Second United Nations World Geospatial Information Congress

13-Oct-2022

ATULYA GANGA

AN 11 YEARS COMMITMENT FOR GANGA REJUVENATION

An Unprecedented Initiative for Rivers of India

Started : April 2019

Agenda

1. Atulya Ganga Project : Overview
2. Pollution Mapping: 2020-21
3. Mobile App for Pollution Mapping
4. Atulya Ganga Project : Road Map

Atulya Ganga Project
2020 - 2031

Our Aim

Monitoring River Ganga pollution levels to drive improvement for the next 10 years and create an exemplary model for other rivers

Our Mission

Synergise all resources of the Government, NGOs, Volunteer Organisations and General public for revitalisation of River Ganga

Our Vision

Rejuvenation and restoration of Indian Rivers for future generations.

ATULYA GANGA

AN 11 YEARS COMMITMENT FOR GANGA REJUVENATION

Atulya Ganga Project: Our USP

A **committed, apolitical, secular, non-discriminatory and non-hierarchical** organization mainly of **military veterans** with Ganga as **single point agenda**. Our goal is to undertake regular activities such as **walkathons, cyclothons, plantation drives** to provide a unique platform for a number of **path breaking initiatives** – such as water pollution mapping, awareness camps, geo-tagging items of interest like monuments, flora, fauna, and historical monuments along the entire river.

- An independent 3rd party audit.
- Yearly detailed water sampling plan from origin to the estuary of the river - to serve as a model for other rivers in our country and beyond.
- Adherence to international protocols of water sampling.
- In-situ testing with field testing kit and laboratory testing for balance water parameters.
- Raising public awareness about pollution levels in the entire river basin leveraging technology through mobile apps, AI and IOT (Internet of Things).
- Annual water pollution reports with detailed findings, analysis and recommendations submitted to the Governing authorities.

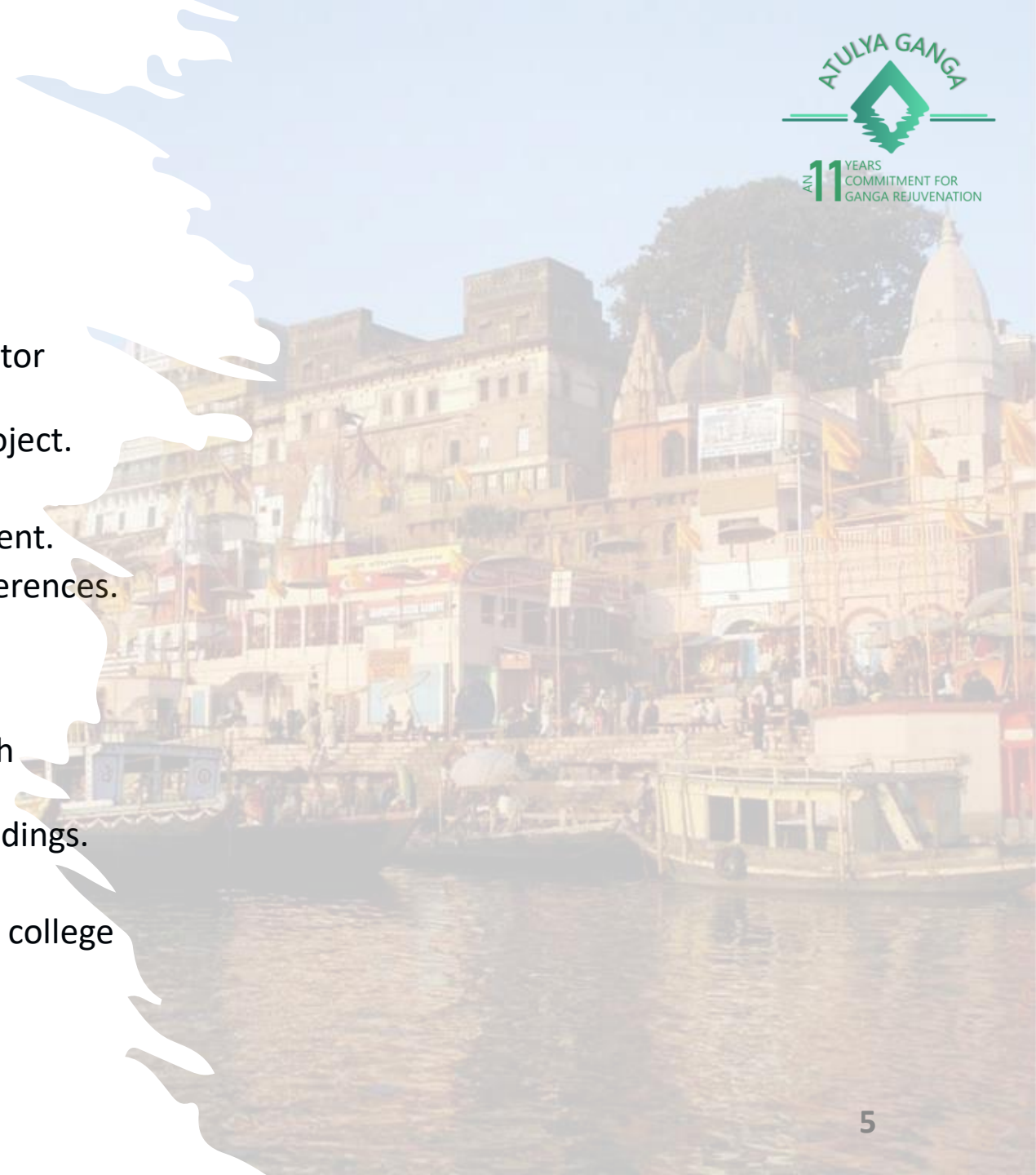
Atulya Ganga Project: 11-Year Plan

Yearly Activities

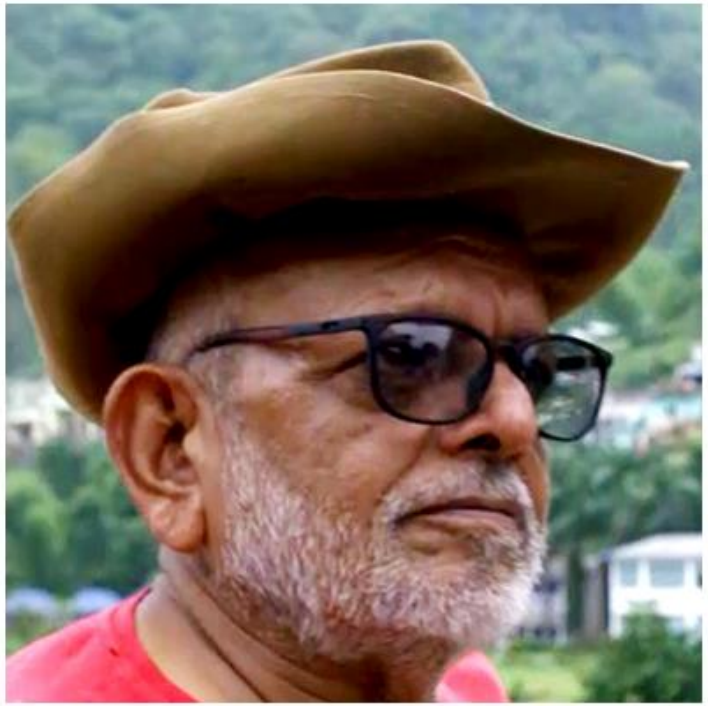
- Parikrama of River Ganga and its tributaries.
- Water Sample Testing, calculating water quality index to monitor pollution levels
- Data Collection and Analytics of all aspects covered by the project.
- Sustainable plantation i.e., wilding both banks of River Ganga.
- Demarcation of boundary of River Ganga to avoid encroachment.
- Holding of Awareness programs, brainstorming sessions/conferences.

Empowerment Program

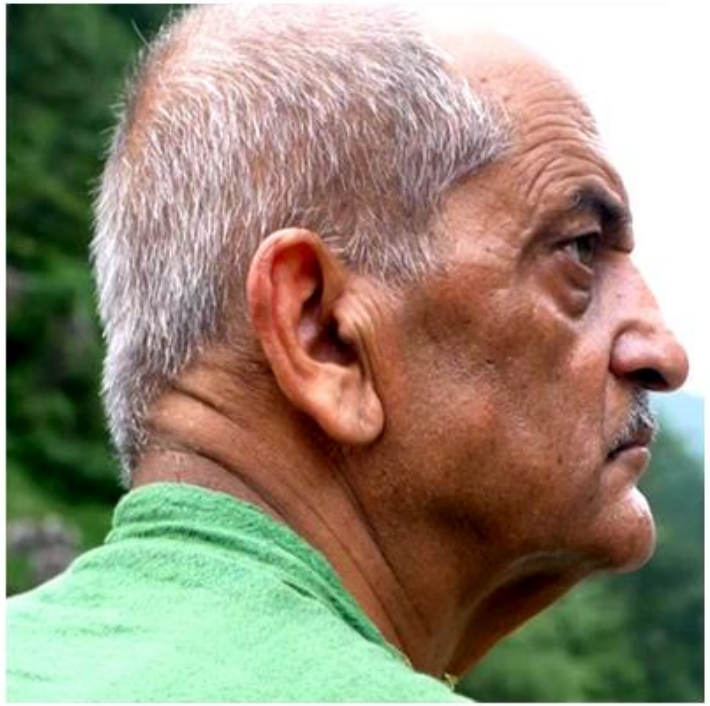
- Preparation and maintenance of mobile app and Ganga Health Dashboard for general public use.
- Advise and maintain cleanliness of Ghats/Riverfronts/Surroundings.
- Empowering of Nishad/Fishermen Community.
- Introduction of a chapter in restoration of rivers in school and college syllabus.



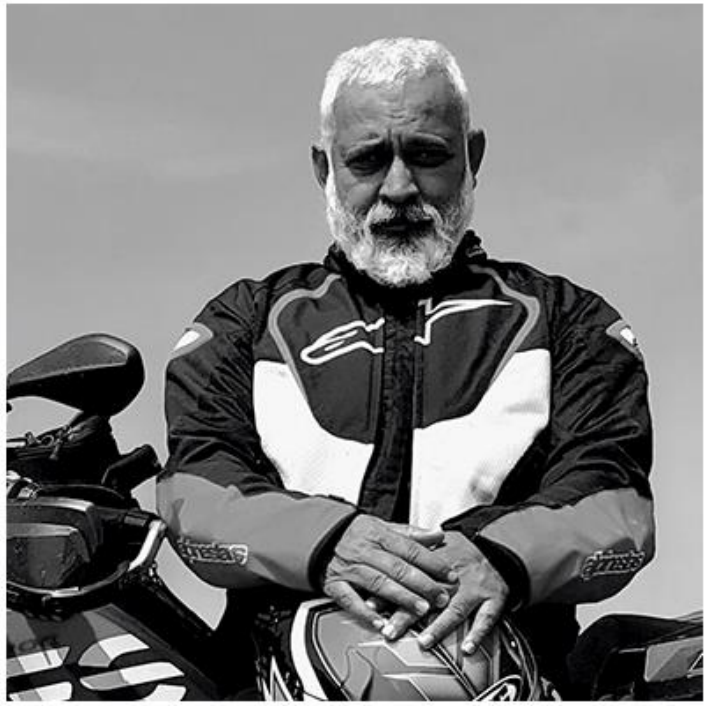
Atulya Ganga Project: Founding Members



Gopal Sharma
(Ace Mountaineer)



Lt Col. Hem Lohumi SM (Retd)
A multifaceted adventurer



Col. Manoj Keshwar (Retd)
Leading adventure organiser

Atulya Ganga Project: Ganga Health Dashboard Team

Maj Gen VK Bhatt
Environment Adventure & Sports Expert

Dr Rasik Ravindra
Glaciers & Ocean Expert

Maj Gen Soma Pillai
Champion Sailor, Geo-mapping Expert

Dr (Col) Kailash Tiwari
Delhi Technological University

Dr Vijay Loganathan
Asst Professor, IIT Ropar

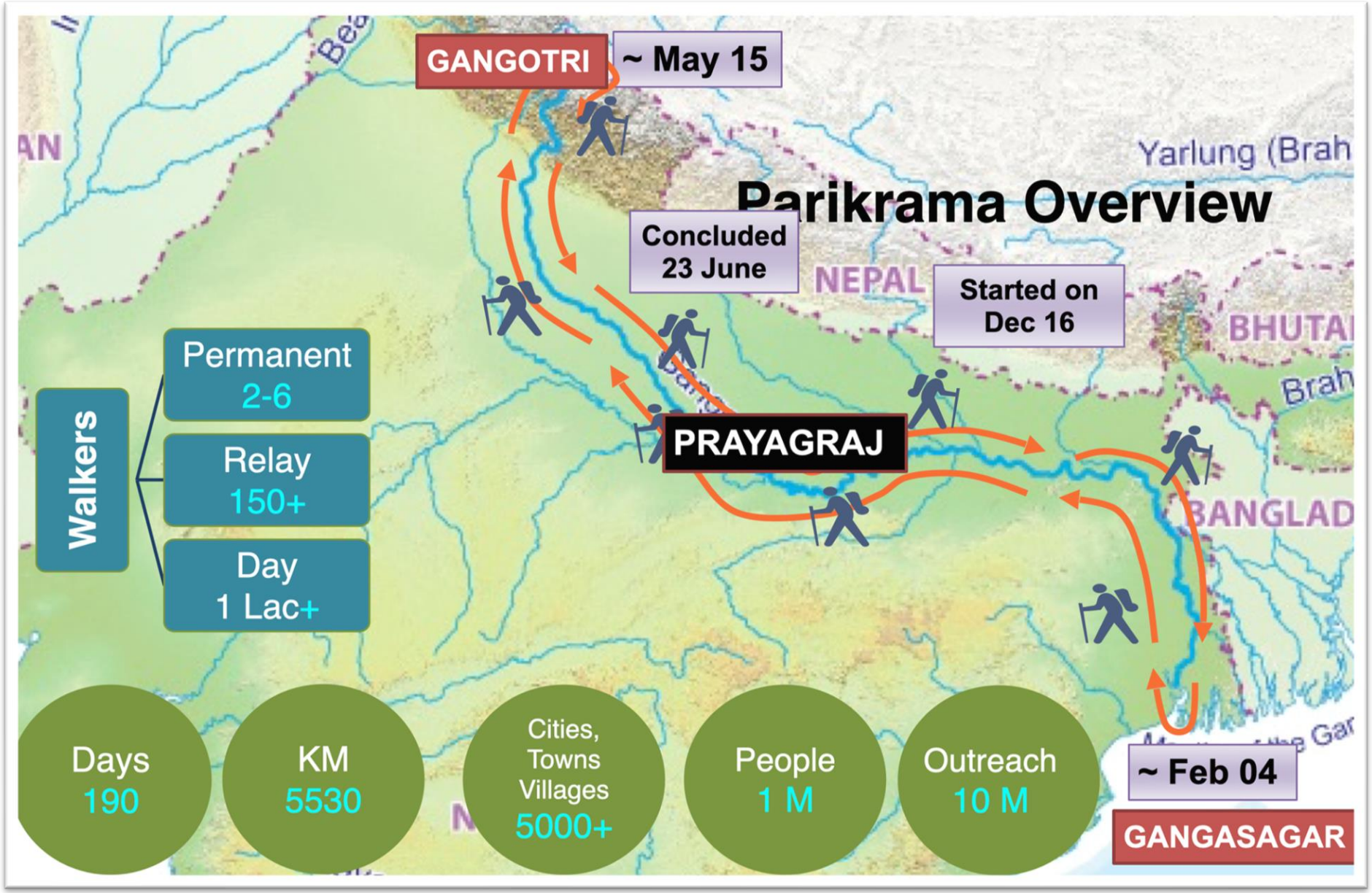
Mohit Verma
PHD Scholar IIT Ropar, Tech Guru

Achievements in the past 3 Years

(with limited funds and Covid-19)

2020	2021	2022
✓ Registration of Atulya Ganga Trust ✓ Obtaining 12AA and 80G Tax Exemption and CSR eligibility ✓ Preparatory ground-work of mobile app and Ganga Health Dashboard ✓ Capacity building for water sampling and testing to Ganga Praharis ✓ Training for Mundmaal Parikrama (Walkathon)	✓ **Mundmal Parikrama (walkathon) of 5530km** in 190 days ✓ Plantation of 30,000+ plants of endemic variety – Neem, Bargad, Imli, Pipal, etc. ✓ **Pollution mapping of River Ganga at 224 Points** ✓ Development of novel model for analyis of Water Quality data. ✓ Awareness camps in major cities, towns, schools, colleges to generate Jan Andolan. ✓ Submitted reports to Ministry of Tourism on Places of Tourist Interest / Historical Significance.	✓ Submission of first year water pollution report giving findings and recommendations to Ministry of Jal Shakti and National Green Tribunal (NGT) ✓ Publication of paper on Ganga Water Quality Index in Ecological Indicators Journal (ELSEVIER), Oct-2022 issue. ✓ **Atulya Ganga Cyclothon of 2800 km** from Gangotri to Gangasagar in 28 days. ✓ **2nd Year Water Pollution Testing for Entire Ganga at 150 places.**

Mundmal Parikrama : 2020-21



Plantation: 2020-21

- Green India Foundation
- Vriskshmaal Project
- Geo-tagged Saplings
- Mentor Fixed
- 30,000+ Trees

Awareness Campaign

नमामि गंगे | नेशनल ग्रीन ट्रिब्यूनल ने कहा, अब तक जारी फंड के उचित और समयबद्ध उपयोग को लेकर तय हो जवाबदेही

36 वर्षों से गंगा मैली की मैली ही, जांच की आवश्यकता

नई दिल्ली, 29 नवंबर : नेशनल ग्रीन ट्रिब्यूनल (एनजीटी) ने कहा है कि पिछले 36 वर्षों से निगरानी के बावजूद गंगा की सफाई चुनौती बनी हुई है। ट्रिब्यूनल ने कहा कि अब समय आ गया है जब नदी की सफाई के लिए आवंटित फंड के सुचित व समयबद्ध उपयोग की जवाबदेही तय करने करने की जरूरत है। साथ ही प्रदूषण कम करने का लक्ष्य प्राप्त करने के लिए आवंटित फंड और इसके उपयोग के संबंध में उचित जांच की आवश्यकता है।

एनजीटी चेयरमैन जस्टिस आदर्श कुमार गोयल की अध्यक्षता वाली पीठ ने कहा, यद्यपि गंगा एक्शन प्लान एक और दो के जरिये केंद्र सरकार के स्तर पर पहल की गई हैं और उसके बाद नेशनल मिशन फार क्लीन गंगा (एनएमसीजी) की स्थापना हुई, लेकिन गंगा का प्रदूषण बेरोकटोक बरकरार है। एनजीटी ने कहा कि जवाबदेही और प्रतिकूल परिणामों के बगैर ही समय सीमा का उल्लंघन किया जाता है।

पीठ ने कहा, 'ऐसा प्रतीत होता है कि संबंधित प्रशासन के शीर्ष स्तर की राष्ट्रीय स्वच्छ गंगा मिशन के कामकाज में संरचनात्मक परिवर्तनों पर विचार करने की आवश्यकता है, ताकि समयसीमा बनाए रखने के लिए जवाबदेही तय की जा सके और निश्चित भविष्य में लक्ष्यों को प्राप्त करने के लिए प्रभावित रणनीति क्रम पता लगाया जाए।'

एनजीटी ने कहा कि प्रदर्शन मापदंडों और समयसीमा स्पष्ट रूप से परिभाषित करने और कार्य संपादन के आडिट की आवश्यकता है। पीठ ने कहा, 'विफलता के कारणों और जिम्मेदार व्यक्तियों की पहचान की जानी चाहिए और उन्हें उचित रूप से जवाबदेह बनाया जाना चाहिए। प्रदर्शन में विफलता के लिए जिम्मेदार लोगों की पहचान करने के संबंध में एक तंत्र को निरंतर आधार पर संचालित करने की ' आवश्यकता है। अनुशासनात्मक और गुणवत्ता नियंत्रण के बिना मिशन की सफलता की संभावना बहुत कम हो सकती है।'

ट्रिब्यूनल ने कहा कि आंतरिक समीक्षा तंत्र को मजबूत बनाने की आवश्यकता है जो वर्तमान में प्रतीत नहीं होता। पीठ ने कहा, यदि यह पाया जाता है कि प्रदूषण उपशमन और निर्यारण योजना को क्रियान्वित करने के लिए एनएमसीजी द्वारा नियोजित एजेंसियां ठीक तरह से प्रदर्शन नहीं कर पा रही हैं तो एक उपयुक्त एजेंसी - सरकारी, निजी या हाइब्रिड की काम सौंपकर संरचनात्मक परिवर्तनों पर विचार करने की आवश्यकता है, जिन्हें शर्तों के अनुसार प्रदर्शन और लक्ष्यों को प्राप्त करने के संबंध में जवाबदेह ठहराया जा सके।

ट्रिब्यूनल ने कहा, 'संक्षेप में, प्रदर्शन का मूल्यांकन करने और जवाबदेही तय करने की आवश्यकता है। आवंटित धन और प्रदूषण कम करने के लिए निर्धारित लक्ष्य हासिल करने में हुई प्रगति और अन्य मापदंडों का विवरण देने वाली तिमाही रिपोर्ट एनएमसीजी की वेबसाइट पर डाली जा सकती है ताकि समुदाय की भागीदारी एवं समर्थन बढ़ाया जा सके। क्षतिपूर्ति, जैसा कि पिछले आदेश में निर्देशित किया गया है, अब केंद्रीय प्रदूषण नियंत्रण बोर्ड और एनएमसीजी द्वारा दो महीने के भीतर सकारात्मक रूप से एकत्र की जा सकती है।'

पीठ ने अपने हाल के आदेश में कहा, 'गैर अनुपालन के मामले में एनजीटी अधिनियम, 2010 की धारा-26 के तहत उल्लंघनकर्ताओं के खिलाफ मुकदमा शुरू करने सहित दंडात्मक उपाय किए जाएं। एनएमसीजी और सीपीसीबी 31 मार्च, 2022 तक की प्रगति के संबंध में रिपोर्ट 15 अप्रैल, 2022 तक दाखिल कर सकते हैं।' ट्रिब्यूनल ने इस मामले को 28 अप्रैल, 2022 को आगे विचार के लिए सूचीबद्ध किया है। एनजीटी ने इससे पहले देश की सभी 350 नदियों के कायाकल्प के लिए एक राष्ट्रीय योजना तैयार करने और उस पर अमल के लिए केंद्रीय निगरानी समिति गठित की थी।

Time to fix accountability for Ganga cleaning, says National Green Tribunal

The tribunal said there is a need for due investigation about the funds allocated and their utilisation

PTI, New Delhi, NOV 29 2021, 16:50 IST | UPDATED: NOV 29 2021, 16:50 IST

A view of the polluted Ganga river in Varanasi. Credit: PTI Photo

Observing that the challenge of cleaning Ganga remains despite monitoring it for the past 36 years, the National G
said that it is time to fix accountability for proper and timely utilisation of funds allocated for cleaning the river.

Snapshots

Pollution Mapping: 2021

Rohit Nishad & Anshu Nishad

- App Under Development
- Ganga Health Dashboard
- 224 River Water Samples
- 600 + Nallas Geo-tagged
- Established Water Quality Index
- Publication in International Journal

Pollution Mapping: 2021

Basic Pollution Parameters Tested

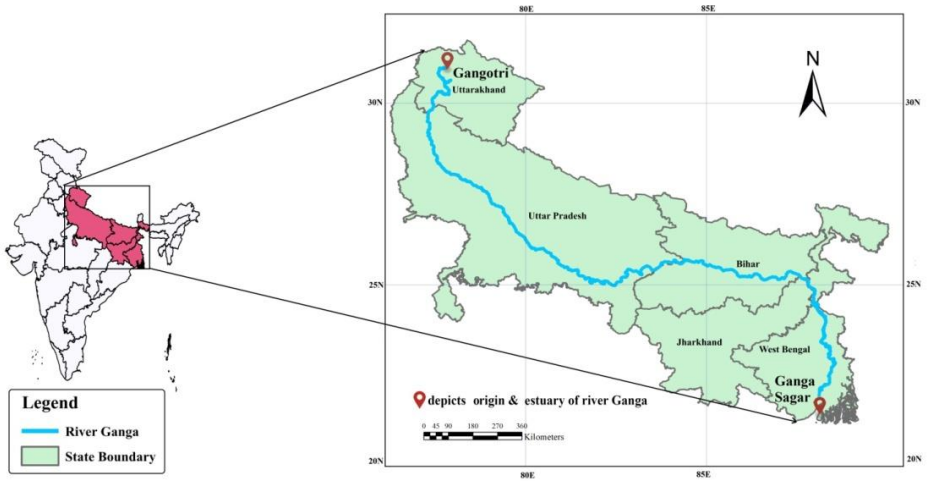
Parameters	Class -A
pH	6.5-8.5
Turbidity(mg/L)	10
Hardness(mg/L)	300
Chlorides(mg/L)	250
Fluorides(mg/L)	1.5
Dissolved Oxygen(mg/L)	6.0-14
TDS(mg/L)	500

Water Quality Index Based on Tested Parameters

Ser no.	MWQI	Class	Water Status
1	100	I	Excellent
2	<100-80	II	Good
3	<80-50	III	Fair
4	<50-20	IV	Poor
5	<20-0	V	Heavily polluted

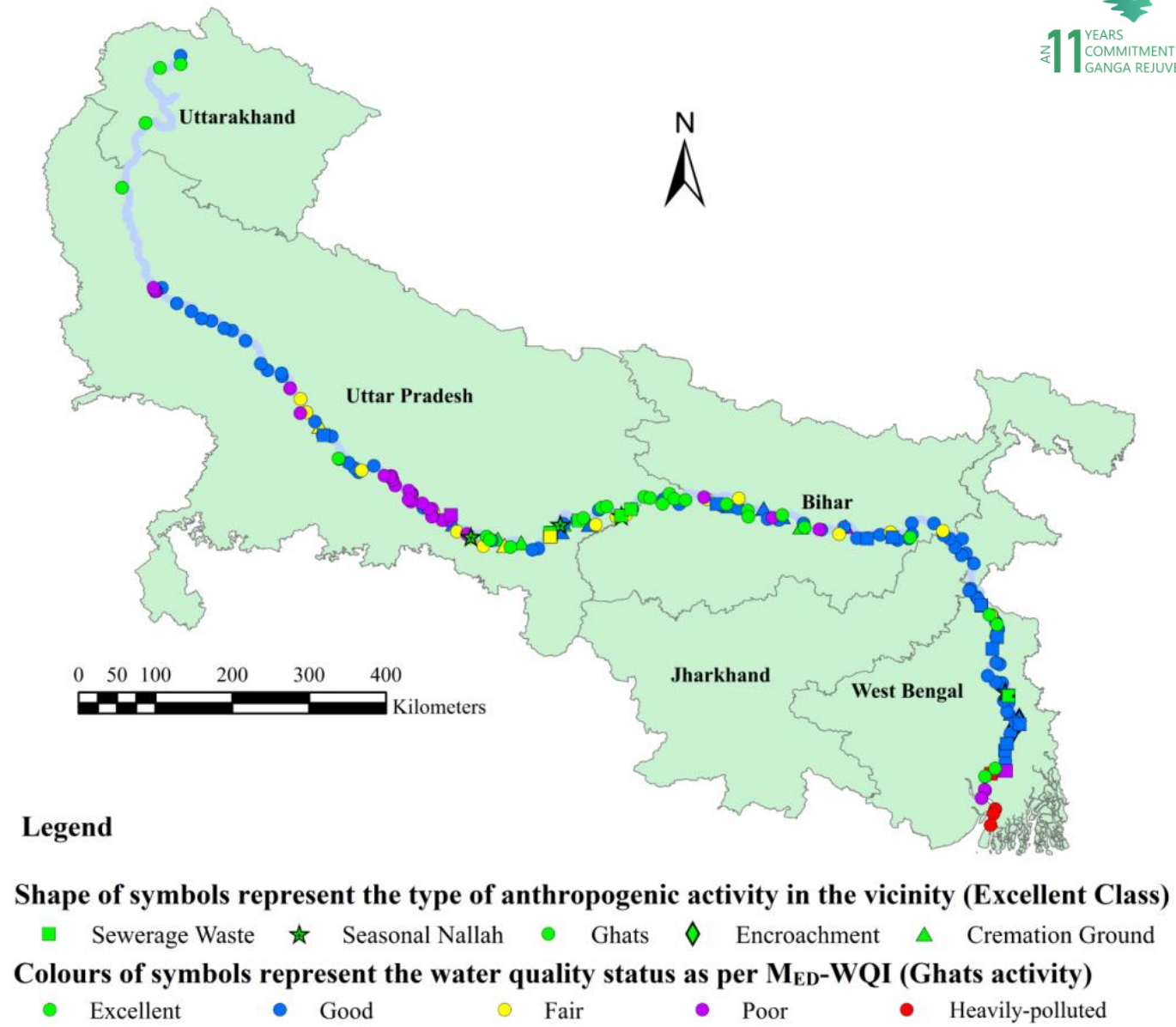
Pollution Mapping: 2021

Geo-tagged pollution levels



Findings:

- Excellent Quality (WQI : 100) – 44 locations
- Good Quality (WQI : <100-80) – 121 locations
- Fair Quality (WQI : <80-50) – 13 locations
- Poor Quality (WQI : <50-20) – 31 locations
- Heavily Polluted (WQI : <20) – 10 locations



Pollution Mapping: 2021

Heavily Polluted Locations (Hot Spots – 2021) : Class V

Ser No	Table S. No.	Name of City/Town	Name of Place	WQI (<20)
1	84	24 Parganna (P) Kakdwip, WB	Harwood Point	1.02
2	87	24 Parganna (P) Kakdwip, WB	PS Castle	1.02
3	83	24 Parganna (P), WB	Kulpi	3.38
4	82	24 Parganna (S), WB	Durgapur	7.63
5	203	Bijnour, UP	Nabalpur Barage	16.28
6	205	Bulandshahr, UP	Rajghat Naraura	17.84
7	207	Aligarh, UP	Kachalaghat	17.84
8	79	24 Parganna(S), WB	Noorpur Ferry ghat	18.03
9	204	Bulandshahr, UP	Anoop Shahr	19.19
10	209	Kanpur, UP	Pettambra Peeth	20.01

Pollution Mapping: 2021

Poor Quality Locations : Class IV

Ser No	Table S.No.	Name : city/town	Name of place	WQI (<50-20)
1	80	24 Parganna(S), WB	Nurpurghat	22.21
2	78	24 Parganna(S), WB	Fatehpur Faita, PS	22.47
3	77	24 Parganna(S), WB	Fatehpur Raipur Ghat	27.27
4	211	Unnao, UP	Bighapur Karmi Garehwa	25.08
5	213	Raibareilly, UP	GokaranGhat	22.47
6	214	Raibareilly, UP	Kotraghat	27.27
7	221	Prayagraj, UP	Suressarghat	27.27
8	208	Kanpur, up	Shuklaganj Ganga Br	29.45
9	222	Prayagraj, UP	JhunshiGhat	31.96
10	166	Fatehpur, UP	Manipuri Ghat	31.94
11	28	Chapra, Bihar	Chirand Bangli Baba Math	31.13
12	223	Prayagraj, UP	Kila Ghat	32.97
13	75	24 Parganna(N), WB	Dakshineshwar Temple Tilagarh	33.17
14	164	Prayagraj, UP	Kada Dham	33.42
15	165	Prayagraj, UP	Sato Police Station	33.43

Ser No	Table S.No.	Name : city/town	Name of place	WQI (<50-20)
16	167	Fatehgarh, UP	Naubata Ghat	33.33
17	2	Prayagraj, UP	Gokul Ghat	33.74
18	74	24 Parganna (N), WB	Tilagarh Ind Waste Nalah	33.85
19	37	Begusarai, Bihar	Kharampura Ghat	33.85
20	76	24 Parganna (N), WB	Tilagarh Balu Ghat	33.85
21	169	Fatehpur, UP	Surjipur	33.43
22	219	Pratapgarh, UP	Kunda Shrengusarpur Ghat	33.45
23	217	Pratapgarh, UP	Gothani Ghat	33.85
24	224	Prayagraj, UP	Triveni Sangam	33.45
25	206	Gaziabad, UP	Garhmukteshwar Kaali river	33.80
26	182	Farukhabad, Kannauj, UP	Mehndi Ghat	33.81
27	168	Fatehpur, UP	Samopur Khalispur Ghat	33.84
28	33	Samastipur, Bihar	Patori / Jaunpur	38.33
29	38	Begusarai, Bihar	Munger Ghat	38.23
30	161	Prayagraj, UP	Bharatganj Ujihni Ghat	43.44
31	212	Raibareilly, UP	Baksar Ghat	27.27

Pollution Mapping: 2021

Findings

- Out of 224 Samples of river water:
  - Heavily Polluted (WQI : <20) – 10 locations
  - Poor Quality (WQI : <50-20) – 31 locations
  - Fair Quality (WQI : <80-50) – 13 locations
  - Good Quality (WQI : <100-80) – 121 locations
  - Excellent Quality (WQI : 100) – 44 locations
- Water quality generally good
- Ghats lack cleanliness
- Poor disposal of garbage

Other Observations

- Tagged 573 Nalas, 56 Cremation Grounds/Ghats, 19 Ghats, 26 Encroachment Areas and 7 places with open defecation.
- Poverty and unemployment prevalent in fishermen community.
- Some industries / villages / towns directly release domestic waste, sewage and chemical effluents into the river.
- Additionally, geo-tagged flora, fauna, historical/mythological sites and places of tourist interest.

Pollution Mapping: 2021

Recommendations

- Use drones/RPVs to physically map 100% of streams, nalas, distributaries.
- Set up 24/7 monitoring stations in 10 heavily polluted and 31 poor quality locations by CPCB/SPCB.
- Mobile app and pollution health dashboard to monitor WQI should be available to all stakeholders.
- Improve local accessibility to WQI and water parameters via GIS / Remote sensing maps.
- Ensure enforcement of Environmental Protection Act to prevent sewage and chemical effluents flowing directly into the river (332 sewage and 11 industrial nalas tagged in first year).
- Ensure 100% treatment of effluents from STP/ETP before release.
- Prevent encroachment on the riverbanks and islands.
- Promote sustainable development of organic farming along the riverside without use of chemical fertilizers and pesticides.
- Undertake wilding (plantation) of riverbanks to reduce soil erosion and constant change of river course.
- Use MNREGA and MPLAD funds for treatment of domestic sewage before release into the river by methods such as bioremediation, root zone, etc.
- Set up 24/7 operational and maintenance contracts to ensure cleanliness of Ghats and Water Fronts.
- Install water fountains to increase dissolved oxygen levels in the water bodies next to Ghats and Water Fronts all along the river.

Development of Entropy and Deviation-based Water Quality Index: Case of River Ganga, India

Authors: Mohit Verma, L.Vijay Anand, Vinod K. Bhatt

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Indian Institute of Technology Ropar
Punjab, India
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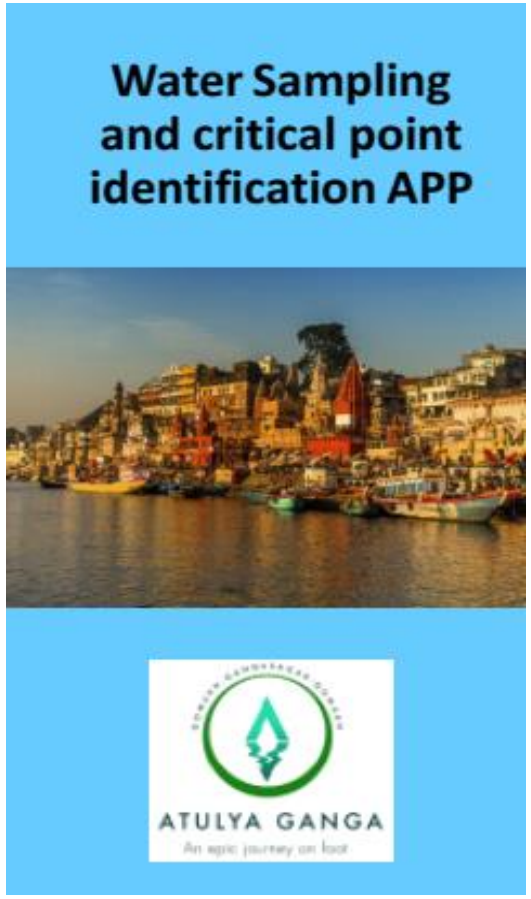
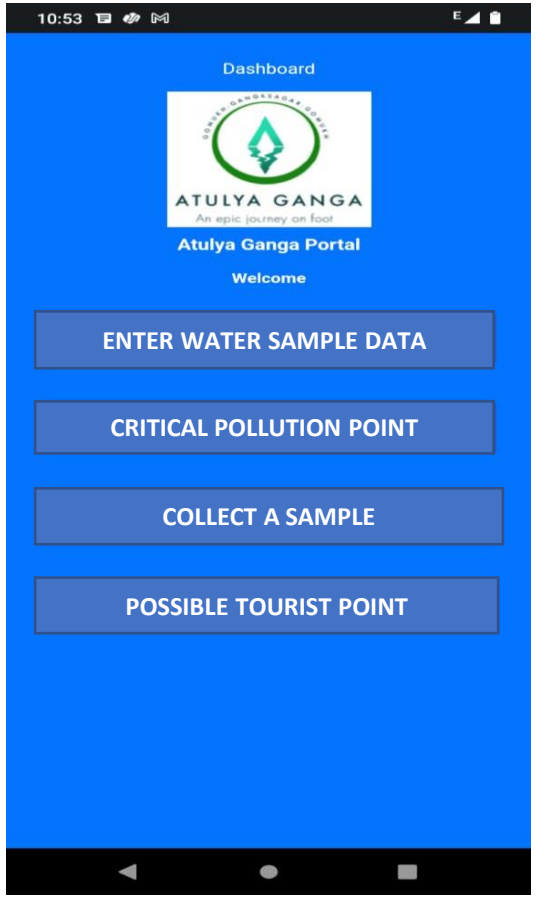
Haryana, India

Mobile application for data collection



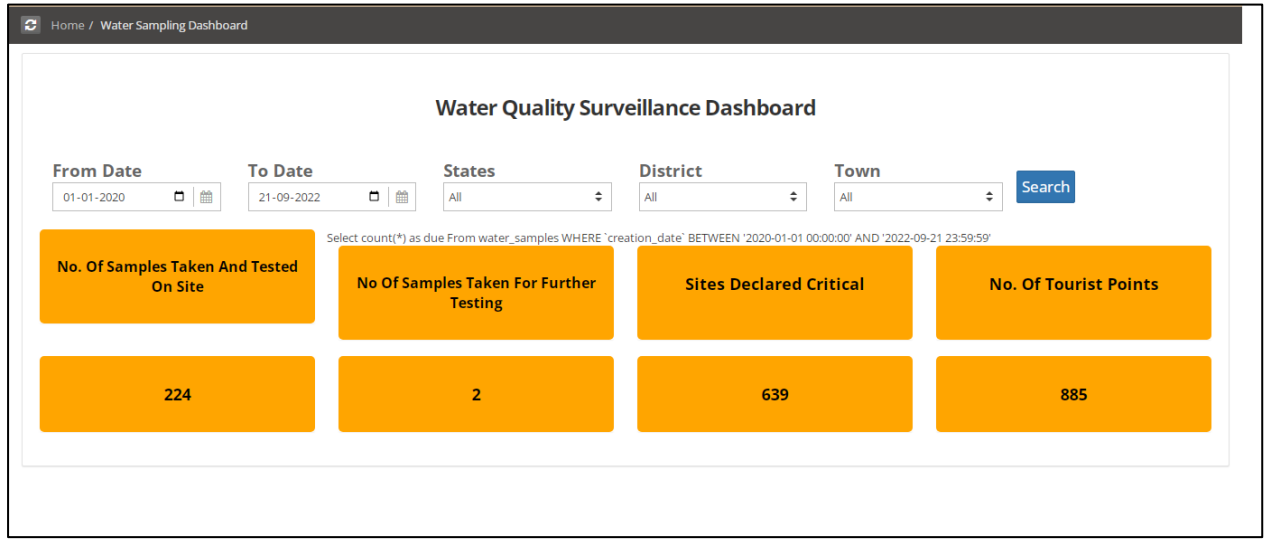


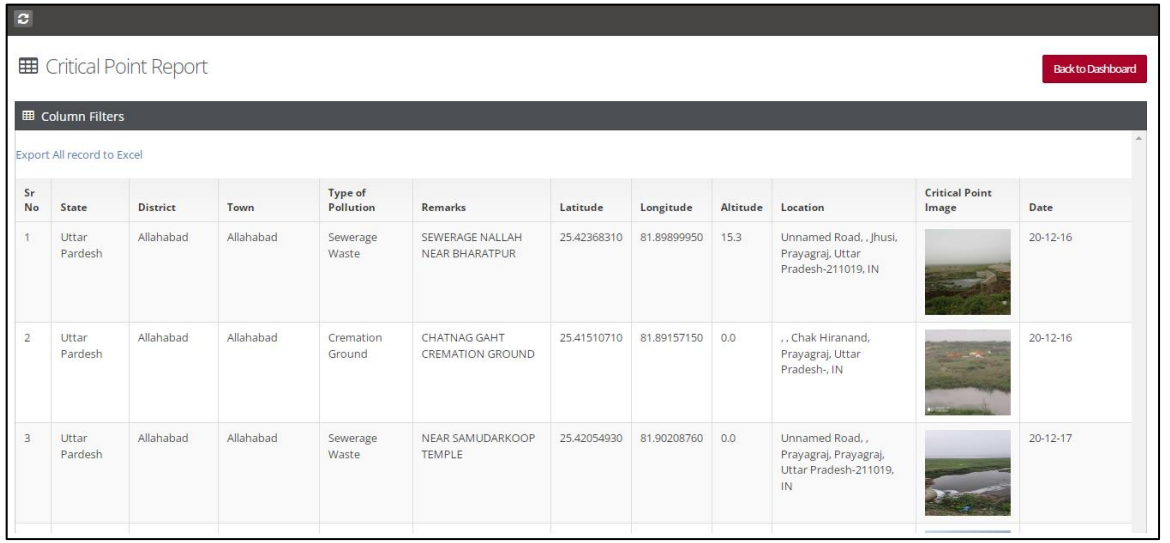
Mobile Application

Choose appropriate field

Enter Data

Online Pollution Dashboard





Sample Collected and Tested Report

Back to Dashboard

Column Filters

Export All record to Excel

Sr No	State	District	Town	pH	Turbidity	Hardness	Chloride	Free Chlorine	Iron	Flourites	Bacteria	DO	Tds	Electric Conductivity	Temperature	Type of Pollution	Remarks	Latitude	Longitude	Altitude	Location	Date of Sample Collection
1	Uttar Pardesh	Allahabad	Allahabad	8.86	10	240	80	0.1	0.15	0.5	N		398		19.5	Cremation Ground	CHHATNAG GHAT	25.41994300	81.89259520	0000-00-00	, , Chak Sayad Arab Darvesh, Prayagraj, Uttar Pradesh-, IN	20-12-16
2	Uttar Pardesh	Allahabad	Allahabad	8.8	50	225	80	0.1	0	0.5	N		234	468	20.5	Ghat	10 feet from bank	25.30294090	82.05059840	0000-00-00	भीरपुर लकटहाघाट मार्ग, , Basahi, Prayagraj, Uttar Pradesh-212307, IN	20-12-16
3	Uttar Pardesh	Allahabad	Handia	8.5	0	210	160	0	0	0.7	N		218	437	21.9	Seasonal Nallah	LAKSHA GRAH GHAT	25.27366960	82.09739180	0000-00-00	, , Usmapur Kachhar, Prayagraj, Uttar Pradesh-	20-12-17

Development of M_{ED}-WQI*

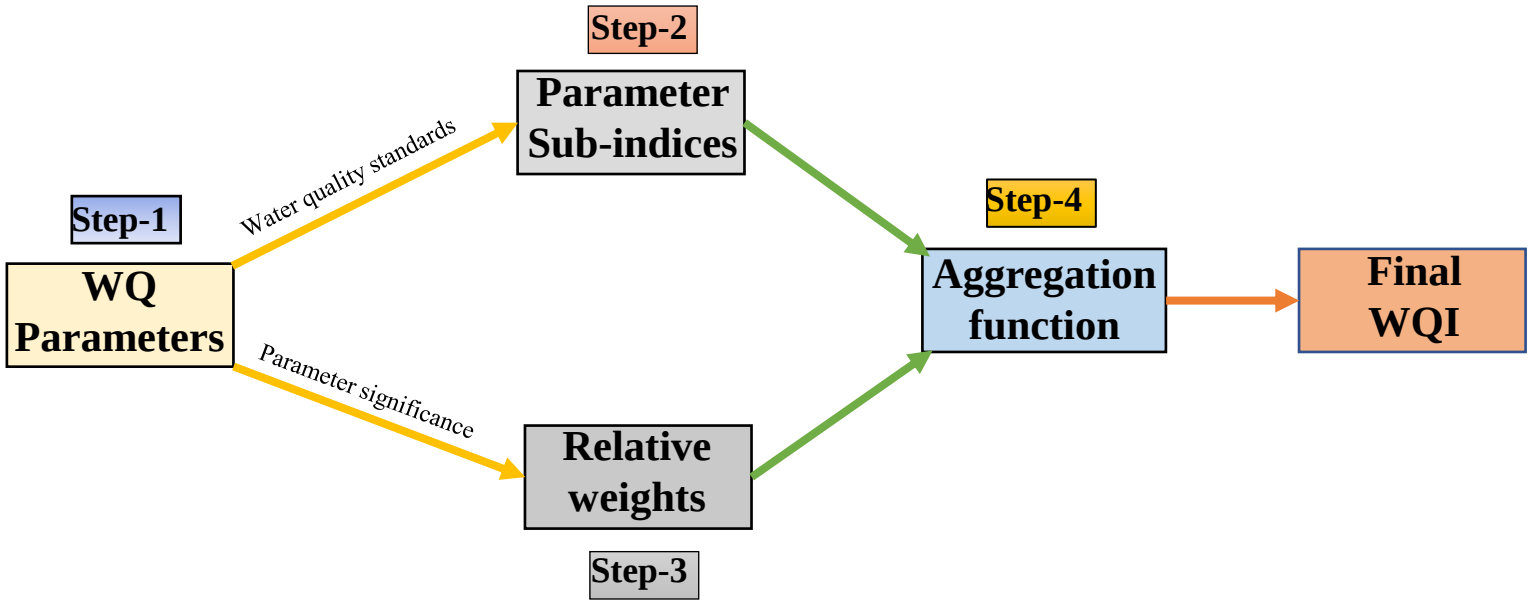
(i) Selection of the water quality parameters

(ii) Developing sub-indices functions (S_i)

(iii) Estimation of relative weights using entropy method

(iv) Multiplicative aggregation of sub-indices to estimate M_{ED}-WQI

(v) Implementation of M_{ED}-WQI in visual basic based spreadsheet program



*Source - Verma et al., Development of entropy and deviation-based water quality index: Case of river Ganga, India, Ecological Indicators, 143:109319, 2022.

Framework of M_{ED}-WQI

- **Parametric Deviation** $D_i = | D_p - D_d |$ Where D_i deviation in parameter, D_p is parameter value, D_d is MCL.
- **Sub-index calculation** $S_i = m\, D_p + c$ Where m and c constant depends on deviation range
- **Entropy based relative weights**

$$X = \begin{pmatrix} x_{11} & x_{12} & . & x_{1n} \\ x_{21} & x_{22} & . & x_{2n} \\ . & . & . & . \\ x_{m1} & x_{m2} & . & x_{mn} \end{pmatrix} \quad Y = \begin{pmatrix} y_{11} & y_{12} & . & y_{1n} \\ y_{21} & y_{22} & . & y_{2n} \\ . & . & . & . \\ y_{m1} & y_{m2} & . & y_{mn} \end{pmatrix}$$

$$y_{ij} = \frac{x_{ij} - (x_{ij})_{min}}{(x_{ij})_{max} - (x_{ij})_{min}} \qquad e_j = -K \sum_{i=1}^{m} P_{ij} \ln P_{ij}$$

$$P_{ij} = \frac{y_{ij}}{\sum_{i=1}^{m} y_{ij}} \qquad w_j = \frac{1 - e_j}{\sum_{j=1}^{n} 1 - e_j}$$

Where X is eigenvalue matrix, Y is normalized matrix, P_{ij} is parameter index and e_j is information entropy, w_j is entropy weight

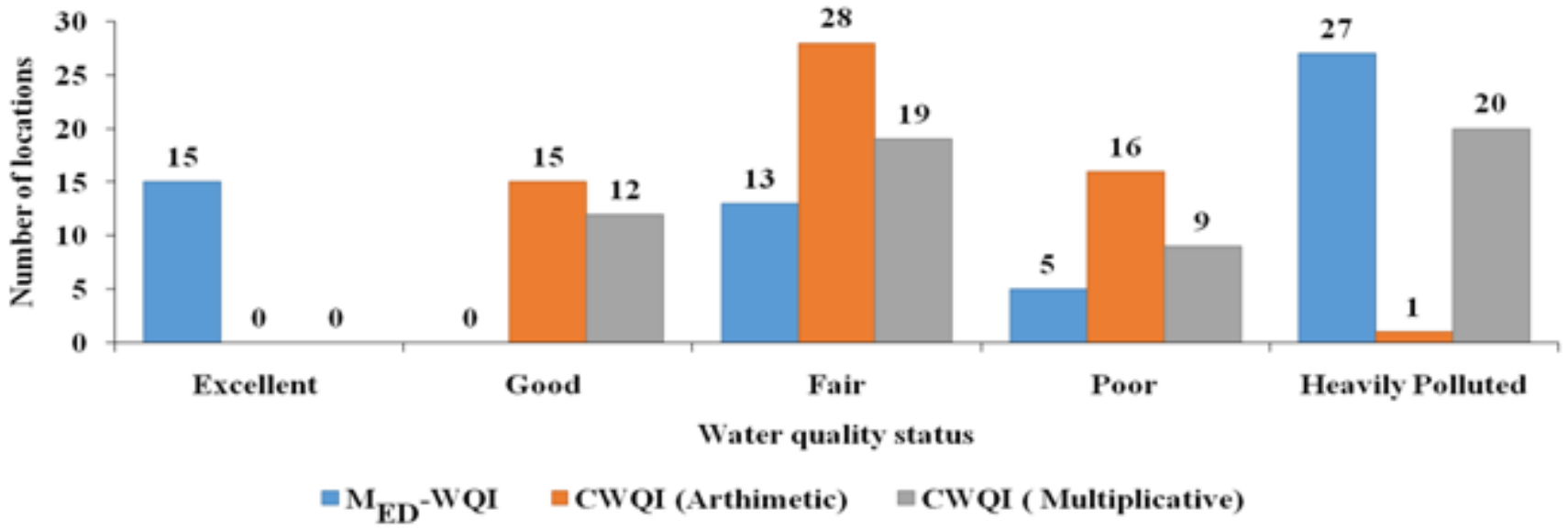
- **Multiplicative aggregation**

$$M_{ED} - WQI = \prod_{i=1}^{n} S_i^{w_i}$$

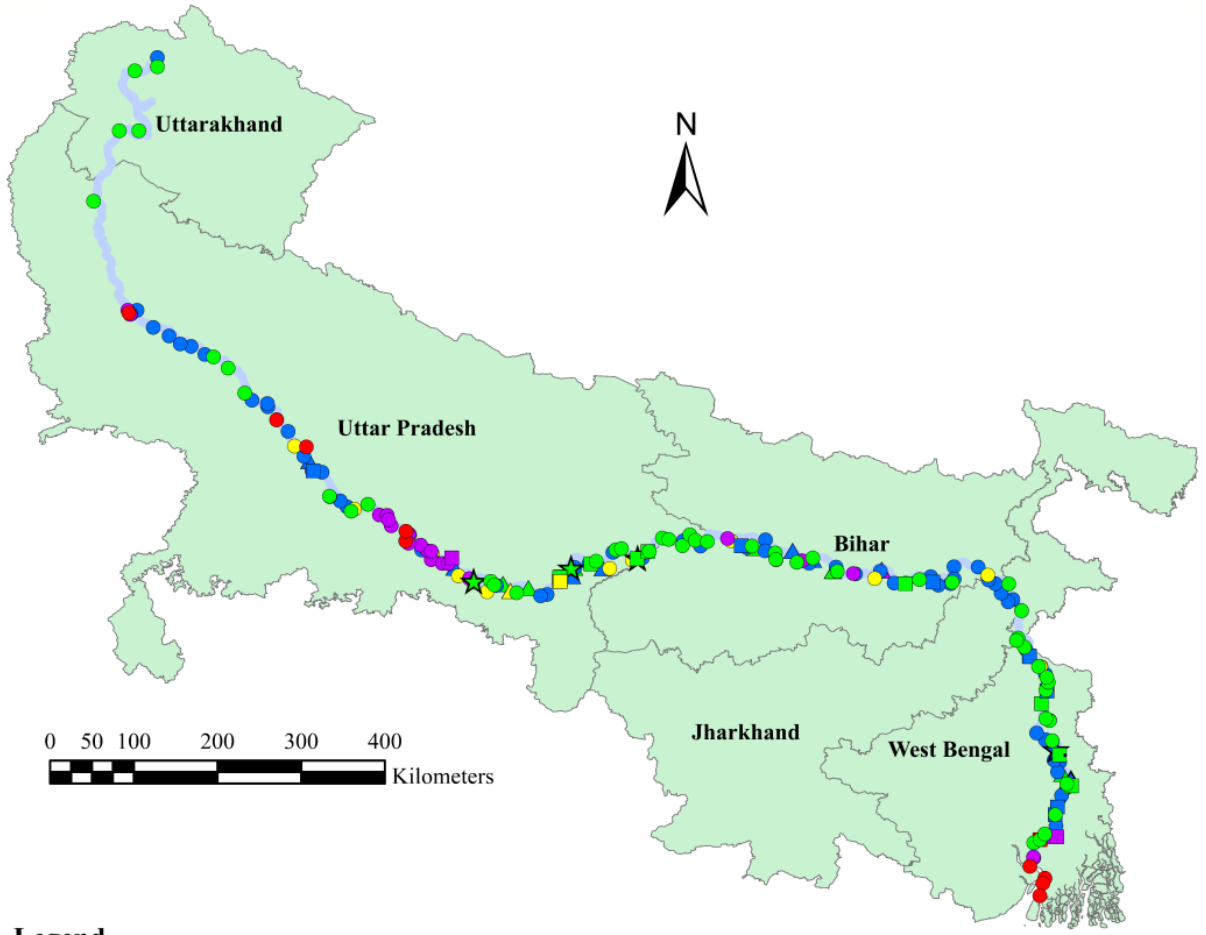
Where S_i is the sub-index value , w_i is the relative weight and n is number of parameters

Comparison of M_{ED}-WQI with CWQI for Synthetic Data-Set

S No	Dataset	Nature
1	First 15 samples	All water quality parameter within MCL
2	Middle 30 samples	Water quality parameter having moderate exceedance in MCL
3	Last 15 samples	All water quality parameter having high exceedance in MCL



Comparison of M_{ED}-WQI with CWQI for Ganga Data-Set



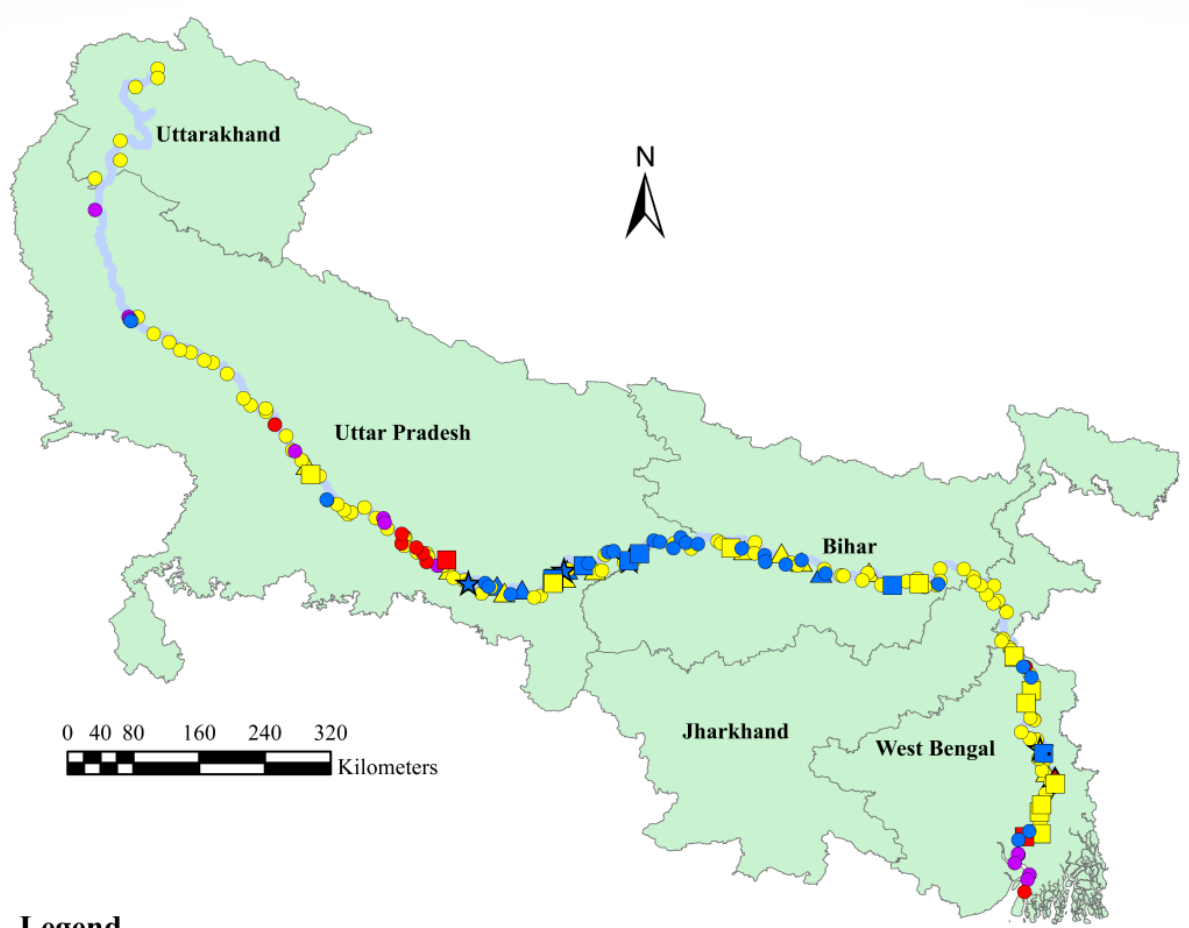
Legend

Shape of symbols represent the type of anthropogenic activity in the vicinity (Excellent Class)

Ghats Sewerage Waste Seasonal Nallah Encroachment Cremation Ground

Colour of the symbol represent the water quality status as per M_{ED}-WQI (Ghats activity)

Excellent Good Fair Poor Heavily-polluted



Legend

Shape of symbols represent the type of anthropogenic activity in the vicinity (Good Class)

Ghats Sewerage Waste Seasonal Nalah Encroachment Cremation Ground

Colours of symbols represent the water quality status as per CWQI (Ghats activity)

Good Fair Poor Heavily-polluted

Summary

- The role of mobile application and online dashboard in data collection saves time and human effort. It provides easy accessibility to all stakeholders.
- The M_{ED}-WQI approach used in this study captures the pollution level better than existing methods.
- The M_{ED}-WQI captures pollution in heavily-populated areas and shows strong correlation of water quality class with anthropogenic activity.

Atulya Ganga Project: Road Map

Upcoming Activities

1. Water Sample Testing and Pollution Mapping – Nov 2022
2. Cyclothon of 2,800 km from Prayagraj to Yamunotri – Feb/Mar 2023
3. Plantation along River Ganga starting with Prayagraj and Mirzapur – 2023
4. Awareness Camps in towns, educational institutions and NCC along River Ganga – 2023

Way Ahead (Contingent on Fund Availability)

1. Preparation and release of Mobile App, 24x7 Online Dashboard to All Stakeholders.
2. Procurement of Drones/RPVs for tagging of nalas and streams.
3. Lab-testing of water samples in IITs / NABL authorized labs for various parameters – BOD, COD, Alkalinity, heavy metals, fertilizers, pesticides, etc.
4. Large scale wilding (plantation) along the entire River Ganga.
5. Organize youth programs at regular intervals to raise awareness.
6. Conduct study on emerging contaminants i.e. micro-plastic.

Atulya Ganga Project: Support the Cause

What We Need

Due to COVID restriction and non availability of sufficient funds – we used basic water testing field kits, and tests were restricted to minimum parameters as per international protocols.

Going forward, to achieve our overall goals, we need to systematically plan and fund our bear minimum needs as follows:

Financial support

- App Development - Hardware & software cost : ₹ 55 Lacs ($ 0.66 M)
- Sample collection, Data collation and Testing : ₹ 50 Lacs ($ 0.60 M)
- App / Website / GIS Integration : ₹ 50 Lacs ($ 0.60 M)
- Office / Organisational / Logistic expenses : ₹ 75 Lacs ($ 0.90 M)
- Miscellaneous expenses : ₹ 25 Lacs ($ 0.30 M)

Annual Recurring Expenses

- Per Year : ₹ 2.55 Crores ($ 3.06 M)
- For 5 Years : ₹ 12.75 Crores ($ 15.30 M)

ATULYA GANGA
AN 11 YEARS COMMITMENT FOR GANGA REJUVENATION

Q & A

Appendix

Atulya Ganga Project: Support the Cause

Atulya Ganga Trust is a 12AA & 80G exempted entity that entitles you to a tax saving on 50% of your donations. Please contact us for your Tax Exemption Certificate on mike@atulyaganga.com

Online Donation Bank details

Account Number – **50200047484009**

Name – **ATULYA GANGA TRUST**

IFSC – **HDFC0009285**

In case of any query, contact on below:

- Email ID: hem@atulyaganga.com
- Contact no. : +91-91677 58456

Web-site : https://www.atulyaganga.com/support-now/

Water quality parameters and sub-indices functions details

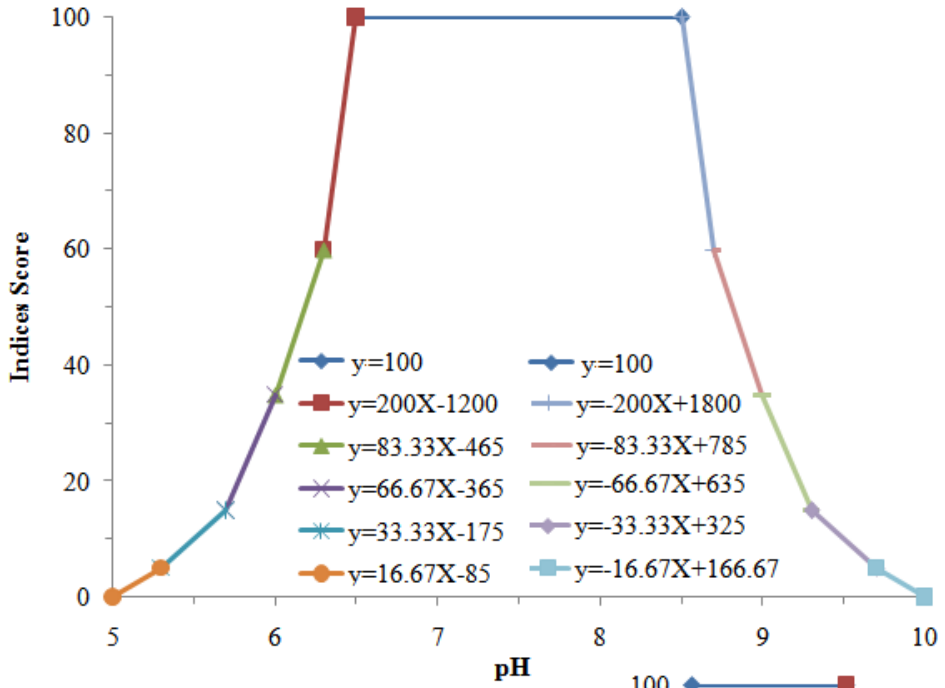
Parameter	(Units)	MCL	Sub-Indices scores				
		IS2296/USEPA*	[100,60]	[60,35]	[35,15]	[15,5]	[5,0]
pH		6.5-8.5	[0,0.2]	[0.2,0.5]	[0.5,0.8]	[0.8,1.2]	>1.2
Hardness	(mg/L)	300	[0,75]	[75,150]	[150,225]	[225,300]	>300
Chloride	(mg/L)	250	[0,150]	[150,300]	[300,450]	[450,600]	>600
Fluoride	(mg/L)	1.5	[0,0.3]	[0.3,0.6]	[0.6,0.9]	[0.9-1.2]	>1.2
DO	(mg/L)	6.0	[0,0.8]	[0.8,1.6]	[1.6,2.4]	[2.4,3.2]	>3.2
TDS	(mg/L)	500	[0,600]	[600,1200]	[1200,1800]	[1800,2400]	>2400
Turbidity	(NTU)	10*	[0,10]	[10,20]	[20,30]	[30,40]	>40

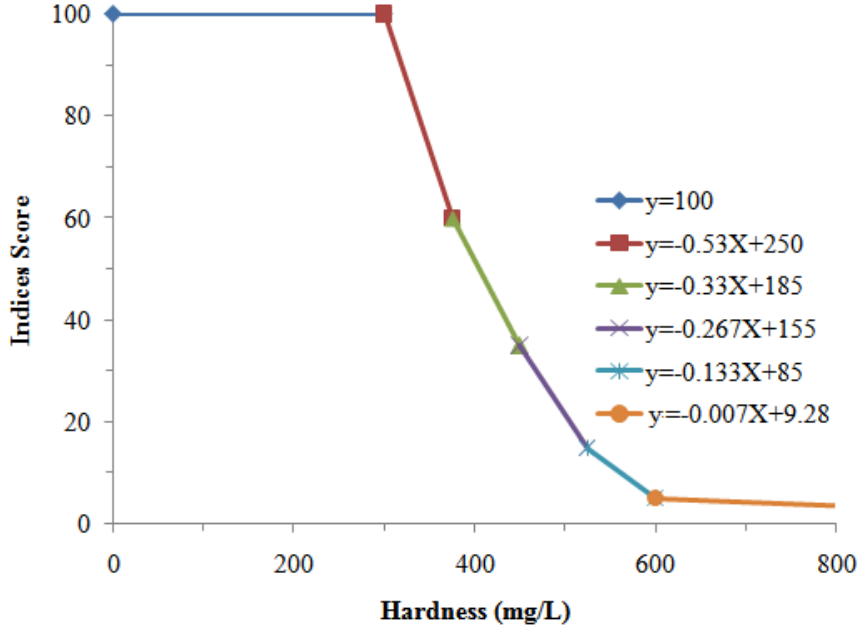
Note: S_i value will be 100 when parameter value is within MCL

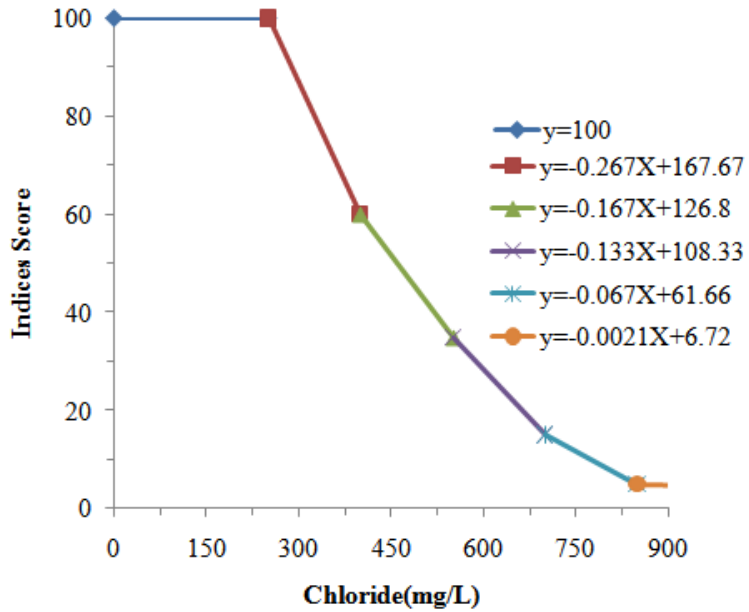
Parameters	Unit	S_i Functions				
		[100,60]	[60,35]	[35,15]	[15,5]	[5,0]
pH (< 6.5)		y=200x-1200	y=83.33x-465	y=66.67x-365	y=33.33x-175	y=16.67x-85
pH (> 8.5)		y=-200x+1800	y=-83.33x+785	y=-66.67x+635	y=-33.33x+325	y=-16.67x+166.67
Hardness	mg/L	y=-0.53x+250	y=-0.33x+185	y=-0.267x+155	y=-0.133x+85	y=-0.007x+9.28
Chlorides	mg/L	y=-0.267x+167.67	y=-0.167x+126.8	y=-0.133x+108.33	y=-0.067x+61.66	y=-0.0021x+6.72
Fluoride	mg/L	y=-133.33x+300	y=-83.33x+210	y=-66.67x+175	y=-33.33x+95	y=-16.67x+50
DO	mg/L	y= 50x-200	y= 31.25x-102.5	y= 25x-75	y= 12.5x-30	y= 2.08x-0.8
TDS	mg/L	y=-0.066x+133.33	y=-0.041x+105.83	y=-0.033x+91.66	y=-0.0167x+53.33	y=-0.0022x+11.6
Turbidity	NTU	y=-4x+140	y=-2.5x+110	y=-2x+95	y=-x+55	y=-0.038x+6.93

Note: S_i value will be 100 when parameter value is within MCL

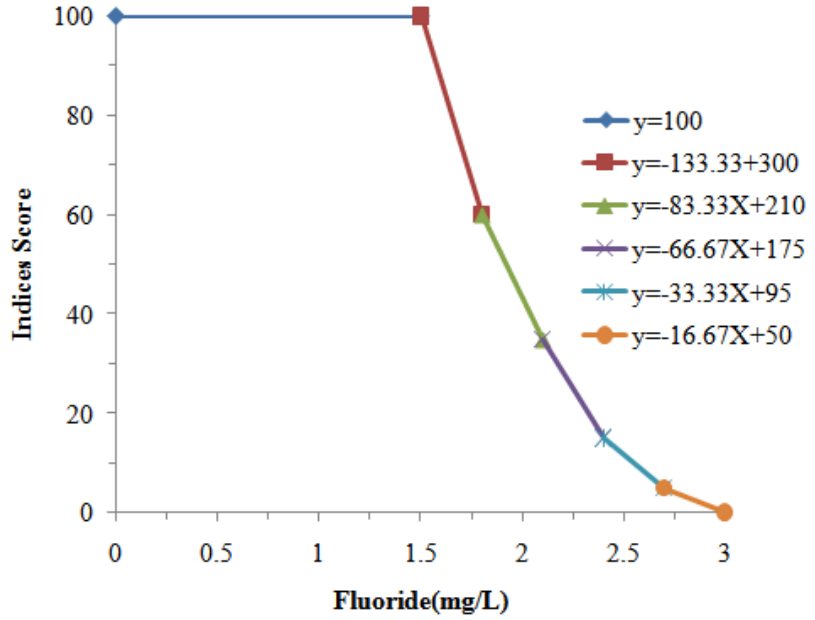
Sub-indices functions details

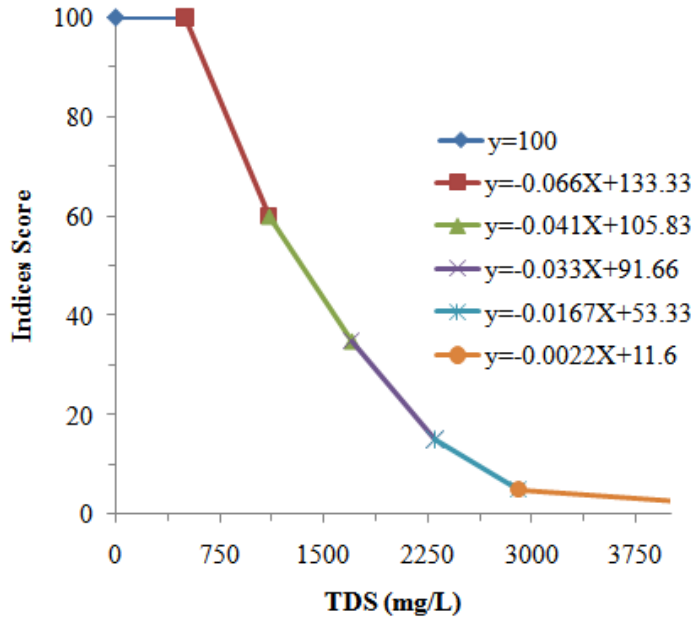


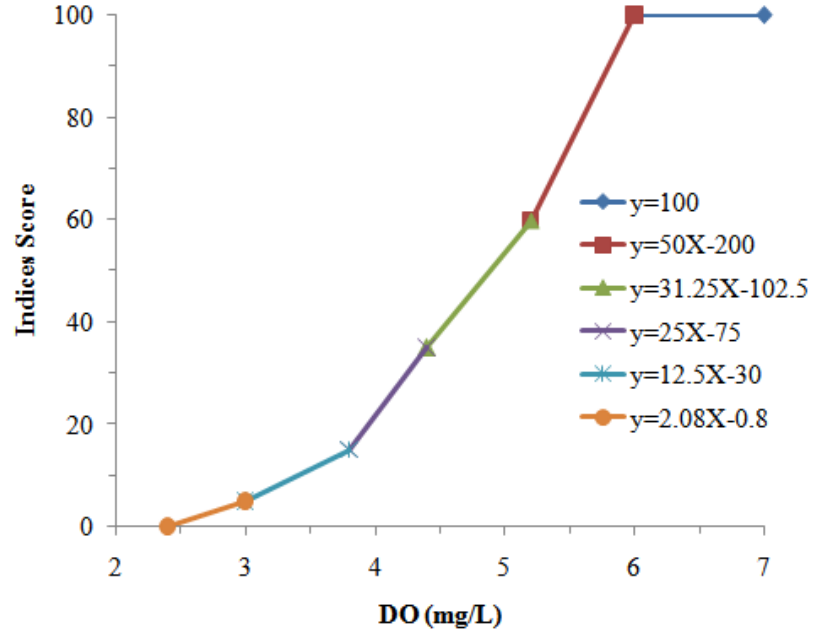


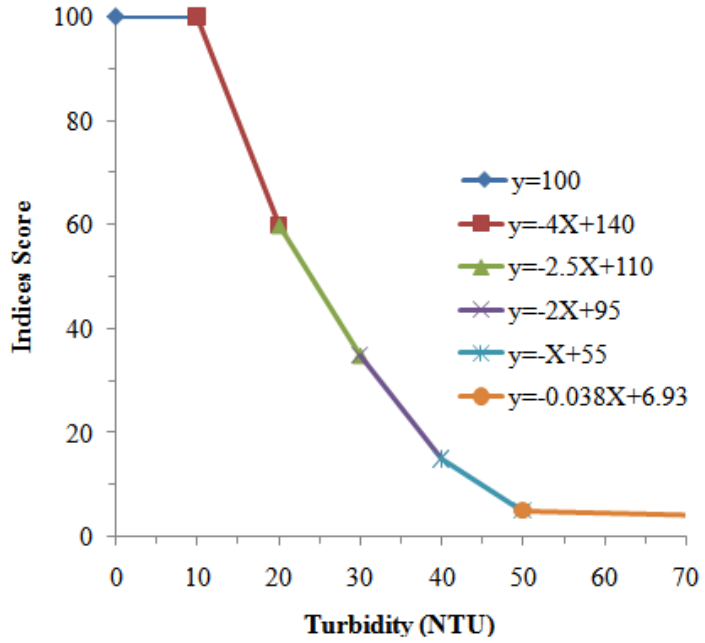


Sub-indices functions details





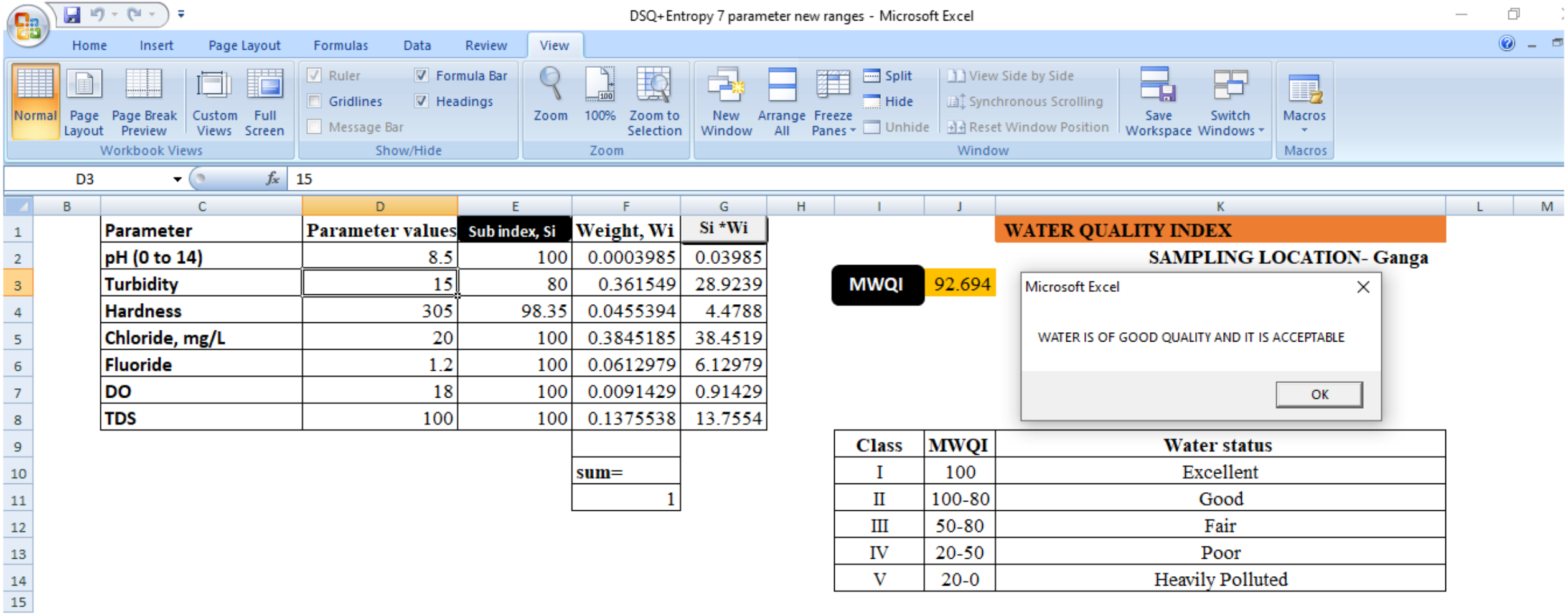




Synthetic dataset characteristics

S No	Dataset	Nature
1	First 15 samples	All water quality parameter within MCL
2	Middle 30 samples	Water quality parameter having moderate exceedance in MCL
3	Last 15 samples	All water quality parameter having high exceedance in MCL

Visual basic program for calculations



Parameter	Parameter values	Sub index, Si	Weight, Wi	Si *Wi
pH (0 to 14)	8.5	100	0.0003985	0.03985
Turbidity	15	80	0.361549	28.9239
Hardness	305	98.35	0.0455394	4.4788
Chloride, mg/L	20	100	0.3845185	38.4519
Fluoride	1.2	100	0.0612979	6.12979
DO	18	100	0.0091429	0.91429
TDS	100	100	0.1375538	13.7554
			sum=	
			1	

WATER QUALITY INDEX

SAMPLING LOCATION- Ganga

MWQI 92.694

Class	MWQI	Water status
I	100	Excellent
II	100-80	Good
III	50-80	Fair
IV	20-50	Poor
V	20-0	Heavily Polluted