02R01L12	30.685	78.415	2104	30.689	78.357	968	Bhagirathi	6.49
126	02R01L13	30.662	78.492	2247	30.678	78.351	929	Bhagirathi	18.3
127	02R01L14	30.606	78.373	1524	30.630	78.333	885	Bhagirathi	5.71
128	02R01R13	30.757	78.261	1656	30.612	78.315	859	Bhagirathi	20.2
129	02R01R13R01	30.679	78.204	1447	30.649	78.297	1004	Stream 3	14.8
130	02R01R13R01R01	30.666	78.179	1945	30.660	78.212	1338	Stream 1	4.58
131	02R01R13R01L01	30.677	78.258	1899	30.641	78.237	1220	Stream 1	5.21
132	02R01R14	30.425	78.283	2507	30.491	78.400	749	Bhagirathi	18.8
133	02R01R15	30.631	78.190	1649	30.561	78.332	807	Bhagirathi	22.3
134	02R01L15	30.569	78.415	1918	30.542	78.350	797	Bhagirathi	10.7
135	02R01L16	30.639	78.488	2143	30.471	78.414	751	Bhagirathi	30.7
136	02R01L17	30.836	78.925	3790	30.386	78.488	646	Bhagirathi	93.6
137	02R01L17L01	30.465	78.807	2528	30.449	78.696	1012	Bhilangana	17.1
138	02R01L17L02	30.370	78.817	1845	30.426	78.665	873	Bhilangana	19.4
139	02R01L17R01	30.713	78.791	3543	30.428	78.640	830	Bhilangana	51
140	02R01L17R01R01	30.684	78.614	2951	30.577	78.645	1327	Balganga	14.7
141	02R01L17L03	30.400	78.683	1396	30.418	78.640	840	Bhilangana	5.1
142	02R37	31.015	78.459	3783	25.423	81.888	72	Ganga	145
143	02R38R03	31.143	78.589	4909	30.508	77.819	460	Yamuna	172
144	02R38R03R01	31.379	78.162	4492	30.953	77.854	940	Tons	86.5
145	02R38R03R02	31.075	77.560	2680	30.825	77.762	780	Tons	43
146	02R38R03R03	30.866	77.481	3329	30.765	77.703	735	Tons	31.3
147	02L02	30.113	78.707	1260	30.120	78.587	466	Ganga	15.2
148	02R02	30.156	78.530	1882	30.115	78.587	458	Ganga	9.86
149	02L03	30.013	79.044	1484	30.063	78.599	449	Ganga	99.7
150	02L03L01	29.783	78.850	1391	29.847	78.867	852	Nayar	10.8
151	02L03R01	29.995	78.954	2194	29.875	78.831	742	Nyar	26.5
152	02L03R02	30.167	79.045	1541	29.934	78.705	557	Nayar	59.6

	River Code	Origin Data			Confluence Data				
S.No	Unique Identification Number	Co-ordinate		Ele (m)	Co-ordinate		Ele (m)	Confluence with	Length Of the river (km.)
		Lat	Long		Lat	Long			
153	02L03R02R01	30.121	78.780	1928	30.002	78.814	701	Stream 1	24.2
154	02L04	30.028	78.495	1383	30.056	78.514	423	Ganga	4.99
155	02R03	30.145	78.513	1415	30.072	78.501	426	Ganga	9.91
156	02L05	30.043	78.488	939	30.055	78.481	404	Ganga	1.89
157	02L06	30.104	78.419	867	30.100	78.433	402	Ganga	1.9
158	02R04	30.210	78.427	1517	30.113	78.434	387	Ganga	14.6
159	02R05	30.404	78.318	1765	30.134	78.390	379	Ganga	40
160	02L07	29.958	78.574	1059	30.117	78.376	364	Ganga	39.5
161	02R06	30.149	78.298	788	30.121	78.308	350	Ganga	4.69
162	02R07	30.208	78.316	1126	30.105	78.307	336	Ganga	21.4
163	02L08	29.923	78.381	1232	30.036	78.270	324	Ganga	21.8
164	02R08	30.432	78.180	1733	30.036	78.246	318	Ganga	61
165	02R08L01	30.397	78.096	987	30.107	78.123	414	Song	47.3
166	02L09	29.971	78.281	435	30.007	78.242	308	Ganga	7.33
167	02L10	29.964	78.318	901	29.977	78.208	395	Ganga	18
168	02L11	29.928	78.260	397	29.928	78.260	397	Ganga	10
169	02L12	29.933	78.228	495	29.900	78.169	271	Ganga	9.77
170	02L13	29.927	78.324	489	29.838	78.180	258	Ganga	21.4
171	02L14	29.967	78.459	1354	29.769	78.203	246	Ganga	44.6
172	02L15	29.819	78.420	447	29.735	78.204	241	Ganga	27.7
173	02L22	29.112	79.839	674	27.137	79.952	128	Ganga	43
174	02L21	30.084	79.234	1976	27.178	79.846	124	Ganga	174
175	02L21R01	30.045	79.251	1758	30.048	79.284	1494	Ram Ganga	7
176	02L21R02	29.987	79.277	1443	29.987	79.320	1298	Ram Ganga	5.73
177	02L21L01	29.994	79.451	1523	29.950	79.408	1096	Ram Ganga	9.84
178	02L21L02	29.884	79.421	1186	29.886	79.381	975	Ram Ganga	4.48
179	02L21R03	29.938	79.303	1263	29.889	79.349	938	Ram Ganga	12.1
180	02L21R04	29.905	79.291	1245	29.881	79.336	927	Ram Ganga	6.1
181	02L21R05	29.867	79.287	1352	29.857	79.301	892	Ram Ganga	1.99
182	02L21R06	29.952	79.270	1589	29.784	79.235	830	Ram Ganga	28.8
183	02L21L03	29.811	79.486	1523	29.697	79.262	766	Ramganga	46

	River Code	Origin Data			Confluence Data				
S.No	Unique Identification Number	Co-ordinate		Ele (m)	Co-ordinate		Ele (m)	Confluence with	Length Of the river (km.)
		Lat	Long		Lat	Long			
184	02L21R07	29.689	79.072	1120	29.606	79.097	549	Ram Ganga	12.3
185	02L21R08	29.794	78.806	1391	29.585	79.008	457	Ram Ganga	45
186	02L21L04	29.475	78.896	409	29.300	78.643	217	Ram Ganga	2.6
187	02L21R09	29.866	78.610	874	29.252	78.652	212	Ramganga	27.9
188	02L21R09R01	29.927	78.632	1442	29.866	78.610	874	Khoh	8.1
189	02L21R09L01	29.917	78.642	1566	29.866	78.611	874	Khoh	8.18
190	02L21L06	29.519	78.936	530	29.222	78.679	211	Ramganga	48
191	02L21L07	29.432	78.995	354	28.872	78.776	192	Ram Ganga	38.4
192	02L21L09	29.841	79.576	1624	28.635	79.029	173	Ramganga	270
193	02L21L09L01	29.579	79.784	1376	29.552	79.606	1054	Koshi	28.9
194	02L21L09L02	29.478	79.334	1541	29.243	79.107	243	Koshi	43.3
195	02L21L09R01	29.211	78.986	230	28.819	78.981	185	Koshi	43.3
196	02L21L10	29.377	79.652	1761m	28.416	79.257	167m	Ganga	108
197	02L21L12	28.888	79.631	205	27.692	79.615	145	Ram Ganga	3.59
198	02L49R09	30.286	80.869	4682	27.685	81.241	121	Ghaghra	264 km. on border
199	02L49R09R01	30.431	80.533	5113	30.180	80.856	3147	Sharda	54.1
200	02L49R09R02	30.542	80.283	5168	29.963	80.600	1141	Sharda	94.2
201	02L49R09R03	29.861	80.418	3112	29.799	80.428	1102	Sharda	9
202	02L49R09R04	30.544	80.057	4248	29.751	80.376	609	Sharda	114
203	02L49R09R05	29.768	80.282	2246	29.737	80.362	617	Sharda	12.8
204	02L49R09R06	30.212	80.118	3687	29.444	80.242	444	Sharda	123
205	02L49R09R06R01	30.039	79.836	1895	29.524	80.103	498	Ram Gar	97.7
206	02L49R09R06R01R01	29.988	79.621	1427	29.836	79.772	873	Saryu	33.7
207	02L49R09R06R01R02	29.480	79.769	1538	29.521	80.078	512	Saryu	48.6
208	02L49R09R07	29.429	80.082	1752	29.323	80.299	406	Sharda	52.2
209	02L49R09R08	29.147	80.136	564	29.108	80.143	265	Sharda	6.29
210	02L49R09R09	29.154	80.132	1286	29.107	80.133	260	Sharda	7.32
211	02L49R09R10	29.154	80.104	1175	29.103	80.129	267	Sharda	8.57
212	02L49R09R11	29.174	80.077	445	29.081	80.118	260	Sharda	14.7
213	02L49R09R12	29.100	80.037	416	28.830	80.105	185	Sharda	23.9



APPENDIX II

RIVER UNIQUE IDENTITY NUMBER BASED ON ADMINISTRATIVE DELINEATION

RIVER UNIQUE IDENTITY NUMBER BASED ON ADMINISTRATIVE DELINEATION

S No	River Code		ENTRY			EXIT			Origin			Confluence			Length Travelled (km.)
	UID Number (Rural)	UID Number (Urban)	Latitude	Longitude	Elevation (m)	Latitude	Longitude	Elevation (m)	Latitude	Longitude	Elevation (m)	Latitude	Longitude	Elevation (m)	
1	356UK11XXYYYZZ0201		30.770	79.495	3145	30.769	79.497	3143							0.17
2	356UK11XXYYYZZ0202		30.775	79.493	3277	30.774	79.493	3225							0.1
3		356UK11020201	30.748	79.497	3094	30.736	79.493	3086							1.7
4	356UK11XXYYYZZ0201		30.702	79.503	2800	30.676	79.511	2418							4
5	356UK11XXYYYZZ0202								30.660	79.388	4478	30.685	79.507	2379	16.7
6	356UK11XXYYYZZ0201		30.676,	79.511	2418	30.644	79.534	2060							4.58
7	356UK11XXYYYZZ0201		30.644	79.534	2066	30.628	79.555	1793							2.76
8	356UK11XXYYYZZ0202		30.653	79.585	2332	30.628	79.566	1944							3.4
9		356UK11020201	30.563	79.576	1438	30.566	79.553	1378							2.3
10		356UK11020202	30.551	79.587	1936							30.563	79.576	1438	1.77
11	356UK11XXYYYZZ0201		30.566	79.558	1399	30.558	79.535	1391							2.69
12	356UK11XXYYYZZ0201		30.558	79.535	1391	30.531	79.509	1349							4
13	356UK11XXYYYZZ0201		30.526	79.502	1273	30.515	79.492	1243							2.23
14	356UK11XXYYYZZ0202		30.534	79.488	1599	30.529	79.505	1378							2.13
15	356UK11XXYYYZZ0201		30.535	79.517	1385	30.529	79.509	1354							1.16
16	356UK11XXYYYZZ0201		30.529	79.509	1341	30.515	79.492	1236							2.47
17	356UK11XXYYYZZ0202		30.529	79.505	1372	30.527	79.506	1285							1.9
18	356UK11XXYYYZZ0201		30.515	79.492	1238	30.501	79.483	1198							1.82
19	356UK11XXYYYZZ0201		30.515	79.492	1255	30.489	79.473	1147							3.52
20	356UK11XXYYYZZ0201		30.489	79.473	1147	30.487	79.471	1110							2.12
21	356UK11XXYYYZZ0202		30.484	79.490	1424							30.492	79.475	1170	2
22	356UK11XXYYYZZ0201		30.487	79.471	1130	30.482	79.460	1106							1.11
23	356UK11XXYYYZZ0201		30.482	79.460	1149	30.474	79.453	1099							1.93
24	356UK11XXYYYZZ0201		30.463	79.432	1092	30.458	79.427	1081							0.84
25	356UK11XXYYYZZ0202		30.467	79.426	1159	30.463	79.431	1093							0.44

S No	River Code		ENTRY			EXIT			Origin			Confluence			Length Travelled (km.)
	UID Number (Rural)	UID Number (Urban)	Latitude	Longitude	Elevation (m)	Latitude	Longitude	Elevation (m)	Latitude	Longitude	Elevation (m)	Latitude	Longitude	Elevation (m)	
26	356UK11XXYYYZZ0201		30.458	79.427	1082	30.454	79.426	1079							0.46
27	356UK11XXYYYZZ0201		30.447	79.426	1106	30.438	79.426	1084							0.99
28	356UK11XXYYYZZ0201		30.427	79.426	1080	30.413	79.402	1060							2.95
29	356UK11XXYYYZZ0201		30.414	79.402	1056	30.410	79.389	1046							1.89
30	356UK11XXYYYZZ0201		30.408	79.381	1028	30.413	79.373	1020							0.91
31	356UK11XXYYYZZ0201		30.413	79.373	1020	30.412	79.364	1004							0.98
32		356UK11030201	30.412	79.364	1004	30.395	79.322	942							5.32
33		356UK11030202	30.413	79.358	1062	30.408	79.358	990							0.68
34	356UK11XXYYYZZ0201		30.395	79.323	941	30.391	79.321	935							0.48
35	356UK11XXYYYZZ0201		30.391	79.321	935	30.385	79.322	931							0.58
36	356UK11XXYYYZZ0202		30.388	79.316	967	30.388	79.321	932							0.58
37	356UK11XXYYYZZ0201		30.385	79.322	931	30.378	79.319	918							0.89
38	356UK11XXYYYZZ0201		30.378	79.319	918	30.355	79.318	885							3.77
39	356UK11XXYYYZZ0201		30.355	79.318	885	30.344	79.318	871							1.34
40	356UK11XXYYYZZ0201		30.344	79.318	871	30.333	79.318	857							1.4
41	356UK11XXYYYZZ0201		30.327	79.306	853	30.307	79.297	825							3
42	356UK11XXYYYZZ0202		30.321	79.294	865	30.320	79.299	835							0.56
43	356UK11XXYYYZZ0201		30.307	79.297	825	30.297	79.297	813							1.24
44	356UK11XXYYYZZ0201		30.297	79.297	813	30.295	79.297	811							0.25
45	356UK11XXYYYZZ0201		30.294	79.296	810	30.296	79.285	809							1.54
46	356UK11XXYYYZZ0201		30.297	79.286	809	30.293	79.275	790							1.32
47	356UK11XXYYYZZ0201		30.293	79.275	790	30.290	79.268	787							0.79
48	356UK11XXYYYZZ0201		30.291	79.273	787	30.292	79.263	781							1.1
49	356UK11XXYYYZZ0201		30.292	79.263	783	30.290	79.255	775							0.92
50	356UK11XXYYYZZ0201		30.290	79.255	775	30.283	79.244	772							1.36
51	356UK11XXYYYZZ0201		30.283	79.244	769	30.278	79.236	764							1
52	356UK11XXYYYZZ0202											30.279	79.236	774	
53	356UK11XXYYYZZ0201		30.278	79.236	766	30.266	79.219	755							2.33
54		356UK11060201	30.266	79.219	752	30.265	79.213	765							0.76

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