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BEFORE THE NATIONAL GREEN TRIBUNAL,

PRINCIPAL BENCH, NEW DELHI

ORIGINAL APPLICATION NO. 511 OF 2023

IN THE MATTER OF:

Priyank Bharati

...Applicant

Versus

State Of U.P. & Ors.

...Respondent(s)

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THROUGH COUNSEL



BHANWAR PAL SINGH JADON
STANDING COUNSEL FOR STATE OF U.P.

EMAIL- bhanwar09jadon@gmail.com

Ph: 9639286572

DATE: 13.10.2025

PLACE: NOIDA



BEFORE THE NATIONAL GREEN TRIBUNAL,

PRINCIPAL BENCH, NEW DELHI

ORIGINAL APPLICATION NO. 511 OF 2023

IN THE MATTER OF:

Priyank Bharati

Versus

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...Respondent(s)

FURTHER PROGRESS REPORT ON BEHALF OF CHIEF ENGINEER(GANGA), IRRIGATION AND WATER RESOURCE DEPARTMENT, MEERUT, STATE OF UTTAR PRADESH IN COMPLIANCE OF THE ORDER DT. 17.03.2025 PASSED BY THE HON'BLE NATIONAL GREEN TRIBUNAL, NEW DELHI

I, Gyan Prakash Srivastava, aged about 55 years S/o Naval Kishore Srivastava,

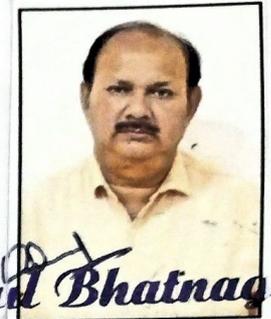
presently posted as Chief Engineer (Ganga), Irrigation and Water Resources

Department, State of Uttar Pradesh, do hereby solemnly affirm and state on oath

as under:

1. That I, the Deponent in the above captioned matter am fully conversant with the facts of the case and is competent and authorized to swear the present response.

मुख्य अभियन्ता (गंगा)
सिंचाई एवं जल संसाधन विभाग
उ० प्र० मेरठ



Anil Bhatnagar
Advocate
UP Bar Council No. 13764/20
Ch. No. 16, Zila Bar Building, Meerut
Mob. 9219503050



2. That I state that the contents of the response have been drafted by my counsel on my instructions and the contents of the same are true to my knowledge and nothing material has been concealed therefrom.

I. BACKGROUND OF THE MATTER:

3. That in the present matter the Hon'ble Tribunal is considering the issue of encroachment on the flood plains of river Budhi Ganga originating from Village Deval of District Muzaffarnagar and reaching to River Ganga at Garhmukteshwar of District Hapur.
4. That the present matter was last listed for hearing on 14.07.2025, wherein the Hon'ble Tribunal directed as under:

"2. Counsel for State of U.P. is directed to serve a copy of the report to the applicant also within one week who will have an opportunity to file objection to the report, if any, within for weeks.

3. Let further progress report be also filed by State of UP before the next date of hearing.

4. List on 14.10.2025."




मुख्य अभियन्ता (गंगा)
सिंचाई एवं जल संसाधन विभाग
उ० प्र० मेरठ

5. That it is respectfully submitted that, as mentioned in the earlier affidavit dt. 11.07.2025 (*Refer @Pg No. 661 of the Judicial Record*) the Survey of India has written a letter dt. 08.07.2025 to the Executive Engineer, Drainage Division-I, Meerut. That the said letter states that contour data at 1-meter interval was provided by the Survey of India vide letter dated 07.07.2025. That the said letter further states that the 1-meter interval contour data provided on 07.07.2025 has been generated from the DEM data earlier provided on 07.10.2024.

That in furtherance of the above, the Survey of India has written a letter dt. 01.08.2025 to the Executive Engineer, Drainage Division-I, Meerut. That vide the said letter the 1-meter contour data pertaining to the area of 782.30 sq. km related to the Budhi Ganga River has been provided. That with the said letter the Invoice No. RK/54/UPGD, Lucknow dated 01.08.2025 has also been provided.

A Copy of the letter dt. 01.08.2025 has been annexed herewith as **ANNEXURE R-1.**



मुख्य अभियन्ता (गंगा)
सिंचाई एवं जल संसाधन विभाग
उ० प्र० मेरठ

7. That subsequently, the Executive Engineer, Drainage Division-I, Meerut vide letter dated 09.07.2025 provided the Shape File Digital Data (1.37 GB, 5760 files in Pen Drive) for 1071 sq. km area out of the total 1853.30 sq. km of River Budhi Ganga, with 1-meter contour interval, as received from the Survey of India, to NIH, Roorkee.

The copy of the letter dated 09.07.2025 is enclosed herewith as **ANNEXURE R-2.**

8. That further, the Executive Engineer, Drainage Division-I, Meerut vide letter dated 02.08.2025 provided Shape File Digital Data (1.27 GB, 3516 files in Pen Drive) with 1-meter contour interval of the remaining 782.30 sq. km, as received from the Survey of India, Lucknow to NIH, Roorkee, thereby making available DEM data for the entire 1853.30 sq. km stretch of River Budhi Ganga.

The Copy of letter dated 02.08.2025 is enclosed herewith as **ANNEXURE R-3.**


मुख्य अभियन्ता (गंगा)
सिंचाई एवं जल संसाधन विभाग
रा.प्र. मेरठ

9. That it is pertinent to state that the Director, NIH, Roorkee, vide its Letter No. SWHD/NIH/2025-26/SP-77 dated 29.09.2025, has submitted the final delineation report of the floodplain zone of River Budhi Ganga to the Executive Engineer, Drainage Division-I, Meerut. That vide the said letter, the NIH has stated that the boundary coordinates remain consistent with the previous data, with certain minor corrections incorporated in the maps, and that the project for demarcation of the floodplain zone in Muzaffarnagar, Meerut, and Hapur districts has been prepared, with the demarcation work scheduled to be completed by 31st May 2026.

The Copy of letter dated 29.09.2025 and final report is enclosed herewith as **ANNEXURE R-4**.

II. PRESENT STATUS AND COMPLIANCE

10. That based on the delineation report received from NIH, Roorkee, the Irrigation and Water Resources Department has commenced the process of physical demarcation of the delineated floodplain zone on ground.

11. That the work is being undertaken in a phased manner in coordination with the concerned district administrations of Muzaffarnagar, Meerut, and Hapur. The Department is ensuring that the process is conducted with scientific accuracy, transparency, and in conformity with legal requirements.



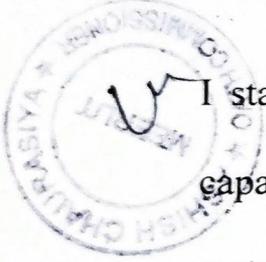

मुख्य अभियन्ता (गंगा)
सिंचाई एवं जल संसाधन विभाग
उ० प्र० मेरठ

12. That it is respectfully submitted that the physical demarcation work is targeted to be completed by May 2026.

13. That the Department remains fully committed to the directions of this Hon'ble Tribunal and shall submit the final compliance report upon completion of the demarcation process.

14. Hence, the present affidavit is being submitted for the kind perusal of this Hon'ble Tribunal. It is prayed that the same be taken on record.

I state that everything stated above has been stated by me in my official capacity on and derived from the official record and I state that nothing material has been concealed therefrom.




18/10/23

मुख्या अधिवक्ता (संसाधन)
DEPONENT
सिंचाई एवं जल ससाधन विभाग
उ० प्र० मेरठ

VERIFICATION

Verified at MEERUT on this 13 day of october, 2025, that the contents of the above affidavit from paragraphs 1 to 14 are believed to be true and correct to the best of my knowledge and belief. No part of it is false and nothing material has been concealed therefrom.



Identify

[Signature]
13/10/2025

Rahul Bhatnagar

Advocate
UP Bar Council E. N. 3764/20
Ch No. 16, Zila Bar Building, Meerut
Mob: 9219503050

[Signature]
13/10/2025

DEPONENT

Serial No. 38 (Case No. 2178251)
Verified that Shri. [Signature]
Identified by Shri. [Signature]
made this affidavit before me on
13/10/25
[Signature]
Commissioner

भारत सरकार
798
GOVT. OF INDIA

आपका
अमृत महोत्सव

टेली-फैक्स/Tele-fax – 0522-2720634

दूरभाष/Telephone-0522-2720638

ई-मेल/E-mail: up.gdc soi@gov.in (Tech)
upgdc-lko@up.nic.in (Admn)



निदेशक का कार्यालय/Office of Director
भारतीय सर्वेक्षण विभाग/Survey of India

मानचित्र भवन/Manchitra Bhawan

उत्तर प्रदेश भू-स्थानिक निदेशालय (उत्तरीक्षेत्र)

Uttar Pradesh G.D (Northern Zone)

5, विभूतिखण्ड, गोमतीनगर, लखनऊ -226010(उ0प्र0)
5, Vibhuti Khand, Gomti Nagar, Lucknow-226010 (UP)

पत्र सं0 त-2816/39-C-ED (कोर्ट केस)

दिनांक: 01/08/2025

सेवा में,

✓ अधिशासी अभियन्ता,

ड्रेनेज खण्ड प्रथम, मेरठ।

(ई-मेल:- eedrainagemeerut@gmail.com)

विषय:- मा0राष्ट्रीय हरित अधिकरण नई दिल्ली में योजित ओ0 ए0 संख्या 511/2023, प्रियंक
भारती बनाम उत्तर प्रदेश राज्य व अन्य में पारित आदेश दिनांक 05/08/2024 के संबंध में।

संदर्भ:- आपके कार्यालय का पत्र संख्या 1290/डीडीएम/511 प्रियंक भारती बनाम उत्तर प्रदेश राज्य व
अन्य/2023 दिनांक 31/07/2025

महोदय,

उपरोक्त विषय व संदर्भित पत्र के संबंध में आपके कार्यालय के श्री पंकज कुमार, जूनियर
इन्जीनियर को संलग्नित बीजक संख्या RK/54/UPGD, Lucknow दिनांक 01/08/2025 के
अन्तर्गत बूढ़ी गंगा नदी से संबंधित इस कार्यालय में उपलब्ध 782.30 वर्ग किमी. का 01 गीटर के
कन्टूर इन्टरवल का shape file डाटा प्रदान किया जा रहा है। यह डाटा अन्य किसी के साथ साझा
नहीं करना सुनिश्चित करेंगे।

उक्त आपके सूचनार्थ प्रेषित है।

भवदीय,

संलग्न:- यथोपरि।

01.08.25

(पवन कुमार द्विवेदी)

अधिकारी सर्वेक्षक/तकनीकी अधिकारी

कृते निदेशक

प्रतिलिपि:- अपर महासर्वेक्षक, उत्तरी क्षेत्र, दिल्ली कैंट को सूचनार्थ प्रेषित।

799

भारतीय सर्वेक्षण विभाग
Survey of India

INVOICE NO. R.K/54/UPGD, LUCKNOW
Dt.01-08-2025

प्रेषक / From

निदेशक

उत्तर प्रदेश भू-स्थानिक निदेशालय (उ०क्षेत्र)

भारतीय सर्वेक्षण विभाग

विभूति खण्ड

गोमती नगर, लखनऊ-226010

सेवा में, To,

अधिशायी अभियंता

इंज-खण्ड प्रथम

मेरठ.

संदर्भ: आपका पत्र सं०.1290/D.D.M/511 प्रियंक भारती बनाम उत्तर प्रदेश राज्य व अन्य /2023. दिनांक.01-07-2025.
आपको निम्नलिखितरजिस्टर्ड/पार्सल/मालगाड़ी, सवारी गाड़ी द्वारा भेजी गई हैं कृपया हस्ताक्षर करके इस
बीजक की एक प्रति वापस कीजिए

Reference your Letter No.

The under mentioned have been dispatched to you by hand/Registered/Parcel
Post/Train. Please sign and return one copy of this invoice

हस्ताक्षरSignature..... पद /Designation.....

नाम साफ अक्षरों में /Name in Block Letter.....

क्रम सं० Sl. No	विवरणDescription HARD DISK No. / PEN DRIVE	FILE / SPACE	REMARK
1	बूढी नदी (782.30) वर्ग किलो मीटर एक मीटर कंटूर	(1.27 GB) 3516 FILE & 3 FOLDER	BY HAND By pen drive 16 GB

संख्या/No.

तारीख/Date

उपयुक्त प्राप्त किया / Received the above

हस्ताक्षर / Signature

पद / Designation

नाम साफ अक्षर / Name in block letter



प्रेषक,

अधिकासी अभियन्ता,
ड्रेनेज खण्ड प्रथम मेरठ।

800

प्रेषित,

निदेशक,
नेशनल इंस्टिट्यूट आफ हाईड्रोलॉजी, (NIH)
रुड़की (उत्तराखण्ड)

पत्रांक: 1149/डी0डी0एम0/511 प्रियंक भारती बनाम उत्तर प्रदेश राज्य व अन्य/2023

दिनांक: 09.07.2025

विषय: मा0 राष्ट्रीय हरित अधिकरण नई दिल्ली में योजित ओ0ए0 संख्या-511/2023, प्रियंक भारती बनाम उत्तर प्रदेश राज्य व अन्य में पारित आदेश दिनांक 05.08.2024 (Original Application N0- 511/2023 (IA No. 346/2024, IA No- 345/2024, IA No. 309/2024 Dated 05-08-2024) के सम्बन्ध में

महोदय,

कृपया उपर्युक्त विषयक अवगत कराना है कि मा0 राष्ट्रीय हरित अधिकरण नई दिल्ली में योजित ओ0ए0 संख्या-511/2023, प्रियंक भारती बनाम उत्तर प्रदेश राज्य व अन्य में पारित आदेश जनपद मुजफ्फरनगर, मेरठ एवं हापुड़ में बूढी गंगा नदी के फ्लड प्लेन जोन के चिन्हीकरण एवं सीमांकन कार्य हेतु आप द्वारा बूढी गंगा नदी के 01 M Accuracy का DEM data उपलब्ध कराने की वॉछना की गयी थी।

उक्त सम्बन्धित डाटा प्राप्त करने हेतु इस कार्यालय के माध्यम से सर्वे आफ इण्डिया लखनऊ को पत्राचार किया गया। जिसमें उनके द्वारा ई0मेल के माध्यम से अवगत कराया गया है कि बूढी गंगा नदी के 1853.30 वर्ग कि0मी0 के 0.5 मीटर Accuracy का DEM data आपको पूर्व में उपलब्ध कराया गया है। वर्तमान में आपके द्वारा माँगे गये 01 मी0 कन्टूर इन्टरवल के कुल क्षेत्र में से केवल 1071.00 वर्ग कि0मी0 का Shape File डाटा ही उनके पास उपलब्ध है, जो आपको उपलब्ध कराया जा सकता है। शेष 782.30 वर्ग कि0मी0 क्षेत्र का 01 मीटर कन्टूर इन्टरवल का डाटा वर्तमान में उनके विभाग के पास उपलब्ध नहीं है।

सर्वे आफ इण्डिया द्वारा उनके पास उपलब्ध डाटा अपने कार्यालय पत्रांक-2324/39-C-ED (कोर्ट केस) दिनांक 07.07.2025 व Invoice N0-RK/47/UPGDC LKO दिनांक 07.07.2025 (प्रति संलग्न) के द्वारा श्री संजय कुमार शर्मा जूनियर इंजीनियर को उपलब्ध करा दिया गया है।

अतः सर्वे आफ इण्डिया लखनऊ से प्राप्त बूढी गंगा नदी का 1071 वर्ग कि0मी0 का 01 मीटर के कन्टूर इन्टरवल का Shape File Digital Data (1.37) GB, 5760 File (Pen Drive) आपको संलग्न कर अग्रेत्तर आवश्यक कार्यवाही हेतु प्रेषित है।

उक्त के सम्बन्ध में अनुरोध है कि प्रकरण में शीघ्रताशीघ्र अग्रेत्तर आवश्यक कार्यवाही करते हुए अन्तिम रिपोर्ट तैयार कर इस कार्यालय को उपलब्ध कराने का कष्ट करें, ताकि सभी कार्यवाही समयान्तर्गत पूर्ण की जा सके। आप अवगत ही है कि प्रकरण मा0 राष्ट्रीय हरित अधिकरण से आच्छादित है, उक्त वाद की आगामी सुनवाई की तिथि 14.07.2025 निर्धारित है।

संलग्न- Shape File Digital Data (1.37) GB, (Pen Drive)
(Space-1.37 GB, Files 5760)


अधिकासी अभियन्ता
ड्रेनेज खण्ड-प्रथम, मेरठ

पत्रांक: 1149/डी0डी0एम0/511 प्रियंक भारती बनाम उत्तर प्रदेश राज्य व अन्य/2023 तददिनांक
प्रतिलिपि निम्नलिखित को सूचनार्थ एवं आवश्यक कार्यवाही हेतु प्रेषित है।

- 1- मुख्य अभियन्ता (जल संसाधन) सिंचाई एवं जल संसाधन विभाग उ0प्र0 लखनऊ।
- 2- मुख्य अभियन्ता (गंगा),सिंचाई एवं जल संसाधन विभाग मेरठ।
- 2- अधीक्षण अभियन्ता गंगा नहर संचालन मण्डल मेरठ।

अधिकासी अभियन्ता
ड्रेनेज खण्ड-प्रथम, मेरठ



801

प्रेषक,

अधिकासी अभियन्ता,
ड्रेनेज खण्ड प्रथम मेरठ।

प्रेषित,

निदेशक,
नेशनल इंस्टिट्यूट आफ हाइड्रोलॉजी, (NIH)
रुड़की (उत्तराखण्ड)

पत्रांक: 1309/डी0डी0एम0/511 प्रियंक भारती बनाम उत्तर प्रदेश राज्य व अन्य/2023

दिनांक: 02.08.2025

विषय: मा0 राष्ट्रीय हरित अधिकरण नई दिल्ली में योजित ओ0ए0 संख्या-511/2023, प्रियंक भारती बनाम उत्तर प्रदेश राज्य व अन्य में पारित आदेश दिनांक 05.08.2024 (Original Application NO- 511/2023 (IA No. 346/2024, IA No- 345/2024, IA No. 309/2024 Dated 05-08-2024) के सम्बन्ध में।

महोदय,

कृपया उपर्युक्त विषयक मा0 राष्ट्रीय हरित अधिकरण नई दिल्ली में योजित ओ0ए0 संख्या-511/ 2023, प्रियंक भारती बनाम उत्तर प्रदेश राज्य व अन्य में पारित आदेश जनपद मुजफ्फरनगर, मेरठ एवं हापुड में बूढी गंगा नदी के फ्लड प्लेन जोन के चिन्हीकरण एवं सीमांकन कार्य हेतु आप द्वारा बूढी गंगा नदी के 01 M Accuracy का DEM data उपलब्ध कराने की वॉछना की गयी थी।

जिसके अनुपालन में इस कार्यालय के पत्रांक-1149/डी0डी0एम0/511 प्रियंक भारती बनाम उत्तर प्रदेश राज्य/2023 दिनांक: 09.07.2025 के माध्यम से बूढी गंगा नदी के कुल क्षेत्र 1853.30 वर्ग कि0मी0 के सापेक्ष 1071 वर्ग कि0मी0 का 01 मीटर के कन्टूर इन्टरवल का Shape File Digital Data (1.37) GB, 5760 File (Pen Drive) सर्वे आफ इण्डिया से प्राप्त कर आपको उपलब्ध करा दिया गया था।

वर्तमान में सर्वे आफ इण्डिया लखनऊ के पत्रांक-2816/39-C-ED (कोर्ट केस) दिनांक 01.08.2025 व Invoice NO-RK/54/UPGDC LKO दिनांक 01.08.2025 (प्रति संलग्न) से प्राप्त बूढी गंगा नदी का शेष 782.30 वर्ग कि0मी0 का 01 मीटर के कन्टूर इन्टरवल का Shape File Digital Data (1.27) GB, 3516 File (Pen Drive) आपको संलग्न कर अग्रेत्तर आवश्यक कार्यवाही हेतु प्रेषित है।

इस सम्बन्ध में आपसे अनुरोध है कि प्रकरण में शीघ्रताशीघ्र अग्रेत्तर आवश्यक कार्यवाही करते हुए अन्तिम रिपोर्ट तैयार कर इस कार्यालय को उपलब्ध कराने का कष्ट करें, ताकि सभी कार्यवाही समयान्तर्गत पूर्ण की जा सके। आप अवगत ही है कि प्रकरण मा0 राष्ट्रीय हरित अधिकरण से आच्छादित है।

संलग्न- Shape File Digital Data (1.27) GB, (Pen Drive)
(Space-1.27 GB, Files 3516)

Data Keemed on 4/8/2025



Scientist
Surface Water Hydrology Division
National Institute of Hydrology

अधिकासी अभियन्ता
ड्रेनेज खण्ड-प्रथम, मेरठ

पत्रांक: 1309/डी0डी0एम0/511 प्रियंक भारती बनाम उत्तर प्रदेश राज्य व अन्य/2023 तददिनांक

प्रतिलिपि निम्नलिखित को सूचनार्थ एवं आवश्यक कार्यवाही हेतु प्रेषित है।

- 1- मुख्य अभियन्ता (जल संसाधन) सिंचाई एवं जल संसाधन विभाग उ0प्र0 लखनऊ।
- 2- मुख्य अभियन्ता (गंगा), सिंचाई एवं जल संसाधन विभाग मेरठ।
- 3- अधीक्षण अभियन्ता गंगा नहर संचालन मण्डल मेरठ।

अधिकासी अभियन्ता
ड्रेनेज खण्ड-प्रथम, मेरठ



राष्ट्रीय जलविज्ञान संस्थान
 (जल शक्ति मंत्रालय, जल संसाधन, नदी विकास एवं गंगा संरक्षण विभाग,
 के अधीन भारत सरकार की सभिति)
 जलविज्ञान भवन, रुड़की-247 667 (उत्तराखण्ड) भारत
National Institute of Hydrology
 (A Government of India Society under Ministry of Jal Shakti,
 Department of Water Resources, R.D. & G.R.
 Jalvigan Bhawan, Roorkee - 247 667, (Uttarakhand) INDIA
 (An ISO 9001 : 2015 Certified Organization)



No. SWHD/NIH/2025-26/SP-77

Date: Sept 29, 2025

To,

Executive Engineer,

Drainage Division-I, Meerut,

Irrigation and Water Resources Department, Govt. of UP

**Sub: Flood plain zone delineation of Burhi Ganga a tributary of the Ganga river from
 village Dabal in Dist. Muzaffarnagar to Garh Mukteshwara.**

Sir,

The report of the study "Flood plain zone delineation of Burhi river" is enclosed herewith for kind consideration and further necessary action. This is to inform you that coordinates of the flood plain zone boundary are same as per previous submitted report. However, Some text and maps are modified/added in this report.

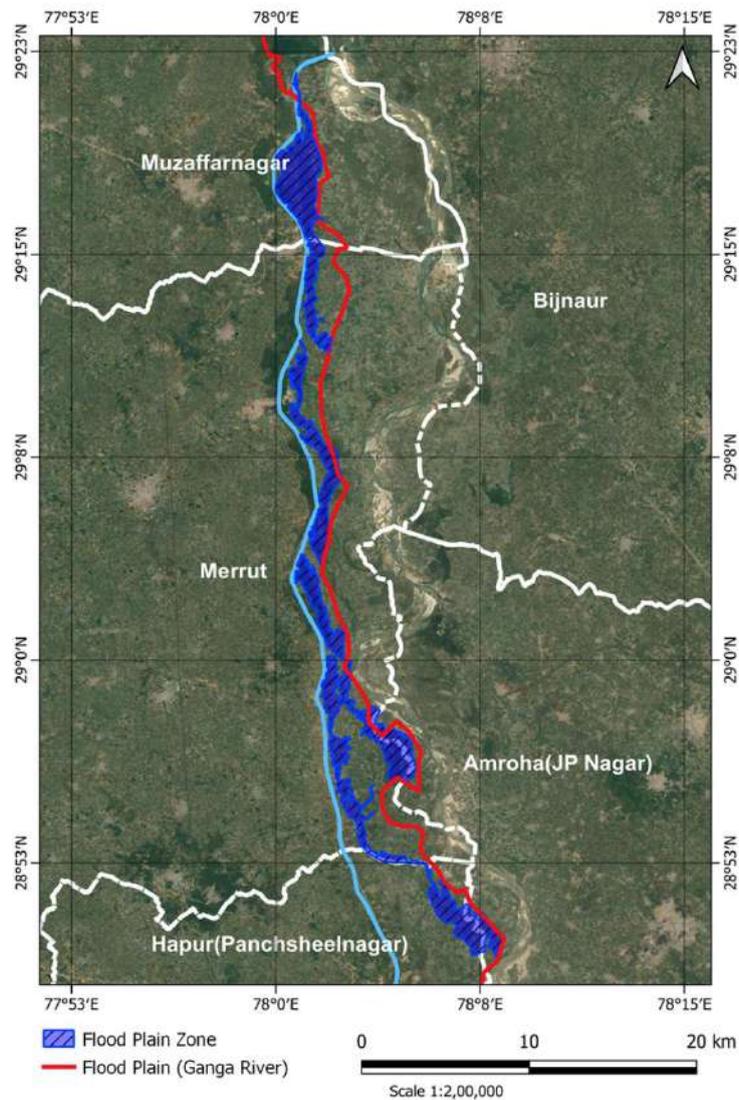
With Regards,

(J. P Patra)

Scientist-E

Surface Water Hydrology Division

Flood Plain Zone (FPZ) Delineation of the Budhi Ganga River



National Institute of Hydrology
Jal Vigyan Bhawan, Roorkee (Uttarakhand) – 247667
September, 2025

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List of Abbreviation

Abbreviation	Definition
1-D	One Dimensional
2-D	Two Dimensional
CWC	Central Water Commission
DEM	Digital Elevation Model
ESRI	Environmental Systems Research Institute
FABDEM	Forest And Buildings removed Copernicus DEM
FFA	Flood Frequency Analysis
FPZ	Flood Plain Zoning
G&D	Gauge and Discharge
GIS	Geographic Information System
GLO	Generalized Logistic
HEC	Hydrologic Engineering Centre
HFL	Heights Flood Level
HO	Hydrological Observation
JRC	Joint Research Centre
NGT	National Green Tribunal
NRSC	National Remote Sensing Centre
PT3	Pearson Type-III
QGIS	Quantum Geographic Information System
RAS	River Analysis System
RSAC-UP	Remote Sensing Applications Centre, Uttar Pradesh
SOI	Survey of India
USACE	US Army Corps of Engineers
OWS	Observed Water Surface
WS	Simulated Water Surface

1 INTRODUCTION

Floods constitute one of the major national calamities faced by India almost every year resulting in substantial loss of life, large scale damage to property, disruption of community lifelines besides entailing untold misery to the millions. Concerted efforts have been made over the years to reduce the damage due to floods and mitigate the sufferings of the people. Various structural flood control measures were taken up in the past including construction of reservoirs, embankments, drainage channels, etc. It is, however, now realised that absolute and permanent protection to all flood prone areas and for all magnitudes of floods by structural measures alone is not only impossible but also not economically viable. The emphasis has therefore been rightly shifted to non-structural measures like Flood Plain Zoning and Regulation, Flood Forecasting, etc., to effectively supplement the structural measures for providing sustainable protection to flood affected areas. The broad concept in flood plain zoning is to regulate the land use in order to mitigate the damage potential. The role of flood plains and need for flood plain zoning was recognized by the Central Water Commission (CWC) as early as 1975. This bill envisages zoning of flood plain of a river according to flood frequencies and defines the type of use of flood plain. The States of Manipur, Rajasthan, Uttarakhand, and erstwhile State of Jammu & Kashmir had enacted the legislation. Moreover, The Central Water Commission (CWC) has drafted technical guidelines for flood plain zoning, which have been circulated to states and union territories for review and feedback. The guidelines aim to provide a framework for states to scientifically assess and zone floodplains, promoting non-structural flood management strategies. However, as per direction given by Hon'ble NGT and following "Ganga Rejuvenation Act" passed in 2014 the flood plain zone is to be demarcated corresponding to once in hundred years return period flood.

2 OBJECTIVES AND SCOPE OF WORK

The Executive Engineer, Drainage Division-I, Meerut, Irrigation and Water Resources Department, Govt. of UP has approached Director, National Institute of Hydrology Roorkee to carryout the study for “Flood plain zone delineation of Budhi Ganga a tributary of the Ganga river from village Dabal in Dist. Muzaffarnagar to Garh Mukteshwara” as per direction given by Hon’ble NGT. Director, NIH has assigned Surface Water Hydrology Division to take up this study.

The Budhi Ganga River a tributary is having very less width and water flows mainly during the rainy seasons and joint to the Ganga river at 3 to 4 locations. There was no observation of flood/discharge or water level in this river. Under these condition following methodologies/ scope of work is decided for delineation of flood plain corresponding to frequency of once in hundred year flood.

- Catchment Delineation: The catchment area of the Budhi Ganga will be delineated from the CartoSat DEM and Survey of India Topo Sheets in GIS platform.
- Flood Frequency Analysis: Since historical flood discharge data is not available, the flood value will be estimated from 100 year return period rainfall.
- Hydraulic Modelling: Once the flood corresponding to 100 year return period is estimated, the HEC RAS hydraulic model is used to simulate the flow pattern on the existing topography (represented through cross-section, Bathymetry i.e. 0.5 m Digital Elevation Model) for estimating flood inundation extent. The river cross-section and Digital Elevation Model is provided by the Irrigation and Water Resources Department, Govt. of UP.
- Flood Plain Zone Demarcation: The hydraulic model will provide the flood inundation extent for 100 year return period flood. NIH will process the output and the line corresponding to the outer extent of flood plain will be provided as a KML file and Shape file to the Irrigation and Water Resources Department, Govt. of UP. The coordinates (Lat, Log) at suitable interval (or bend to bend) will also be provided for further use.

3 STUDY AREA AND DATA

The location map of the study reaches of the Budhi Ganga River is shown in Figure 3.1. There are four main river stretches (R1 to R4) of varying length of about 24 to 29 km independently joining the river Ganga on its right bank. These rivers flow between the right bank of Ganga river and Madhya Ganga canal. The flow of Budhi Ganga river at upstream might have directly connected with the Ganga river in past. However, at present there is no surface flow from the Ganga river to Budhi Ganga river, after construction of Madhya Ganga barrage.

Various data and information are collected from the Survey of India (SOI), Earlier study data from Central Water Commission (CWC), Remote Sensing Applications Centre, Uttar Pradesh (RSAC-UP) and field survey by the Irrigation and Water Resources Department Govt. of U.P. and provided to NIH for this study.

3.1 Data

Following data/ information are used in this study

- 0.5 m Digital Elevation Model (DEM) from the Survey of India (Figure 3.2).
- 1 m contour interval data (Shape File Digital Data) from the Survey of India (Figure 3.3).
- Surveyed river cross-section data provided by Irrigation and Water Resources Department Govt. of U.P.
- Historical Flood Inundation extent from Satellite for different years from Remote Sensing Applications Centre, Uttar Pradesh (RSAC-UP) (Figure 3.4).
- Satellite datasets of Joint Research Commission (JRC)- European commission for the period 1984-2021.

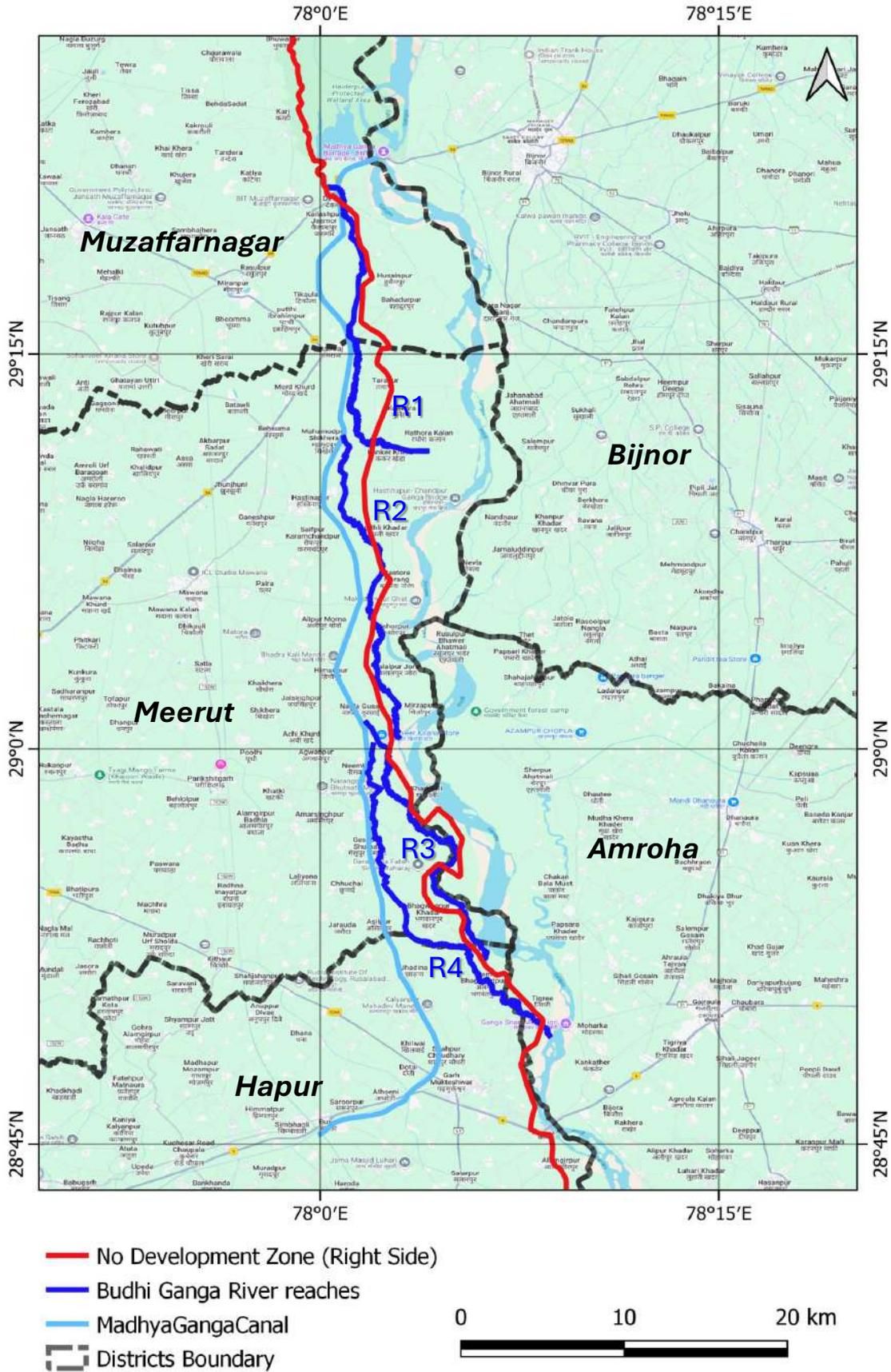


Figure 3.1: Index Map of the Study Area

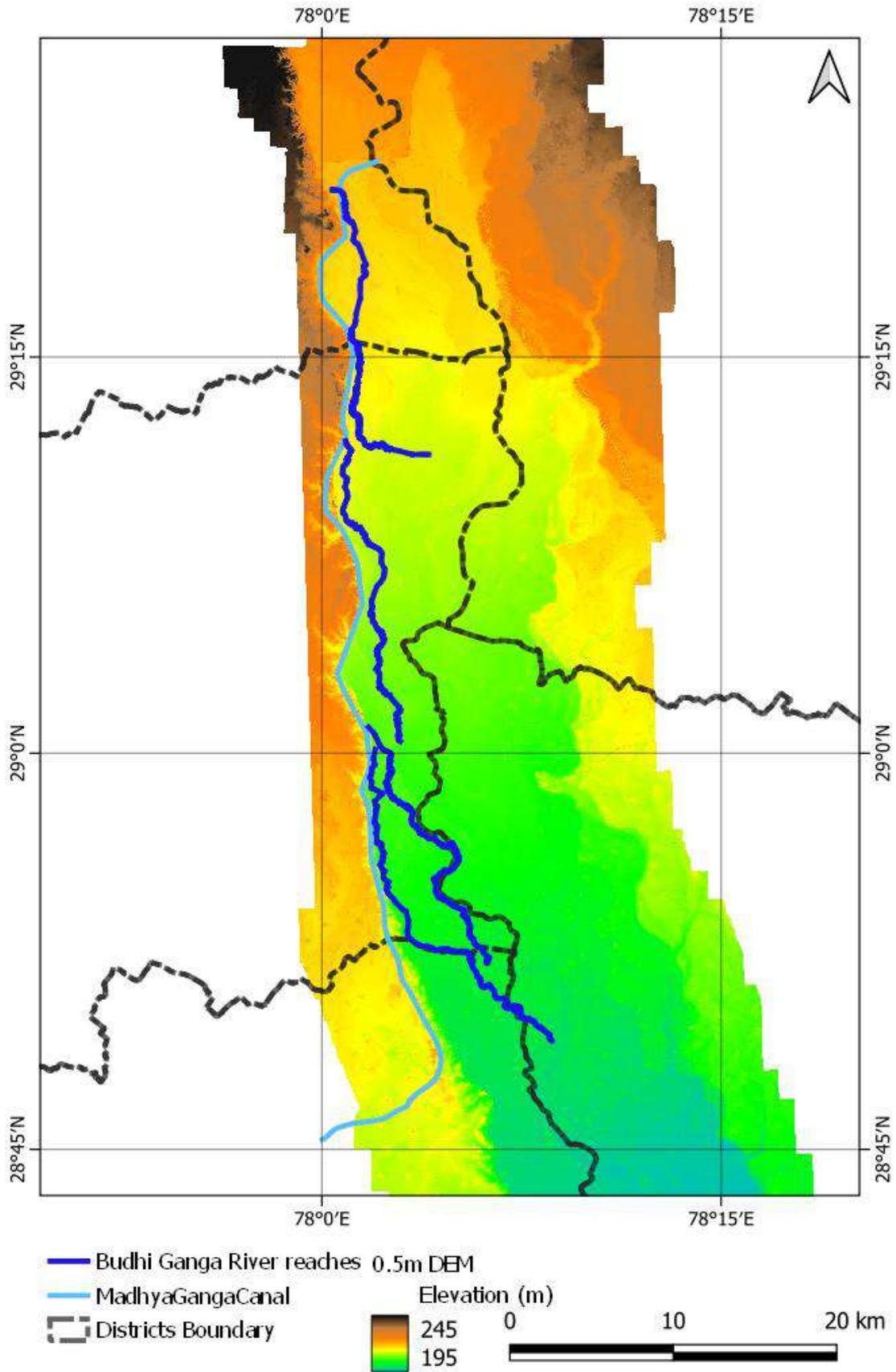


Figure 3.2 : Digital Elevation Model (DEM) provided by SOI

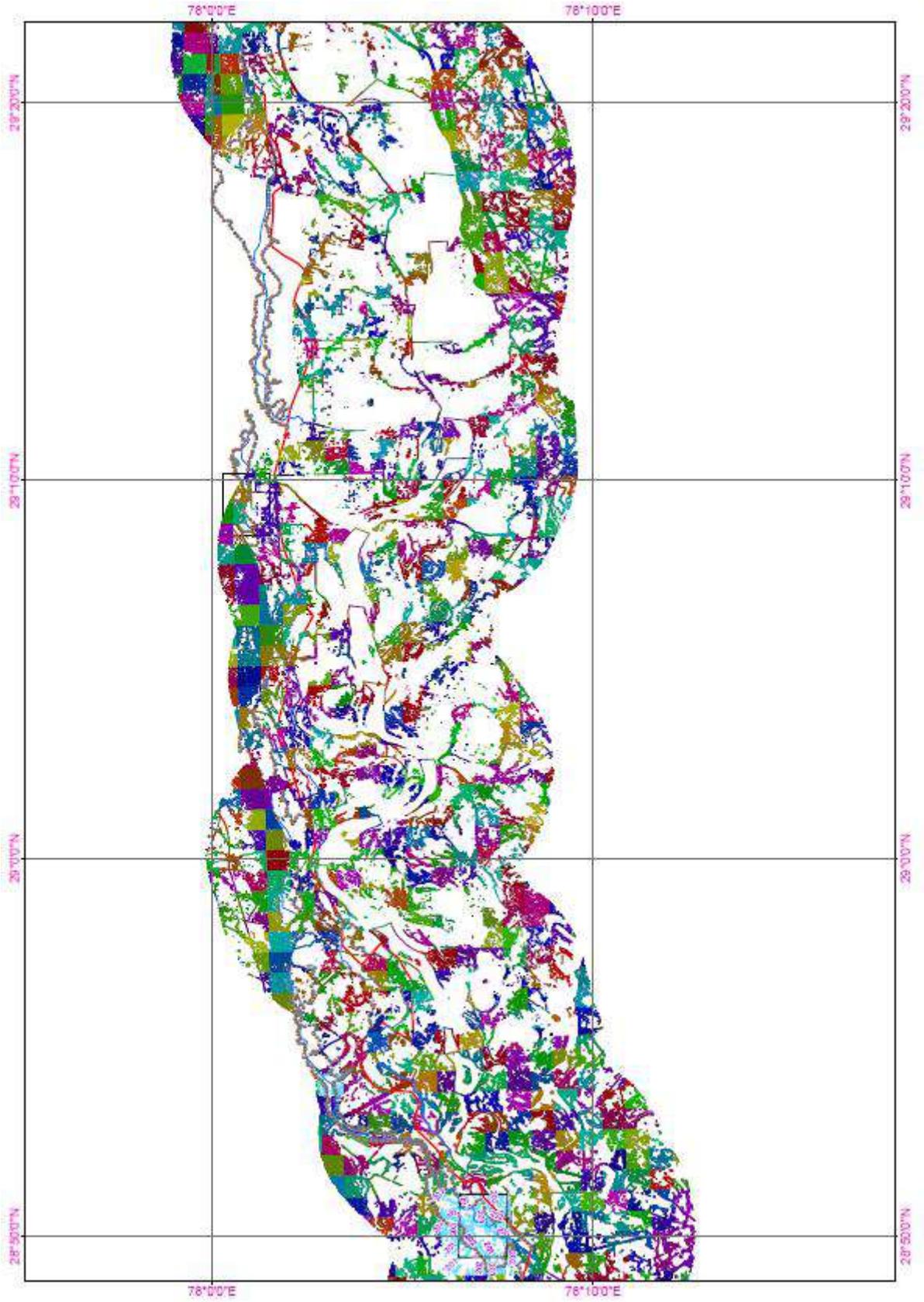


Figure 3.3: 1m contour data provided by SOI

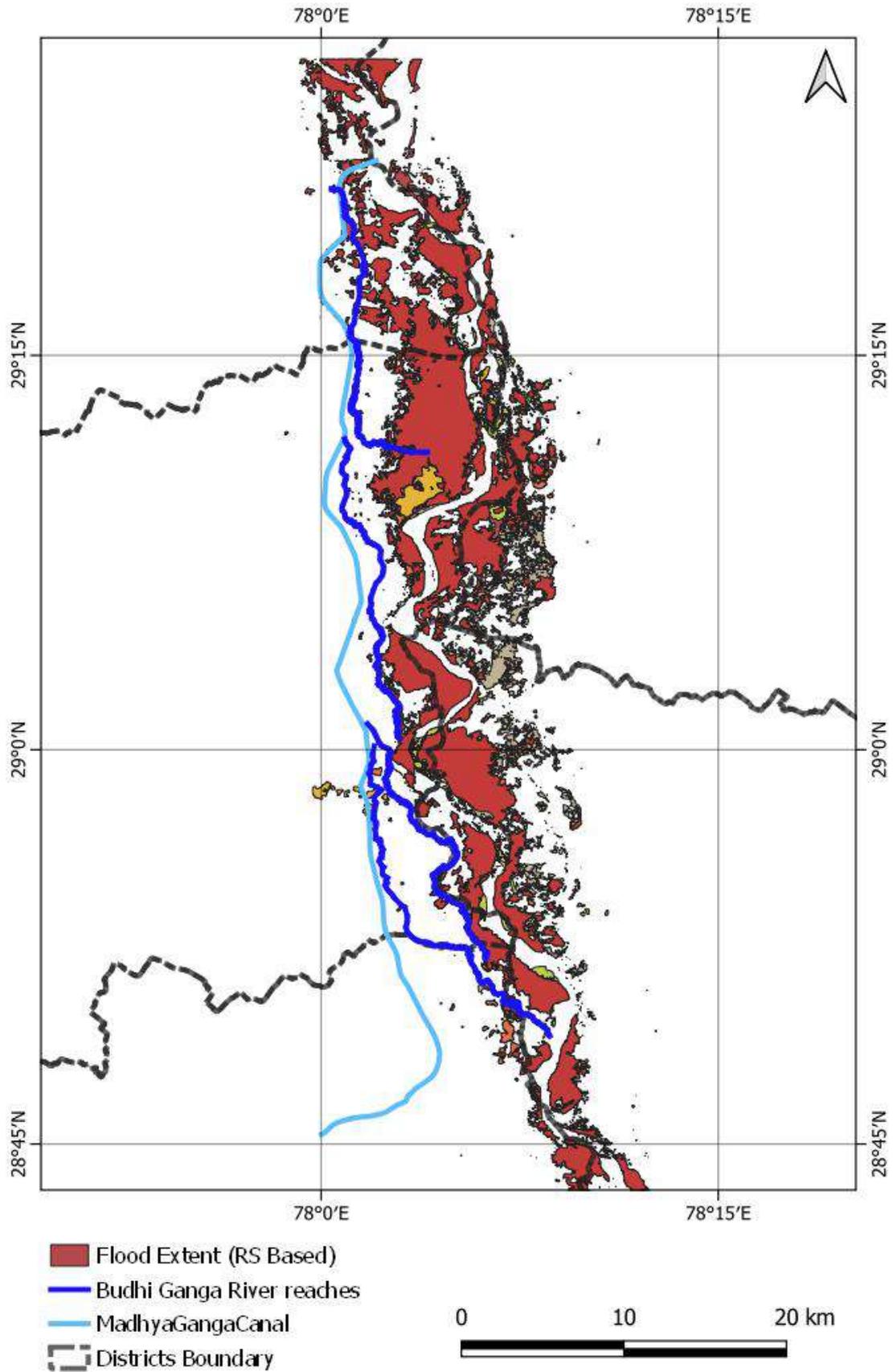


Figure 3.4: Satellite based historical flood inundation extent.

4 SOFTWARE USED

4.1 Hydraulic Model

HEC-RAS, a hydraulic model developed by the USACE, is extensively applied in calculating the hydraulic characteristics of rivers. It is an integrated program and uses the following energy equation for calculating water surface profiles:

$$Y_2 + Z_2 + \frac{\alpha_2 V_2^2}{2g} = Y_1 + Z_1 + \frac{\alpha_1 V_1^2}{2g} + h_e$$

Where Y , Z , V , α , h_e , and g represent water depth, channel elevation, average velocity, velocity weighting coefficient, energy head loss, and gravitational acceleration; and subscripts 1 and 2, respectively, show cross sections 1 and 2. This program provides user to input data, data correction, to receive output display and analysis. HEC-RAS model needs details of river cross sections and upstream flow rate. The water depth and mean velocity are calculated for a given cross section using the energy conservation equation HEC-RAS calculates the water levels' variation along the channel and the water level values are overlaid on a digital elevation model (DEM) of the area to get the extent and flood depth using GIS. Spatial data like cross section, river reach, stream network, flow paths, and others have been obtained using RAS mapper of HEC-RAS.

The U. S. Army Corps of Engineers (USACE) developed HEC-RAS, and it is the latest product of 90 years of hydraulic modelling experience in the United States. Hydraulic modelling development began in the United States after a major flood event on the Mississippi River in 1927 prompting the USACE to begin exploring options to prevent flooding. The Hydrologic Engineering Centre (HEC) is a branch of the USACE that was established for the purpose of researching and developing new techniques to deal with the effects of floods (US Army Corps of Engineers). HEC originally began developing physical models to simulate river flow, but as technology progressed, computer programs that could simulate floods were developed. The computer models were then used to predict water surface profiles in response to potential future flood events and better prepare. The latest update on the program, HEC-RAS 6.5 includes capabilities to model the hydraulics of a river both one and two dimensionally. The three governing equations of hydraulics are the energy equation, the momentum equation, and the continuity equation. One-dimensional HEC-RAS uses a variation of the energy equation in a

procedure called the standard step method to calculate the water surface elevation corresponding to different discharges flowing through the hydraulic system being modelled. The standard outputs of HEC RAS model are water surface elevation, depth and velocity. With use of DEM the inundation boundary and other maps can be generated in RAS mapper. These maps can be exported to as vector file (.shape) and raster file (.tif) for mapping and further analysis by GIS software.

4.2 Geographic Information System (GIS)

A Geographic Information System (GIS) is required for working with geographical data (both vector and raster) and preparation of maps. Built by Esri, ArcGIS is a comprehensive geospatial platform that integrates and connects data through the context of geography. It provides world-leading capabilities for creating, managing, analyzing, mapping, and sharing all types of data. In this study ArcGIS and QGIS an open-source software are used as GIS platform. The GIS is used for following analysis

Pre Processing

- Creation and management of the spatial (raster and vector) data.
- The SOI DEM was provided in number of tiles and these tiles are merged and projected using ArcGIS.
- Catchment delineation by hand digitization and digitization of other important features from SOI toposheet.
- River centerline, cross-section lines, embankments are stored in polyline shape file for importing to HEC RAS and other GIS analysis.

Post Processing

- Raster layers like inundation extent, depth, water level etc. are extracted from the HEC RAS results.
- Conversion of raster layer to vector layer (shape files).
- The shape file of inundation extent is further processed for gap filling etc. in GIS.
- After processing the outer boundary is also exported to KMZ file.
- Polygon layer of flood plain zone boundary is converted to polyline for extracting the extent in left bank and right bank line.
- Various operation like splitting, merging, overlay etc. are performed as per necessary.
- Area, length etc. are calculated using GIS.

5 METHODOLOGY

All relevant data, information collected from various agency are analysed in the following manner: The flowchart of various steps followed for this study is given in Figure 5.1

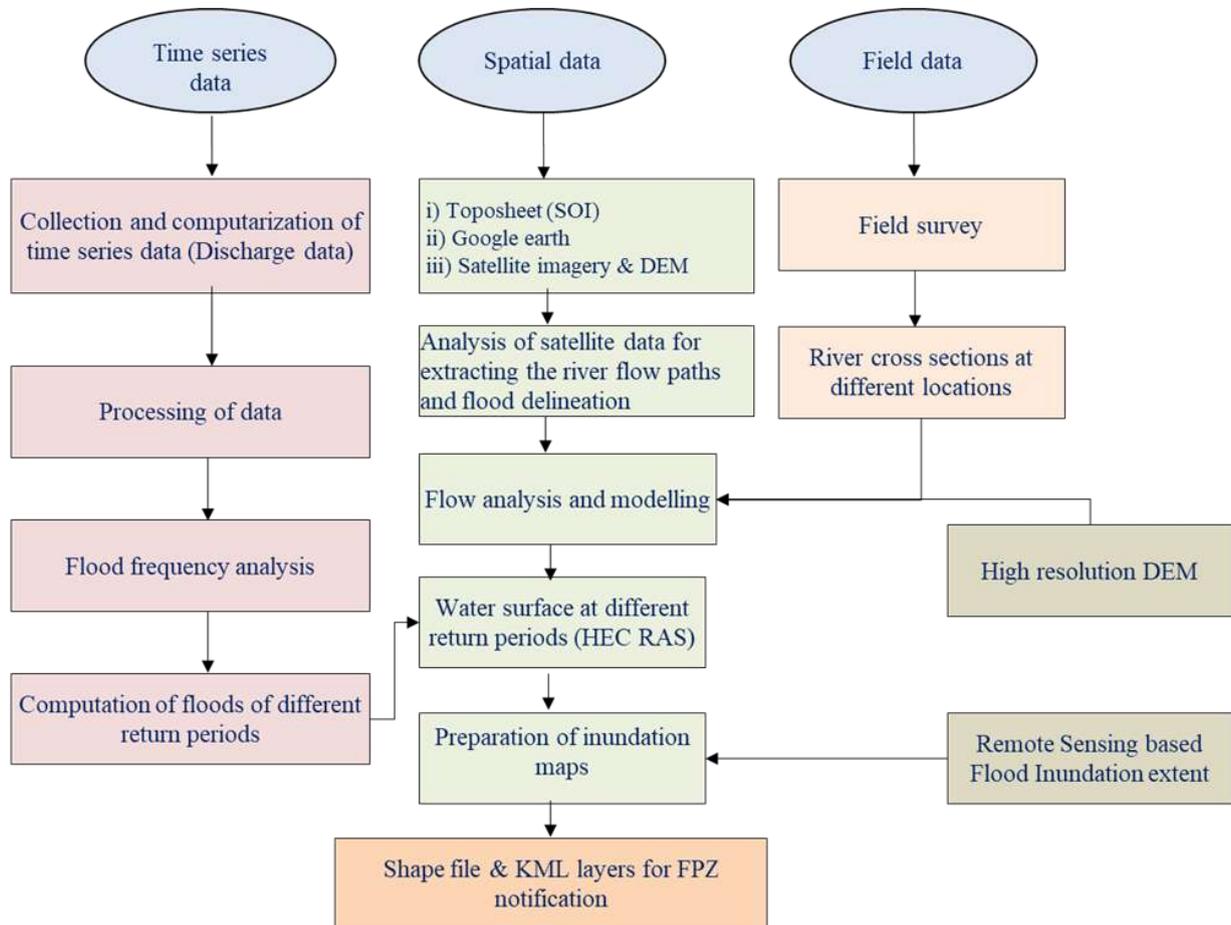


Figure 5.1: Flow chart of methodology

5.1 Flood Frequency Analysis

Historical discharge series for flood frequency analysis was not available. Hence, the discharge corresponding to 100-year return period is estimated from the rainfall data. The estimated value of catchment characteristics are given in Table 5.1. It is to be noted that the catchment and sub catchment area are very small. Hence, SUH is not derived and rational formula is used for computation of discharge. The Time of Concentration is estimated by Kirpich, Kerby and California formula and average value is reported. Considering very mild slope 1 day rainfall is considered for further analysis. The nearest three rain gauge stations namely, Bijnor, Mawana and Hasanpur are selected based on the sub catchment area. The 1 day annual maximum return period rainfall for 100

year return period based on the PMP Atlas (CWC, 2015) are 28.7 cm, 34.2 cm and 24.4 cm at Bijnor, Mawana and Hasanpur respectively. As conservative approach and the Mawana station in Meerut district covers maximum area the 100 year 1 day rainfall of 34.2 cm is considered for discharge estimation. The Rational equation is the simplest method to determine peak discharge from drainage basin runoff. As a conservative approach, the Runoff Coefficient of 0.9 is used as during rainy season and the canal is in operation, the soil will be mostly saturated. The estimated discharge of 100 year return period flood of reaches 1 to 4 are 137.2 m³/s, 142.9 m³/s, 121.5 m³/s and 158.9 m³/s respectively.

Table 5.1: Catchment characteristics

Characteristics	Catchment			
	Reach1	Reach2	Reach3	Reach4
A: Area of the catchment (km ²)	38.5	40.1	34.1	44.6
L: Longest Flow path (km)	26.6	25	23.4	29.2
Tc: Time of Concentration (h)	17.2	14.3	18.2	18.8

5.2 Satellite Based Approach

The flood inundation Extent of recent years (2010, 2011, 2013, 2016, 2018, 2021, 2022 and 2023) was provided by the RSAC, UP (NRSC). This dataset includes major flood events of 2010, 2011 and 2023 etc. The Joint Research Centre-European Commission has analyzed Landsat multispectral satellite images of the past 37 years (1984-2021) for deriving the frequency with which water returns from year to year i.e. recurrence interval and maximum flood extent. The overlay of JRC inundation extent and NRSC data set is shown in Figure 5.2. It is observed that the larger inundation extent is in the dataset obtained from NRSC. This may be due to the fact the Landsat satellites collect images of the Earth's surface on a 16-day repeat cycle is mainly used in JRC inundation extent, whereas daily inundation layer with dataset from active sensors are used by NRSC (RSAC, UP). Hence for further analysis the inundation extent provided by the NRSC is used.

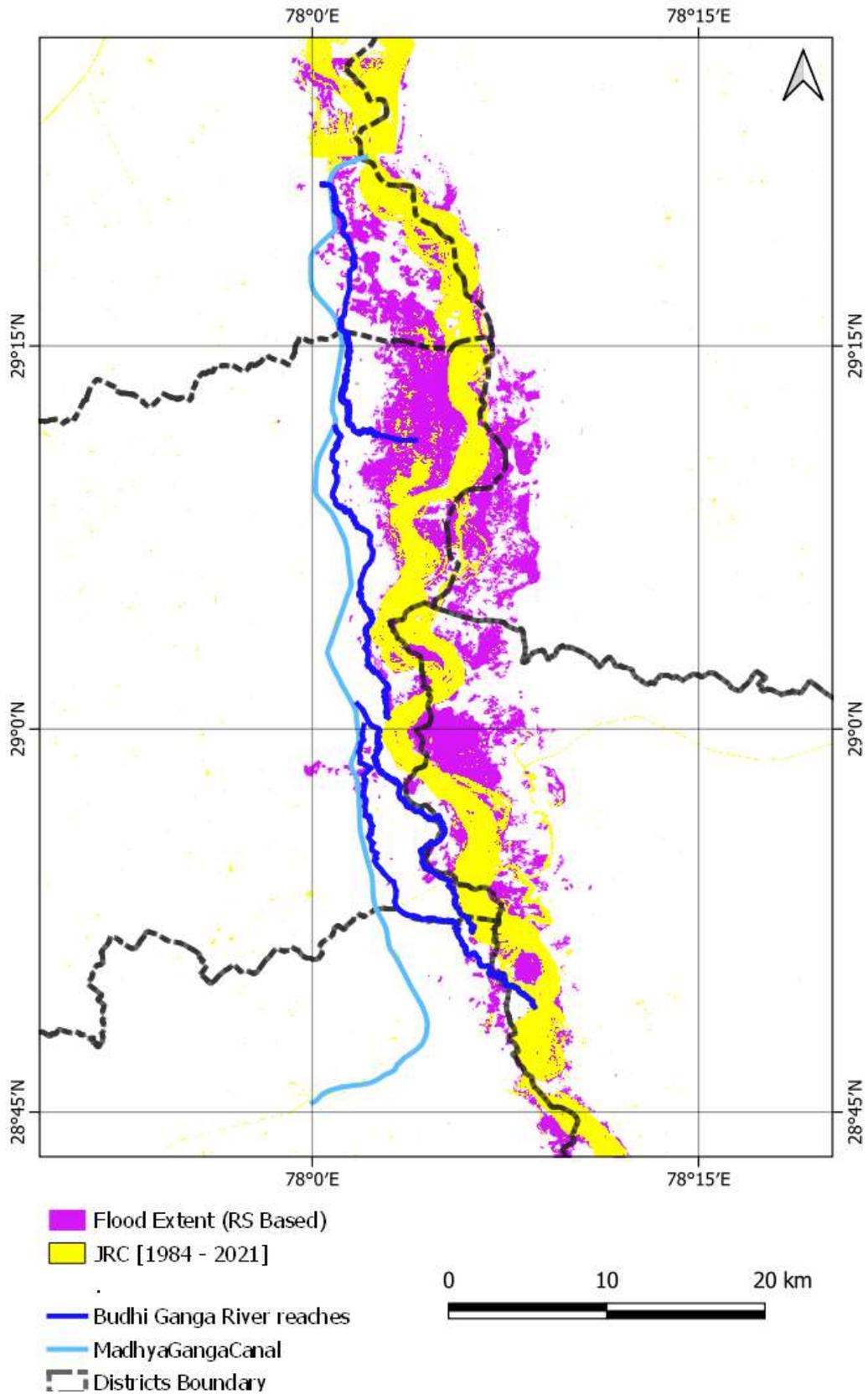


Figure 5.2: Overlay of maximum flood inundation extent of JRC and RSAC,UP (NRSC)

5.3 Hydraulic Modelling Approach

HEC-RAS, a hydraulic model developed by the USACE, is extensively applied in calculating the hydraulic characteristics of rivers. HEC-RAS model needs details of river cross sections (for 1-D modelling) and DEM (for 2-D modelling and flood inundation mapping) apart from boundary conditions (discharge, water level etc.). The latest update on the program, HEC-RAS 6.5 includes capabilities to model the hydraulics both one and two dimensionally is used for this study. The HEC-RAS model is setup is simulated using following data:

- Upstream reaches to provide constant flood magnitude equal to 100 year return period at upstream boundary (area proportionately).
- Downstream boundary as normal depth at downstream.
- Flood plain bathymetry (DEM), River cross-section for routing.

The 1-D model is simulated for steady state condition, while 2-D model is simulated for unsteady flow condition. Initially in 1-D case the model is prepared with provide cross-sections. As per requirement the river cross-sections are extended. The model setups are prepared independently for the four reaches.

6 FLOOD PLAIN DELINEATION

The final hydraulic model result shows small islands within the flood extent causing inundation gaps. These gaps have been filled to get final inundation boundary area. Further, the inundation extent provided by the RSAC, UP (satellite-based approach) are compared with gap filled inundation area. The SOI toposheet clearly marked areas as swamps and such swamps connected with the river are considered as part of flood plain. The reach wise delineated flood plain for 100 year return period flood is shown in **Error! Reference source not found.** It is to be noted that based on the earlier study for river Ganga in this stretch, Irrigation Dept. has provided the boundary of flood plain zone for the Ganga river. Hence the delineated flood plain of Budhi Ganga river in show up to the flood plain boundary of the Ganga river. The Irrigation Dept. also informed that the flood plain zone demarcation for Segment-I is being carried out for 100 year return period flood. It is advisable that while conducting the Flood Plain Zoning of the River Ganga for 100-year return period flood, these tributaries may be modelled/ studied together for combined effect. Further the KML file (can be opened in Google Earth) and tabular value of coordinate (Longitude, Latitude) are also provided for ground truth verification and demarcation.

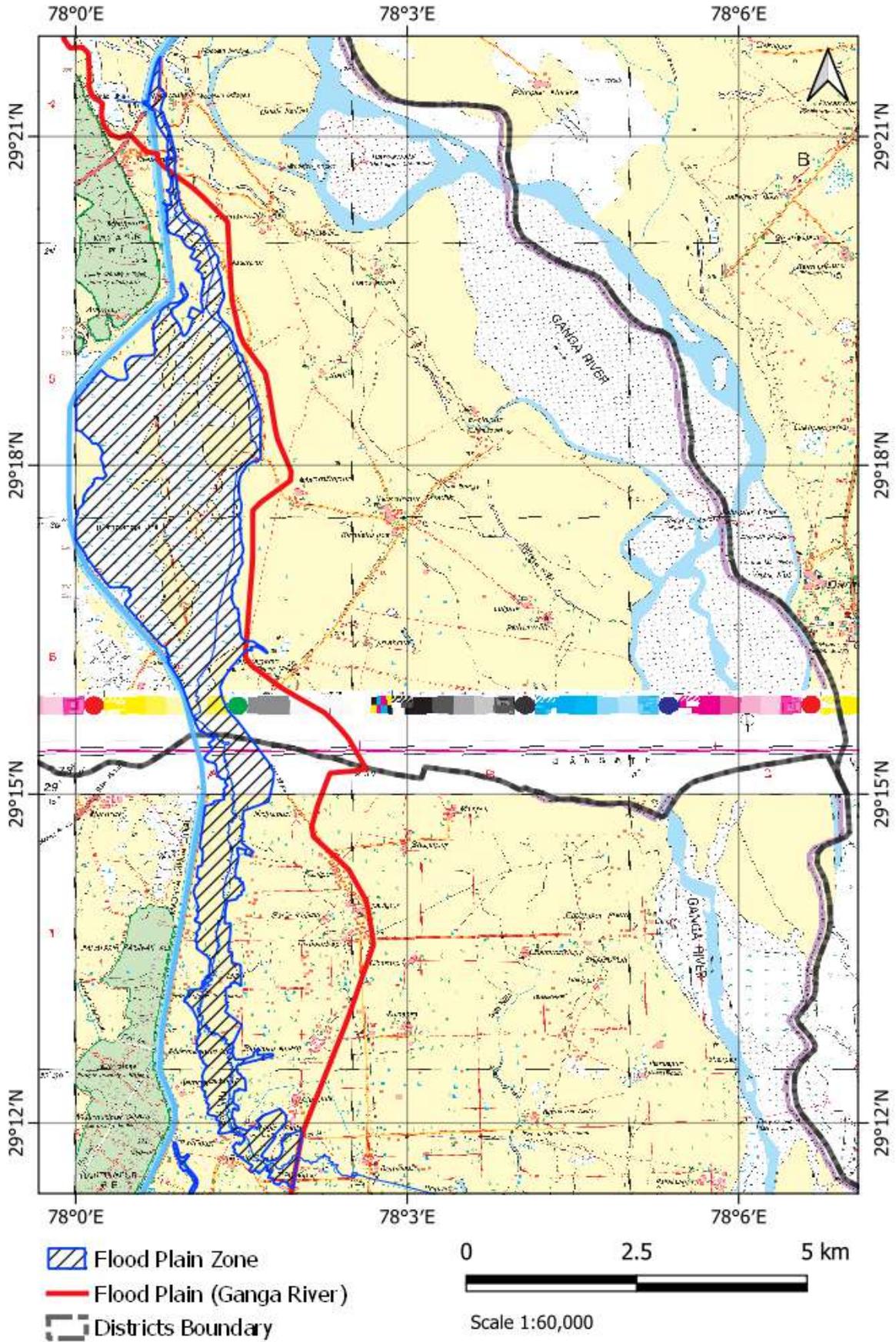


Figure 6.1: Flood plain delineation for 100 year return period flood for Reach 1

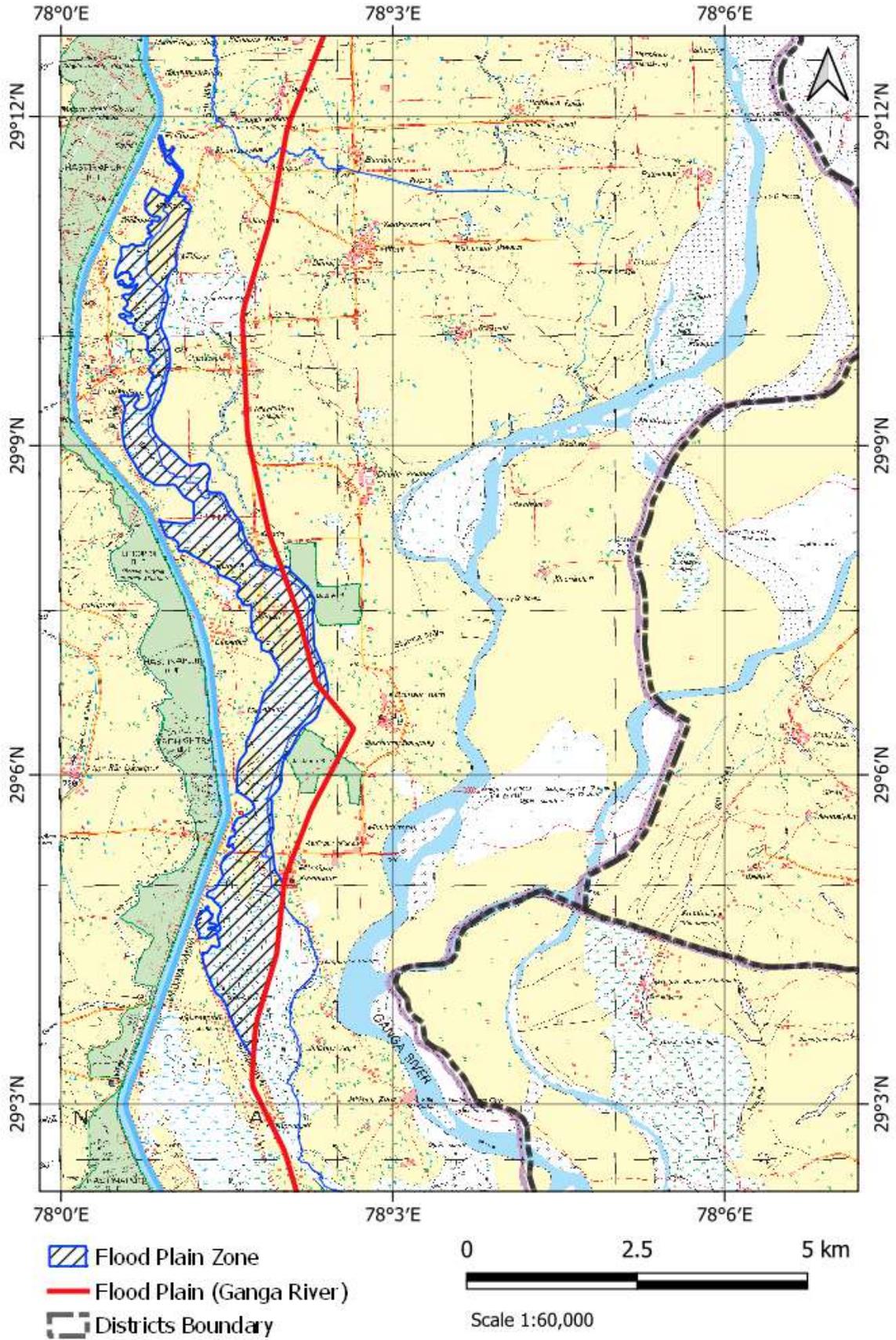


Figure 6.2: Flood plain delineation for 100 year return period flood for Reach 2

6.1 Flood Plain Zone

The district map and delineated flood plain (100-year return period flood) area is shown in Figure 6.4. The total delineated flood plain zone area for Budhi ganga river is about 60 km². The outer extent of 100-year return period flood inundation derived from the study has been provided with coordinated at every 200 m interval in Annexure I.

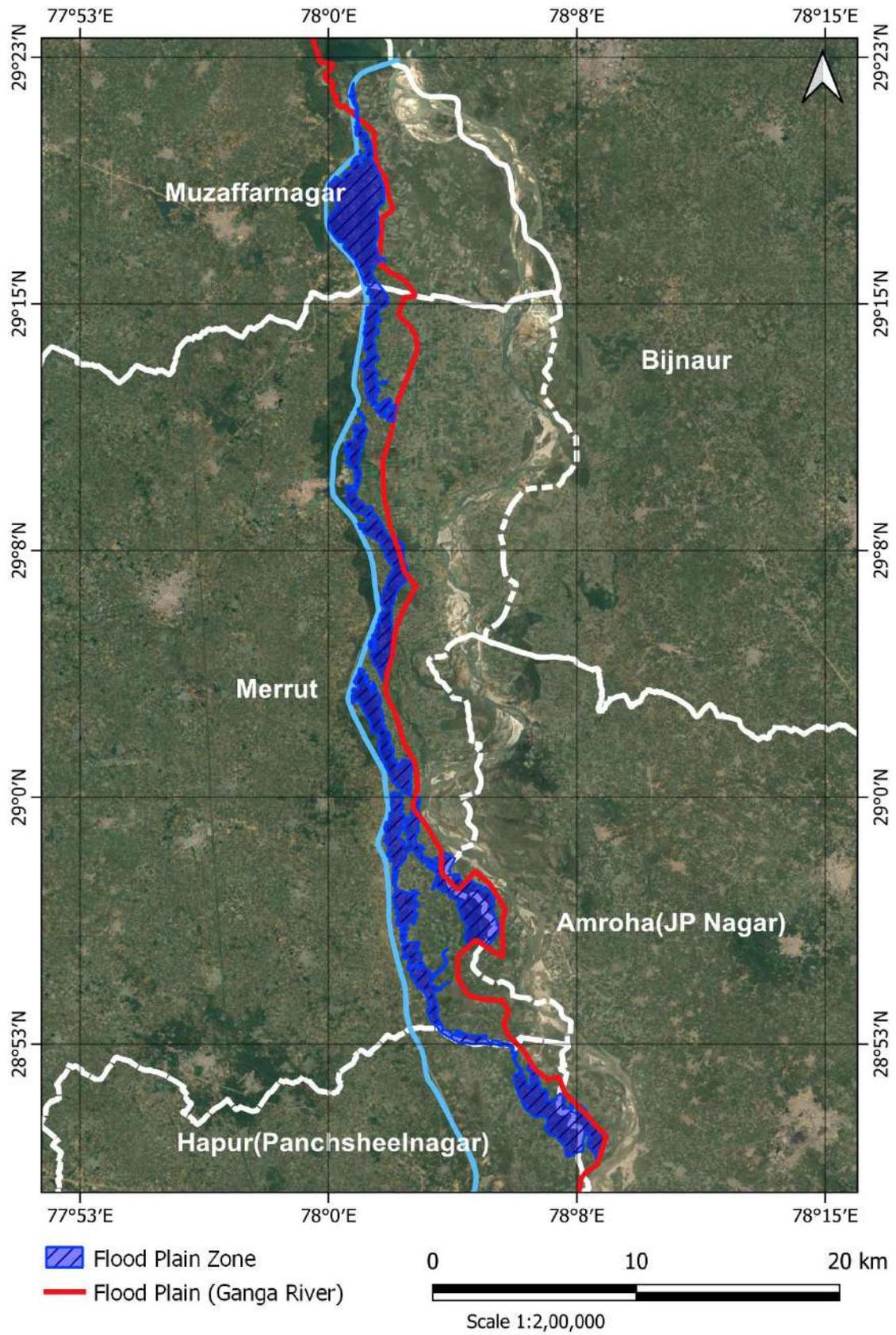


Figure 6.4: District map and 100 year return period flood area

7 ASSUMPTIONS AND LIMITATIONS

For Satellite

- Flood extent covered by satellite depends upon revisit period. cloud cover. River turbidity. river seasonality etc. and classification algorithm used.
- Embankment breach scenarios are not accounted.
- Cannot segregate riverine flooding from other types of flooding.

For Model

- Manning's value of 0.03 to 0.035 was adopted for the river and 0.035 to 0.045 for the flood plain.
- Limitation of river bathymetry below the water spread area in the SOI DEM and accounted using available cross-sections only.
- River morphological changes is not considered.
- Flooding due to drainage congestion. water clogging etc. are not accounted.
- Evaporation, infiltration/ groundwater interaction and diversion losses neglected.

8 CONCLUSION AND RECOMMENDATIONS

Based on studies carried out, data available and constraints posed by any mathematical simulation, following recommendations are made.

- The Budhi Ganga river at upstream might have directly connected with the Ganga river in past. However, at present after construction of Madhya Ganga barrage there is no surface flow from the Ganga river to Budhi Ganga river in normal conditions. Here, the modelling study and subsequent flood plain delineation is done based on the present topography represented with 0.5m DEM (SOI), 1 m contour (SOI) and river cross-section (Irrigation Dept.).
- The extent of 100-year return period flood inundation derived from the study has been provided with coordinated at every 200m interval.
- The SOI toposheet clearly marked areas as swamps and such swamps connected with the river are considered as part of flood plain.
- It is recommended that while conducting the Flood Plain Zoning of the River Ganga for 100-year return period flood, these tributaries may be modelled/ studied together for combined effect.

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Reach wise coordinates of 100 Year flood inundation extent

Reach 1

Left Bank			Right Bank		
SN	Longitude (°E)	Latitude (°N)	SN	Longitude (°E)	Latitude (°N)
1	78.01104	29.35633	1	78.01101	29.35449
2	78.01148	29.35810	2	78.01198	29.35317
3	78.01191	29.35986	3	78.01252	29.35144
4	78.01248	29.36159	4	78.01356	29.34989
5	78.01262	29.36092	5	78.01385	29.34816
6	78.01261	29.35912	6	78.01362	29.34660
7	78.01262	29.35737	7	78.01390	29.34485
8	78.01329	29.35586	8	78.01439	29.34321
9	78.01279	29.35411	9	78.01372	29.34189
10	78.01350	29.35251	10	78.01426	29.34071
11	78.01416	29.35082	11	78.01398	29.33961
12	78.01459	29.34906	12	78.01364	29.33945
13	78.01502	29.34730	13	78.01380	29.33803
14	78.01487	29.34555	14	78.01366	29.33639
15	78.01509	29.34376	15	78.01477	29.33513
16	78.01531	29.34197	16	78.01608	29.33426
17	78.01562	29.34019	17	78.01740	29.33296
18	78.01629	29.33849	18	78.01729	29.33168
19	78.01752	29.33707	19	78.01863	29.33074
20	78.01919	29.33610	20	78.01874	29.32933
21	78.01982	29.33445	21	78.01925	29.32774
22	78.02064	29.33280	22	78.01892	29.32597
23	78.02148	29.33120	23	78.01909	29.32420
24	78.02157	29.32952	24	78.01842	29.32359
25	78.02197	29.32776	25	78.01716	29.32324
26	78.02229	29.32599	26	78.01753	29.32189
27	78.02180	29.32428	27	78.01686	29.32019
28	78.02171	29.32255	28	78.01583	29.32063
29	78.02297	29.32112	29	78.01500	29.32223
30	78.02371	29.31948	30	78.01458	29.32386
31	78.02429	29.31778	31	78.01620	29.32496
32	78.02518	29.31628	32	78.01663	29.32653
33	78.02582	29.31458	33	78.01581	29.32736
34	78.02636	29.31284	34	78.01630	29.32567
35	78.02691	29.31110	35	78.01478	29.32468
36	78.02746	29.30936	36	78.01313	29.32382
37	78.02782	29.30759	37	78.01234	29.32221

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Reach 1

Left Bank			Right Bank		
SN	Longitude (°E)	Latitude (°N)	SN	Longitude (°E)	Latitude (°N)
38	78.02785	29.30581	38	78.01165	29.32056
39	78.02788	29.30401	39	78.01178	29.31876
40	78.02785	29.30221	40	78.01187	29.31698
41	78.02732	29.30059	41	78.00989	29.31668
42	78.02575	29.29988	42	78.00800	29.31621
43	78.02479	29.29830	43	78.00755	29.31458
44	78.02461	29.29652	44	78.00736	29.31302
45	78.02482	29.29473	45	78.00540	29.31339
46	78.02489	29.29295	46	78.00386	29.31453
47	78.02481	29.29131	47	78.00266	29.31313
48	78.02490	29.28971	48	78.00146	29.31166
49	78.02511	29.28792	49	78.00027	29.31019
50	78.02500	29.28618	50	78.00004	29.30846
51	78.02474	29.28446	51	78.00004	29.30665
52	78.02394	29.28299	52	78.00060	29.30527
53	78.02355	29.28134	53	78.00203	29.30404
54	78.02353	29.27956	54	78.00348	29.30306
55	78.02447	29.27805	55	78.00388	29.30141
56	78.02461	29.27632	56	78.00420	29.29968
57	78.02485	29.27454	57	78.00426	29.29810
58	78.02599	29.27333	58	78.00279	29.29759
59	78.02778	29.27258	59	78.00170	29.29610
60	78.02868	29.27160	60	78.00112	29.29442
61	78.02693	29.27245	61	78.00031	29.29286
62	78.02587	29.27199	62	77.99999	29.29111
63	78.02460	29.27071	63	77.99999	29.28930
64	78.02337	29.26927	64	78.00068	29.28766
65	78.02236	29.26770	65	78.00166	29.28608
66	78.02181	29.26600	66	78.00271	29.28456
67	78.02227	29.26425	67	78.00387	29.28307
68	78.02306	29.26259	68	78.00505	29.28159
69	78.02437	29.26120	69	78.00702	29.28150
70	78.02550	29.25970	70	78.00813	29.28069
71	78.02662	29.25819	71	78.00754	29.27912
72	78.02774	29.25667	72	78.00847	29.27764
73	78.02886	29.25516	73	78.00974	29.27622
74	78.02979	29.25356	74	78.01100	29.27480
75	78.02970	29.25177	75	78.01227	29.27337
76	78.02930	29.25000	76	78.01365	29.27214
77	78.02833	29.24864	77	78.01396	29.27068
78	78.02643	29.24795	78	78.01447	29.26922

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Reach 1

Left Bank			Right Bank		
SN	Longitude (°E)	Latitude (°N)	SN	Longitude (°E)	Latitude (°N)
79	78.02520	29.24682	79	78.01545	29.26763
80	78.02535	29.24508	80	78.01621	29.26596
81	78.02507	29.24333	81	78.01684	29.26424
82	78.02597	29.24190	82	78.01745	29.26252
83	78.02616	29.24077	83	78.01805	29.26080
84	78.02514	29.24170	84	78.01910	29.25967
85	78.02452	29.24087	85	78.02071	29.25866
86	78.02422	29.23913	86	78.02028	29.25741
87	78.02408	29.23735	87	78.01971	29.25606
88	78.02520	29.23653	88	78.02031	29.25492
89	78.02498	29.23495	89	78.02125	29.25361
90	78.02362	29.23398	90	78.02227	29.25235
91	78.02263	29.23277	91	78.02250	29.25101
92	78.02247	29.23097	92	78.02231	29.24951
93	78.02332	29.22999	93	78.02079	29.24887
94	78.02321	29.22819	94	78.01947	29.24795
95	78.02303	29.22639	95	78.01923	29.24616
96	78.02352	29.22505	96	78.01899	29.24437
97	78.02485	29.22411	97	78.01875	29.24257
98	78.02489	29.22232	98	78.01914	29.24093
99	78.02461	29.22112	99	78.01898	29.23915
100	78.02332	29.22079	100	78.01827	29.23780
101	78.02265	29.21945	101	78.01835	29.23630
102	78.02288	29.21772	102	78.01785	29.23479
103	78.02338	29.21632	103	78.01843	29.23306
104	78.02491	29.21511	104	78.01836	29.23146
105	78.02433	29.21349	105	78.01870	29.23039
106	78.02364	29.21182	106	78.01815	29.22882
107	78.02384	29.21011	107	78.01828	29.22733
108	78.02558	29.20985	108	78.01915	29.22589
109	78.02692	29.21089	109	78.02029	29.22454
110	78.02749	29.21042	110	78.02016	29.22275
111	78.02953	29.21059	111	78.01909	29.22150
112	78.02833	29.20991	112	78.01815	29.22038
113	78.02635	29.20940	113	78.01687	29.21944
114	78.02438	29.20890	114	78.01683	29.21832
115	78.02486	29.20738	115	78.01789	29.21680
116	78.02560	29.20587	116	78.01852	29.21510
117	78.02466	29.20526	117	78.01874	29.21350
118	78.02382	29.20420	118	78.01828	29.21186
119	78.02438	29.20273	119	78.01871	29.21030

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Reach 1

Left Bank		
SN	Longitude (°E)	Latitude (°N)
120	78.02367	29.20216
121	78.02388	29.20050
122	78.02498	29.19922
123	78.02668	29.19949
124	78.02744	29.20018
125	78.02859	29.20135
126	78.03045	29.20211
127	78.03173	29.20108
128	78.03111	29.19945
129	78.02984	29.19808
130	78.02907	29.19657
131	78.02793	29.19509
132	78.02964	29.19434
133	78.03102	29.19550
134	78.03103	29.19725
135	78.03224	29.19842
136	78.03411	29.19878

Right Bank		
SN	Longitude (°E)	Latitude (°N)
120	78.01969	29.20886
121	78.01905	29.20724
122	78.01893	29.20549
123	78.01954	29.20402
124	78.01998	29.20258
125	78.02036	29.20125
126	78.02157	29.20040
127	78.02164	29.19897
128	78.02285	29.19863
129	78.02461	29.19826
130	78.02502	29.19704
131	78.02370	29.19650
132	78.02452	29.19514
133	78.02609	29.19398
134	78.02650	29.19270
135	78.02795	29.19270
136	78.02876	29.19297
137	78.02930	29.19230
138	78.02979	29.19122
139	78.03112	29.19132
140	78.03247	29.19032
141	78.03279	29.19015

833

Reach 2

Left Bank			Right Bank		
SN	Longitude (°E)	Latitude (°N)	SN	Longitude (°E)	Latitude (°N)
1	78.01500	29.19716	1	78.01476	29.19692
2	78.01556	29.19544	2	78.01507	29.19517
3	78.01683	29.19531	3	78.01568	29.19350
4	78.01647	29.19387	4	78.01687	29.19261
5	78.01766	29.19241	5	78.01788	29.19107
6	78.01831	29.19077	6	78.01711	29.18942
7	78.01750	29.18912	7	78.01638	29.18774
8	78.01824	29.18785	8	78.01603	29.18784
9	78.01915	29.18680	9	78.01439	29.18873
10	78.01923	29.18519	10	78.01317	29.18814
11	78.01878	29.18343	11	78.01266	29.18651
12	78.01812	29.18172	12	78.01339	29.18504
13	78.01747	29.18002	13	78.01492	29.18448
14	78.01732	29.17823	14	78.01364	29.18394
15	78.01673	29.17668	15	78.01331	29.18272
16	78.01595	29.17504	16	78.01318	29.18149
17	78.01596	29.17328	17	78.01190	29.18041
18	78.01587	29.17152	18	78.01021	29.18025
19	78.01539	29.16977	19	78.00904	29.17943
20	78.01512	29.16802	20	78.00870	29.17770
21	78.01587	29.16635	21	78.00819	29.17600
22	78.01631	29.16459	22	78.00927	29.17613
23	78.01641	29.16279	23	78.01056	29.17569
24	78.01604	29.16104	24	78.01075	29.17462
25	78.01565	29.15930	25	78.00932	29.17501
26	78.01509	29.15757	26	78.00935	29.17435
27	78.01431	29.15594	27	78.01112	29.17427
28	78.01372	29.15424	28	78.01087	29.17364
29	78.01386	29.15245	29	78.00938	29.17285
30	78.01488	29.15090	30	78.01000	29.17147
31	78.01634	29.14964	31	78.01017	29.17029
32	78.01773	29.14832	32	78.00983	29.16973
33	78.01921	29.14707	33	78.00924	29.16938
34	78.02117	29.14729	34	78.01078	29.16866
35	78.02241	29.14619	35	78.01166	29.16729
36	78.02203	29.14443	36	78.01296	29.16613
37	78.02255	29.14292	37	78.01306	29.16435
38	78.02447	29.14257	38	78.01400	29.16294
39	78.02524	29.14092	39	78.01333	29.16140
40	78.02628	29.13939	40	78.01366	29.15989
41	78.02724	29.13783	41	78.01295	29.15825

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Reach 2

Left Bank			Right Bank		
SN	Longitude (°E)	Latitude (°N)	SN	Longitude (°E)	Latitude (°N)
42	78.02770	29.13610	42	78.01337	29.15653
43	78.02868	29.13459	43	78.01190	29.15546
44	78.02958	29.13297	44	78.01139	29.15672
45	78.03107	29.13181	45	78.01080	29.15767
46	78.03297	29.13124	46	78.00895	29.15744
47	78.03450	29.13110	47	78.00961	29.15582
48	78.03583	29.12977	48	78.00936	29.15405
49	78.03719	29.12842	49	78.00926	29.15225
50	78.03808	29.12680	50	78.00949	29.15047
51	78.03791	29.12505	51	78.01020	29.14880
52	78.03794	29.12325	52	78.01114	29.14722
53	78.03805	29.12145	53	78.01211	29.14567
54	78.03812	29.11965	54	78.01359	29.14451
55	78.03884	29.11796	55	78.01541	29.14406
56	78.03959	29.11628	56	78.01737	29.14390
57	78.03996	29.11451	57	78.01847	29.14238
58	78.04016	29.11272	58	78.01996	29.14126
59	78.03930	29.11111	59	78.02002	29.13946
60	78.03866	29.10939	60	78.01891	29.13824
61	78.03746	29.10798	61	78.01687	29.13834
62	78.03601	29.10675	62	78.01497	29.13875
63	78.03518	29.10510	63	78.01540	29.13731
64	78.03438	29.10344	64	78.01651	29.13601
65	78.03344	29.10191	65	78.01762	29.13475
66	78.03315	29.10013	66	78.01870	29.13403
67	78.03297	29.09836	67	78.02040	29.13302
68	78.03186	29.09689	68	78.02214	29.13206
69	78.03172	29.09518	69	78.02361	29.13090
70	78.03184	29.09339	70	78.02509	29.12991
71	78.03184	29.09160	71	78.02675	29.12887
72	78.03164	29.08985	72	78.02654	29.12721
73	78.03193	29.08807	73	78.02761	29.12586
74	78.03211	29.08627	74	78.02867	29.12506
75	78.03283	29.08461	75	78.02866	29.12326
			76	78.02909	29.12157
			77	78.03015	29.12024
			78	78.03083	29.11884
			79	78.03211	29.11761
			80	78.03282	29.11594
			81	78.03221	29.11426
			82	78.03092	29.11286

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Reach 2

Left Bank		
SN	Longitude (°E)	Latitude (°N)

Right Bank		
SN	Longitude (°E)	Latitude (°N)
83	78.03022	29.11120
84	78.02974	29.10944
85	78.02915	29.10772
86	78.02844	29.10603
87	78.02789	29.10435
88	78.02727	29.10270
89	78.02661	29.10102
90	78.02654	29.09923
91	78.02657	29.09748
92	78.02821	29.09639
93	78.02910	29.09490
94	78.02749	29.09382
95	78.02614	29.09271
96	78.02617	29.09125
97	78.02532	29.08991
98	78.02585	29.08944
99	78.02545	29.08807
100	78.02423	29.08675
101	78.02435	29.08502
102	78.02360	29.08340
103	78.02215	29.08227
104	78.02290	29.08111
105	78.02408	29.07968
106	78.02364	29.07797
107	78.02373	29.07632
108	78.02240	29.07689
109	78.02298	29.07748
110	78.02274	29.07859
111	78.02209	29.07972
112	78.02109	29.07925
113	78.02041	29.07760
114	78.02080	29.07587
115	78.02210	29.07525
116	78.02357	29.07560
117	78.02363	29.07392
118	78.02218	29.07329
119	78.02134	29.07222
120	78.02182	29.07048
121	78.02249	29.06878
122	78.02325	29.06713
123	78.02453	29.06574

836

Reach 2

Left Bank		
SN	Longitude (°E)	Latitude (°N)

Right Bank		
SN	Longitude (°E)	Latitude (°N)
124	78.02521	29.06405
125	78.02589	29.06236
126	78.02671	29.06070
127	78.02763	29.05909
128	78.02865	29.05753
129	78.02896	29.05707

837

Reach 3

Left Bank			Right Bank		
SN	Longitude (°E)	Latitude (°N)	SN	Longitude (°E)	Latitude (°N)
1	78.01593	29.06509	1	78.01519	29.06452
2	78.01700	29.06461	2	78.01495	29.06275
3	78.01811	29.06356	3	78.01414	29.06120
4	78.01851	29.06236	4	78.01330	29.05964
5	78.01843	29.06068	5	78.01305	29.05798
6	78.01886	29.06008	6	78.01452	29.05694
7	78.01979	29.06161	7	78.01502	29.05544
8	78.01933	29.05995	8	78.01393	29.05440
9	78.01850	29.05837	9	78.01252	29.05520
10	78.02025	29.05882	10	78.01204	29.05358
11	78.02046	29.05758	11	78.01227	29.05253
12	78.02022	29.05592	12	78.01192	29.05086
13	78.02162	29.05615	13	78.01195	29.04906
14	78.02181	29.05462	14	78.01219	29.04736
15	78.02200	29.05327	15	78.01324	29.04882
16	78.02245	29.05493	16	78.01500	29.04944
17	78.02232	29.05672	17	78.01602	29.04846
18	78.02282	29.05803	18	78.01584	29.04704
19	78.02368	29.05661	19	78.01691	29.04607
20	78.02413	29.05493	20	78.01712	29.04472
21	78.02453	29.05330	21	78.01820	29.04319
22	78.02545	29.05173	22	78.01907	29.04159
23	78.02615	29.05005	23	78.01987	29.04002
24	78.02647	29.04829	24	78.02080	29.03844
25	78.02580	29.04659	25	78.02150	29.03692
26	78.02602	29.04488	26	78.02149	29.03527
27	78.02687	29.04331	27	78.02181	29.03351
28	78.02747	29.04197	28	78.02323	29.03241
29	78.02742	29.04028	29	78.02513	29.03201
30	78.02775	29.03946	30	78.02567	29.03035
31	78.02727	29.03781	31	78.02518	29.02879
32	78.02766	29.03654	32	78.02548	29.02709
33	78.02807	29.03542	33	78.02558	29.02538
34	78.02882	29.03375	34	78.02571	29.02358
35	78.03035	29.03262	35	78.02602	29.02180
36	78.03098	29.03097	36	78.02661	29.02010
37	78.03086	29.03003	37	78.02732	29.01856
38	78.03049	29.02930	38	78.02870	29.01766
39	78.03107	29.02793	39	78.02842	29.01618
40	78.03062	29.02686	40	78.02913	29.01458
41	78.03011	29.02525	41	78.03006	29.01297

Reach 3

Left Bank			Right Bank		
SN	Longitude (°E)	Latitude (°N)	SN	Longitude (°E)	Latitude (°N)
42	78.03136	29.02598	42	78.03057	29.01125
43	78.03194	29.02526	43	78.03129	29.00975
44	78.03277	29.02393	44	78.03205	29.00811
45	78.03248	29.02219	45	78.03319	29.00758
46	78.03258	29.02040	46	78.03385	29.00707
47	78.03218	29.01864	47	78.03451	29.00571
48	78.03294	29.01949	48	78.03598	29.00463
49	78.03426	29.01846	49	78.03724	29.00320
50	78.03461	29.01676	50	78.03860	29.00191
51	78.03498	29.01515	51	78.04042	29.00108
52	78.03608	29.01635	52	78.04213	29.00011
53	78.03673	29.01805	53	78.04230	28.99834
54	78.03809	29.01915	54	78.04190	28.99658
55	78.03999	29.01849	55	78.04172	28.99520
56	78.04173	29.01754	56	78.04174	28.99356
57	78.04138	29.01922	57	78.04129	28.99182
58	78.04206	29.02081	58	78.04204	28.99031
59	78.04216	29.02056	59	78.04104	28.98944
60	78.04173	29.01889	60	78.03903	28.98908
61	78.04238	29.01722	61	78.03905	28.98755
62	78.04227	29.01545	62	78.03887	28.98594
63	78.04181	29.01369	63	78.03885	28.98448
64	78.04153	29.01191	64	78.03841	28.98311
65	78.04138	29.01011	65	78.03953	28.98173
66	78.04128	29.00831	66	78.03999	28.98003
67	78.04145	29.00652	67	78.03972	28.97824
68	78.04162	29.00473	68	78.04100	28.97686
69	78.04128	29.00296	69	78.03967	28.97577
70	78.04167	29.00137	70	78.03968	28.97576
71	78.04306	29.00010	71	78.04111	28.97319
72	78.04338	28.99836	72	78.04248	28.97360
73	78.04357	28.99692	73	78.04363	28.97211
74	78.04471	28.99841	74	78.04456	28.97050
75	78.04607	28.99968	75	78.04569	28.96900
76	78.04591	28.99788	76	78.04686	28.96752
77	78.04551	28.99612	77	78.04863	28.96715
78	78.04535	28.99433	78	78.05051	28.96672
79	78.04562	28.99258	79	78.05223	28.96575
80	78.04648	28.99094	80	78.05394	28.96480
81	78.04744	28.98935	81	78.05444	28.96363
82	78.04624	28.98844	82	78.05259	28.96426

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Reach 3

Left Bank			Right Bank		
SN	Longitude (°E)	Latitude (°N)	SN	Longitude (°E)	Latitude (°N)
83	78.04500	28.98702	83	78.05087	28.96525
84	78.04487	28.98523	84	78.04898	28.96548
85	78.04535	28.98348	85	78.05061	28.96439
86	78.04464	28.98212	86	78.05224	28.96329
87	78.04416	28.98052	87	78.05387	28.96219
88	78.04373	28.97877	88	78.05484	28.96131
89	78.04428	28.97716	89	78.05431	28.95957
90	78.04453	28.97574	90	78.05382	28.95785
91	78.04596	28.97552	91	78.05308	28.95619
92	78.04661	28.97486	92	78.05261	28.95443
93	78.04794	28.97467	93	78.05276	28.95297
94	78.04743	28.97324	94	78.05311	28.95475
95	78.04666	28.97187	95	78.05418	28.95482
96	78.04772	28.97044	96	78.05593	28.95399
97	78.04919	28.96948	97	78.05681	28.95294
98	78.05087	28.96855	98	78.05811	28.95182
99	78.05260	28.96786	99	78.06015	28.95162
100	78.05429	28.96686	100	78.06073	28.94999
101	78.05578	28.96762	101	78.06233	28.94899
102	78.05486	28.96851	102	78.06411	28.94808
103	78.05394	28.96927	103	78.06559	28.94686
104	78.05576	28.96897	104	78.06625	28.94602
105	78.05755	28.96963	105	78.06504	28.94531
106	78.05792	28.97095	106	78.06565	28.94359
107	78.05767	28.97212	107	78.06629	28.94188
108	78.05919	28.97143	108	78.06680	28.94014
109	78.06096	28.97056	109	78.06722	28.93839
110	78.06272	28.96963	110	78.06850	28.93699
111	78.06354	28.96842	111	78.06977	28.93557
112	78.06277	28.96675	112	78.07038	28.93396
113	78.06181	28.96516	113	78.06948	28.93235
114	78.06101	28.96350	114	78.06879	28.93067
115	78.06119	28.96218	115	78.06882	28.92890
116	78.06175	28.96051	116	78.06911	28.92712
117	78.06321	28.95972	117	78.06975	28.92541
118	78.06373	28.96087	118	78.06977	28.92361
119	78.06578	28.96094	119	78.06978	28.92320
120	78.06590	28.95930			
121	78.06706	28.95782			
122	78.06897	28.95742			
123	78.07089	28.95783			

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Reach 3

Left Bank		
SN	Longitude (°E)	Latitude (°N)
124	78.07256	28.95711
125	78.07428	28.95612
126	78.07579	28.95524
127	78.07673	28.95457
128	78.07656	28.95311
129	78.07800	28.95386
130	78.07947	28.95404
131	78.08062	28.95275
132	78.08131	28.95141
133	78.08161	28.94974
134	78.08217	28.94922
135	78.08375	28.94936
136	78.08345	28.94761
137	78.08314	28.94583
138	78.08288	28.94406
139	78.08279	28.94241
140	78.08338	28.94069
141	78.08422	28.93914
142	78.08460	28.93751
143	78.08527	28.93591
144	78.08589	28.93423
145	78.08573	28.93243
146	78.08494	28.93079
147	78.08391	28.92923
148	78.08379	28.92905

Right Bank		
SN	Longitude (°E)	Latitude (°N)

841

Reach 4

Left Bank			Right Bank		
SN	Longitude (°E)	Latitude (°N)	SN	Longitude (°E)	Latitude (°N)
1	78.03348	29.00268	1	78.03310	29.00273
2	78.03370	29.00133	2	78.03269	29.00098
3	78.03482	29.00196	3	78.03192	29.00189
4	78.03643	29.00155	4	78.03169	29.00092
5	78.03691	28.99980	5	78.03249	28.99944
6	78.03684	28.99805	6	78.03153	28.99836
7	78.03711	28.99637	7	78.03152	28.99657
8	78.03771	28.99492	8	78.03207	28.99490
9	78.03677	28.99368	9	78.03229	28.99315
10	78.03627	28.99264	10	78.03091	28.99196
11	78.03687	28.99135	11	78.03075	28.99032
12	78.03813	28.99075	12	78.03065	28.98859
13	78.03824	28.98895	13	78.03007	28.98730
14	78.03785	28.98719	14	78.02883	28.98667
15	78.03707	28.98612	15	78.02819	28.98516
16	78.03719	28.98451	16	78.02821	28.98351
17	78.03653	28.98281	17	78.02867	28.98225
18	78.03569	28.98141	18	78.02909	28.98086
19	78.03413	28.98161	19	78.02897	28.97910
20	78.03579	28.98097	20	78.02852	28.97811
21	78.03552	28.97949	21	78.02870	28.97724
22	78.03662	28.97841	22	78.02964	28.97581
23	78.03822	28.97733	23	78.03004	28.97416
24	78.03820	28.97581	24	78.03013	28.97238
25	78.03883	28.97535	25	78.02941	28.97142
26	78.03968	28.97576	26	78.03013	28.96986
27	78.04111	28.97319	27	78.03135	28.96901
28	78.03973	28.97203	28	78.03122	28.96747
29	78.03906	28.97037	29	78.03254	28.96687
30	78.03874	28.96865	30	78.03298	28.96536
31	78.03750	28.96722	31	78.03290	28.96367
32	78.03643	28.96577	32	78.03311	28.96211
33	78.03512	28.96443	33	78.03248	28.96060
34	78.03484	28.96267	34	78.03281	28.95899
35	78.03467	28.96089	35	78.03258	28.95720
36	78.03446	28.95910	36	78.03263	28.95545
37	78.03400	28.95737	37	78.03364	28.95426
38	78.03373	28.95564	38	78.03371	28.95285
39	78.03430	28.95394	39	78.03353	28.95122
40	78.03582	28.95276	40	78.03270	28.94964
41	78.03775	28.95218	41	78.03307	28.94835

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Reach 4

Left Bank			Right Bank		
SN	Longitude (°E)	Latitude (°N)	SN	Longitude (°E)	Latitude (°N)
42	78.03968	28.95156	42	78.03356	28.94661
43	78.04131	28.95057	43	78.03327	28.94489
44	78.04225	28.95122	44	78.03387	28.94354
45	78.04220	28.95275	45	78.03486	28.94228
46	78.04319	28.95249	46	78.03397	28.94111
47	78.04312	28.95143	47	78.03508	28.93986
48	78.04497	28.95172	48	78.03443	28.93832
49	78.04420	28.95064	49	78.03476	28.93663
50	78.04401	28.94936	50	78.03446	28.93507
51	78.04306	28.94824	51	78.03550	28.93539
52	78.04431	28.94682	52	78.03614	28.93541
53	78.04557	28.94544	53	78.03722	28.93426
54	78.04436	28.94469	54	78.03642	28.93302
55	78.04336	28.94339	55	78.03740	28.93241
56	78.04383	28.94187	56	78.03679	28.93108
57	78.04402	28.94063	57	78.03632	28.92939
58	78.04424	28.94036	58	78.03667	28.92767
59	78.04396	28.93986	59	78.03779	28.92628
60	78.04404	28.93853	60	78.03810	28.92517
61	78.04286	28.93730	61	78.03727	28.92373
62	78.04324	28.93606	62	78.03749	28.92214
63	78.04204	28.93615	63	78.03850	28.92069
64	78.04051	28.93648	64	78.03742	28.91951
65	78.03921	28.93533	65	78.03795	28.91854
66	78.03983	28.93413	66	78.03986	28.91806
67	78.03959	28.93235	67	78.04052	28.91700
68	78.03819	28.93236	68	78.04046	28.91533
69	78.03736	28.93097	69	78.04032	28.91368
70	78.03824	28.93123	70	78.04018	28.91376
71	78.03928	28.93002	71	78.03998	28.91254
72	78.03874	28.92829	72	78.04113	28.91208
73	78.03882	28.92659	73	78.04159	28.91037
74	78.04053	28.92619	74	78.04188	28.90887
75	78.04254	28.92649	75	78.04351	28.90784
76	78.04457	28.92670	76	78.04344	28.90639
77	78.04575	28.92592	77	78.04436	28.90481
78	78.04529	28.92417	78	78.04525	28.90330
79	78.04421	28.92298	79	78.04696	28.90234
80	78.04450	28.92226	80	78.04782	28.90183
81	78.04585	28.92101	81	78.04857	28.90044
82	78.04696	28.91950	82	78.04905	28.89971

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Reach 4

Left Bank			Right Bank		
SN	Longitude (°E)	Latitude (°N)	SN	Longitude (°E)	Latitude (°N)
83	78.04674	28.91777	83	78.04973	28.89862
84	78.04728	28.91633	84	78.05002	28.89691
85	78.04754	28.91495	85	78.05017	28.89527
86	78.04568	28.91469	86	78.05108	28.89366
87	78.04425	28.91503	87	78.05087	28.89217
88	78.04296	28.91369	88	78.04965	28.89198
89	78.04337	28.91345	89	78.05019	28.89024
90	78.04535	28.91345	90	78.05088	28.88855
91	78.04714	28.91409	91	78.05164	28.88687
92	78.04860	28.91380	92	78.05271	28.88536
93	78.05003	28.91250	93	78.05414	28.88408
94	78.05129	28.91112	94	78.05539	28.88269
95	78.05201	28.90989	95	78.05633	28.88114
96	78.05361	28.91101	96	78.05792	28.88001
97	78.05527	28.91208	97	78.05964	28.87905
98	78.05689	28.91317	98	78.06138	28.87810
99	78.05814	28.91459	99	78.06312	28.87716
100	78.05899	28.91621	100	78.06488	28.87624
101	78.05839	28.91791	101	78.06667	28.87537
102	78.05753	28.91954	102	78.06825	28.87566
103	78.05764	28.92124	103	78.07020	28.87563
104	78.05899	28.92253	104	78.07212	28.87517
105	78.06007	28.92279	105	78.07414	28.87510
106	78.05853	28.92161	106	78.07582	28.87536
107	78.05811	28.92003	107	78.07786	28.87530
108	78.05892	28.91838	108	78.07990	28.87515
109	78.05982	28.91679	109	78.08175	28.87478
110	78.05923	28.91514	110	78.08375	28.87481
111	78.05817	28.91360	111	78.08569	28.87440
112	78.05689	28.91220	112	78.08768	28.87426
113	78.05537	28.91100	113	78.08970	28.87401
114	78.05395	28.90970	114	78.09160	28.87341
115	78.05237	28.90857	115	78.09239	28.87208
116	78.05245	28.90707	116	78.09210	28.87044
117	78.05131	28.90557	117	78.09381	28.86947
118	78.05216	28.90456	118	78.09311	28.86789
119	78.05378	28.90413	119	78.09373	28.86617
120	78.05532	28.90294	120	78.09426	28.86446
121	78.05679	28.90313	121	78.09539	28.86296
122	78.05783	28.90468	122	78.09619	28.86130
123	78.05931	28.90591	123	78.09580	28.86026

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Reach 4

Left Bank			Right Bank		
SN	Longitude (°E)	Latitude (°N)	SN	Longitude (°E)	Latitude (°N)
124	78.06087	28.90645	124	78.09469	28.85957
125	78.05936	28.90548	125	78.09345	28.85888
126	78.05786	28.90426	126	78.09367	28.85709
127	78.05698	28.90268	127	78.09377	28.85529
128	78.05528	28.90187	128	78.09427	28.85354
129	78.05333	28.90141	129	78.09481	28.85181
130	78.05318	28.89973	130	78.09541	28.85008
131	78.05373	28.89799	131	78.09621	28.84842
132	78.05430	28.89626	132	78.09706	28.84678
133	78.05485	28.89452	133	78.09805	28.84527
134	78.05480	28.89277	134	78.09847	28.84356
135	78.05491	28.89114	135	78.09943	28.84198
136	78.05478	28.88948	136	78.10090	28.84074
137	78.05538	28.88776	137	78.10238	28.83951
138	78.05622	28.88613	138	78.10382	28.83824
139	78.05737	28.88464	139	78.10531	28.83795
140	78.05740	28.88284	140	78.10683	28.83853
141	78.05907	28.88205	141	78.10877	28.83794
142	78.06097	28.88144	142	78.11013	28.83666
143	78.06211	28.88012	143	78.11011	28.83498
144	78.06384	28.87985	144	78.10926	28.83336
145	78.06566	28.87930	145	78.10897	28.83168
146	78.06689	28.88018	146	78.11031	28.83031
147	78.06502	28.88088	147	78.11170	28.82899
148	78.06411	28.88170	148	78.11362	28.82849
149	78.06601	28.88134	149	78.11519	28.82758
150	78.06786	28.88056	150	78.11624	28.82603
151	78.06972	28.87981	151	78.11748	28.82459
152	78.07166	28.87928	152	78.11872	28.82315
153	78.07369	28.87908	153	78.11927	28.82145
154	78.07574	28.87905	154	78.11946	28.81966
155	78.07777	28.87929	155	78.12018	28.81828
156	78.07982	28.87937	156	78.12200	28.81819
157	78.07906	28.87827	157	78.12375	28.81914
158	78.08003	28.87668	158	78.12549	28.82008
159	78.08178	28.87592	159	78.12749	28.82031
160	78.08314	28.87685	160	78.12827	28.82155
161	78.08512	28.87642	161	78.12842	28.82335
162	78.08703	28.87575	162	78.12828	28.82505
163	78.08901	28.87536	163	78.12824	28.82649
164	78.09103	28.87532	164	78.12876	28.82819

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Reach 4

Left Bank			Right Bank		
SN	Longitude (°E)	Latitude (°N)	SN	Longitude (°E)	Latitude (°N)
165	78.09267	28.87426	165	78.13001	28.82957
166	78.09347	28.87266	166	78.13132	28.82951
167	78.09276	28.87101	167	78.13158	28.82841
168	78.09455	28.87032	168	78.13125	28.82694
169	78.09471	28.86880	169	78.13068	28.82521
170	78.09425	28.86725	170	78.13064	28.82341
171	78.09485	28.86557	171	78.13178	28.82198
172	78.09555	28.86388	172	78.13310	28.82060
173	78.09689	28.86264	173	78.13443	28.81922
174	78.09848	28.86164	174	78.13444	28.81752
175	78.09766	28.86024	175	78.13529	28.81590
176	78.09844	28.85862	176	78.13559	28.81538
177	78.09932	28.85702			
178	78.09980	28.85528			
179	78.10090	28.85389			
180	78.10219	28.85423			
181	78.10193	28.85601			
182	78.10187	28.85781			
183	78.10209	28.85957			
184	78.10124	28.86107			
185	78.09991	28.86223			
186	78.10055	28.86394			
187	78.10220	28.86482			
188	78.10364	28.86385			
189	78.10483	28.86242			
190	78.10532	28.86067			
191	78.10557	28.85891			
192	78.10515	28.85715			
193	78.10601	28.85563			
194	78.10602	28.85400			
195	78.10653	28.85227			
196	78.10816	28.85153			
197	78.10959	28.85148			
198	78.11018	28.84975			
199	78.11008	28.84796			
200	78.10870	28.84779			
201	78.11034	28.84696			
202	78.11206	28.84621			
203	78.11370	28.84659			
204	78.11502	28.84746			
205	78.11570	28.84895			

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Reach 4

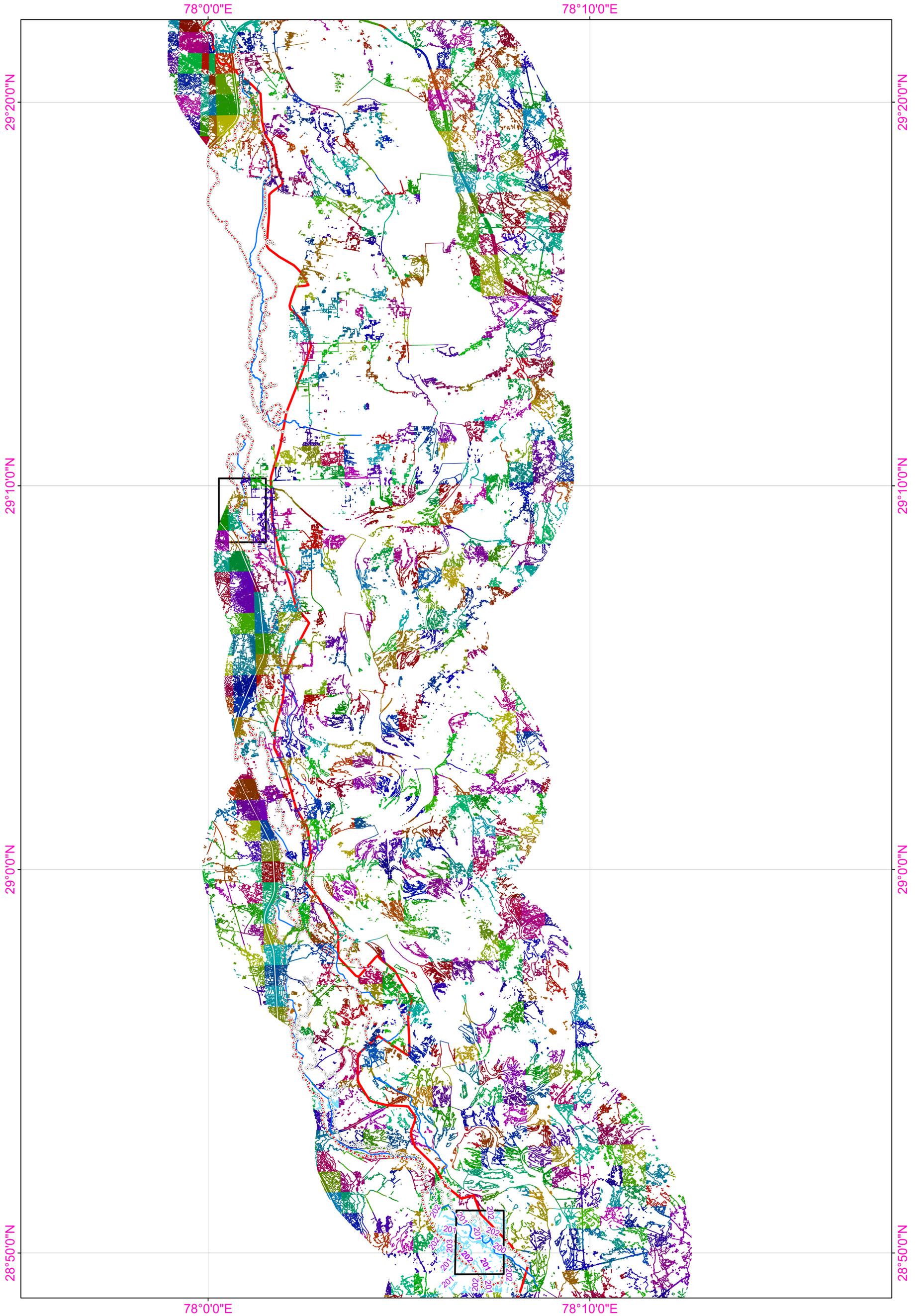
Left Bank		
SN	Longitude (°E)	Latitude (°N)
206	78.11729	28.84942
207	78.11842	28.84808
208	78.11908	28.84637
209	78.11876	28.84467
210	78.11955	28.84318
211	78.12117	28.84214
212	78.12204	28.84277
213	78.12210	28.84457
214	78.12255	28.84436
215	78.12298	28.84267
216	78.12250	28.84091
217	78.12403	28.84018
218	78.12551	28.84009
219	78.12591	28.84174
220	78.12590	28.84354
221	78.12645	28.84416
222	78.12793	28.84291
223	78.12930	28.84160
224	78.13011	28.83995
225	78.13046	28.83817
226	78.13102	28.83644
227	78.13195	28.83492
228	78.13382	28.83441
229	78.13523	28.83314
230	78.13660	28.83180
231	78.13797	28.83046
232	78.13925	28.82909
233	78.13967	28.82793

Right Bank		
SN	Longitude (°E)	Latitude (°N)

Delineated flood plain overlaid on Contour from SOI



847



Flood Plain for once in 100 year

BUDHIGANGA RIVER

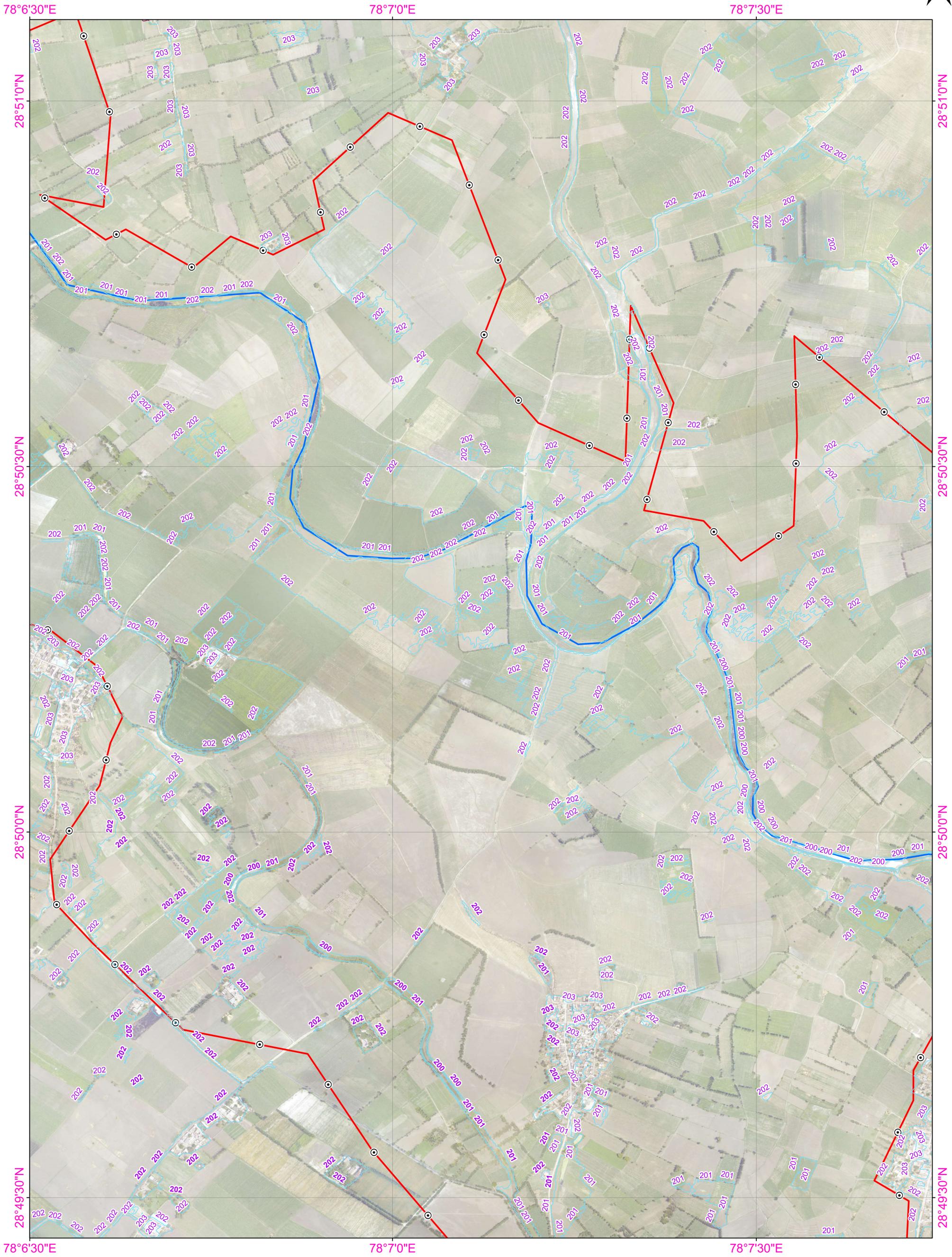
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□ Area for 1:4000 scale



○ Coordinates at 200m

Delimited flood plain overlaid on 1m Contour map from SOI



Flood Plain for once in 100 year

BUDHIGANGA (R4)

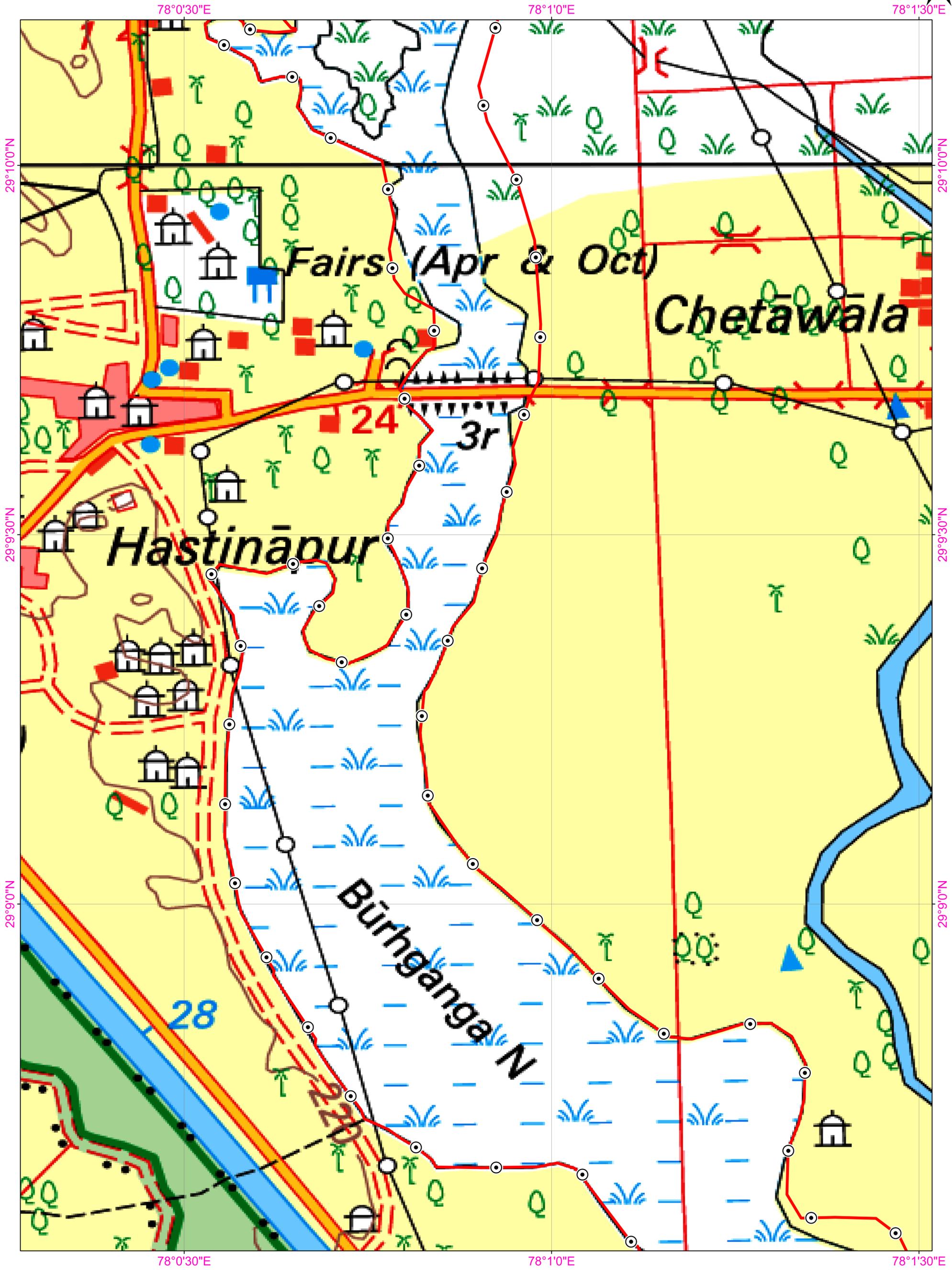
SCALE 1:4,000

— Flood plain zone boundary



○ Coordinates at 200m

Delimited flood plain overlaid on Toposheet from SOI



Flood Plain for once in 100 year

BUDHIGANGA (R2)

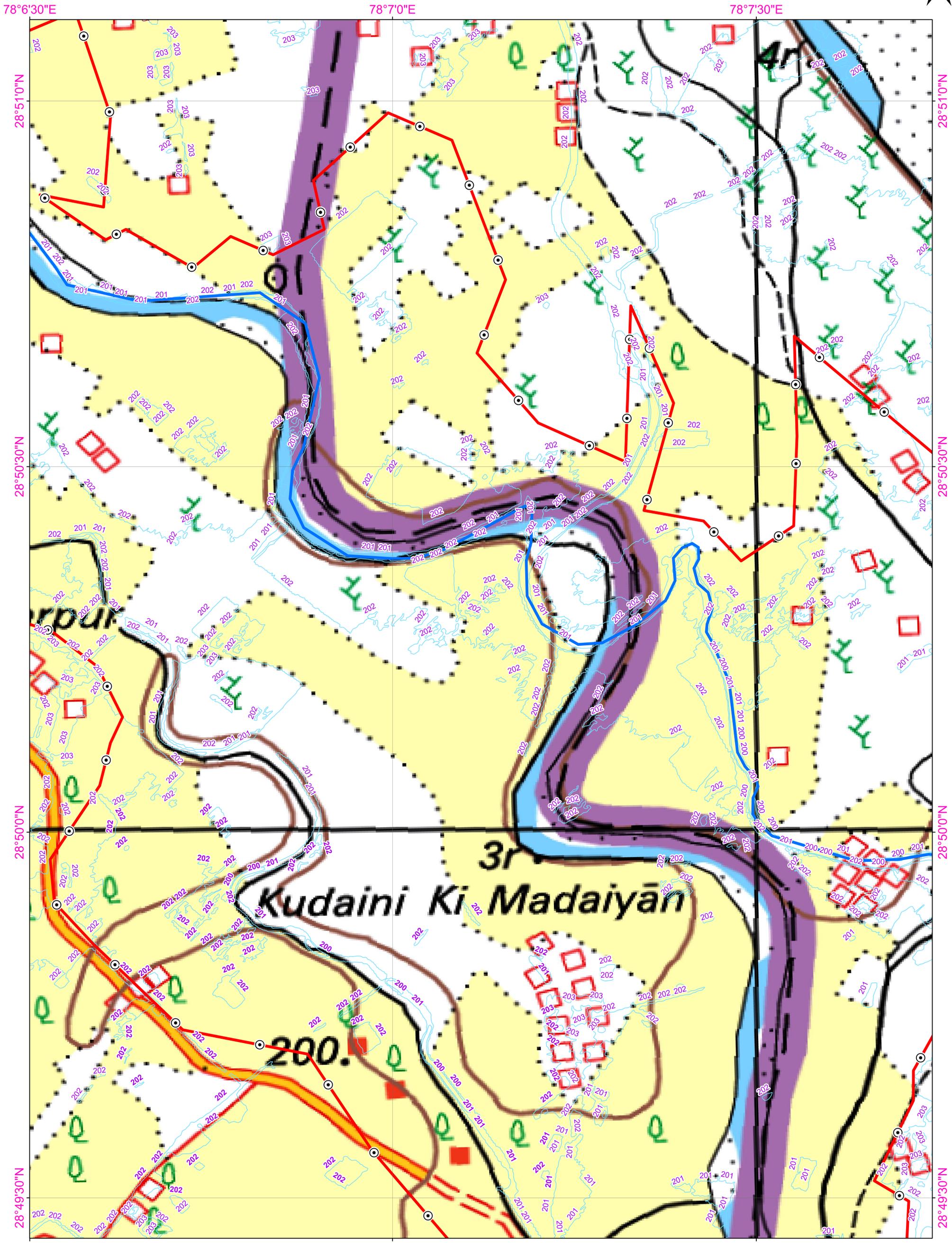
SCALE 1:4,000

⊙ Coordinates at 200m



∩ Flood plain zone boundary

Delimited flood plain overlaid on 1m Contour map from SOI



Flood Plain for once in 100 year

BUDHIGANGA (R4)

SCALE 1:4,000

⊙ Coordinates at 200m

— Flood plain zone boundary

