



# Conserving and Sustainably Managing Gangetic Floodplain Wetlands of Uttar Pradesh

# **Final Technical Report**



2023

Funded By National Mission for Clean Ganga, Government of India Ministry of Jal Shakti



#### **Uttar Pradesh State Wetland Authority**

The Uttar Pradesh State Wetland Authority (UPSWA) exercises powers to perform functions like preparing a list of all wetlands of the State or UT within three months from the date of publication of these rules, preparing a list of wetlands to be notified, within six months from the date of publication of these Rules, taking into cognizance any existing list of wetlands prepared/notified under other relevant State Acts, recommending identified wetlands, based on their Brief Documents, for regulation under these rules; preparing a comprehensive digital inventory of all wetlands within one year from the date of publication of these rules and upload the same on a dedicated web portal, to be developed by the Central Government for the said purpose; the inventory ought to be updated every ten years; developing a comprehensive list of activities, to be regulated and permitted within the notified wetlands and their zone of influence; recommending additions, if any, to the list of prohibited activities for specific wetlands; g) Define strategies for conservation and wise use of wetlands within their jurisdiction; reviewing Integrated Management Plan for each of the notified wetlands (including trans-boundary wetlands in coordination with Central Government), recommending mechanisms for maintenance of ecological character through promotional activities for land within the boundary of notified wetlands or wetlands complex have private tenancy rights,; identifying mechanisms for convergence of implementation of the management plan with the existing State/UT level development plans and programmes; ensuring enforcement of these rules and other relevant Acts, rules and regulations and on a half-yearly basis (June and December of each calendar year) inform the concerned State Government or UT Administration or Central Government on the status of such notified wetlands through a reporting mechanism; and coordinate implementation of Integrated Management Plans based on wise use principle through various line departments and other concerned agencies.



#### Wetlands International South Asia

Wetlands International South Asia Wetlands International South Asia is a non-government organisation working for sustaining and restoring wetlands, their resources and biodiversity in the South Asia region. Its office in New Delhi (India) was established in 1996 as a part of Wetlands International network. Wetlands International is a global, independent, non-profit organisation dedicated to conservation and restoration of wetlands, and presently works in over 100 countries through a network of 18 regional and national offices and expert networks headquartered in The Netherlands. Wetlands International is also one of the five International Organization Partners of the Ramsar Convention. In 2005, Wetlands International South Asia was registered under the Societies Registration Act of Government of India (retaining remit of South Asia region), consequently gaining an Indian legal entity while subscribing to the goals and targets of the Wetlands International network. The organisation endeavours to use a mix of approaches including technical knowledge, policy dialogue and field demonstrations for addressing various issues related to wetland management. To leverage change, the organisation works with national and state governments, knowledge centres, civil society as well as the private sector, often acting as catalysts to enable joined up actions. Given that securing a positive change in the status of wetlands and linked livelihoods takes considerable time, the organisation works for long-term engagement, forging strategic and innovative partnerships.

# Conserving and Sustainably Managing Gangetic Floodplain Wetlands of Uttar Pradesh

# **Executive Summary**





Uttar Pradesh Forest Department





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# MESSAGE

The Ganga is regarded as a sacred river of the nation. The river flows through 27 Districts of Uttar Pradesh covering 1180 km, entering the state at Kotwali in Bijnor District and exiting at Dokti in Ballia District. The floodplains flanking the main channel provide an ecological and hydrological continuum rendering vital ecosystem services and biodiversity habitats. Effective management of these wetlands is crucial for achieving river integrity and food and water security for the dependent communities.

The National Environment Policy (2006), Government of India, recommends the integration of conservation and wise use of wetlands into river basin management involving all relevant stakeholders, in particular local communities, to ensure maintenance of hydrological regimes and conservation of biodiversity. It further recommends the integration of wetland conservation into sectoral development plans for poverty alleviation and livelihood improvement, and link efforts for conservation and sustainable use of wetlands with all ongoing rural infrastructure development and employment generation programmes. If considered as a natural infrastructure capable of providing water and food security, buffering extreme events, and supporting adaptation to climate change, the ecosystem services of Kanwar can support achieving outcomes for several sectoral development plans, particularly for water resources, agriculture, rural development, and disaster risk reduction. The Wetlands (Conservation and Management) Rules, 2017; The River Ganga (Rejuvenation, Protection and Management) Authorities Order, 2016 (amended 2019), and the minimum environmental flows notification of 2018 provides the regulatory framework to prevent any fragmentation of hydrological regimes through hydraulic structures, diversions, encroachments, or impeding flow pathways.

For the effective management of wetlands along the river Ganga, the project on "Conserving and Sustainably Managing Gangetic Floodplain Wetlands of Uttar Pradesh" was undertaken by the Uttar Pradesh State Forest Department under Namami Gange, funded by the National Mission on Clean Ganga, Ministry of Jal Shakti, Government of India.

The report has been prepared by the Uttar Pradesh State Wetland Authority, Uttar Pradesh State Forest Department with the technical support of Wetlands International South Asia. I compliment them for the goal oriented work plan in the form of a comprehensive technical report for the River Ganga.

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# MESSAGE

The Ganga longest river in the India covers 1180 km within the state of Uttar Pradesh. Lives and livelihood of humans and varied flora and fauna in the Ganga basin are directly or indirectly dependent on Ganga and its tributaries.

Within any basin, including the River Ganga Basin, management of hydrological regimes and linked ecosystem processes, services, and biodiversity values are interactions between lentic ecosystems (i.e., the wetlands) and lotic systems (i.e., the river). Floodplains, especially the active part, harbour significant riverine wetlands, which are unique, highly productive, and perform a wide range of functions such as flood control, water purification, carbon storage, groundwater recharge, and water storagé. In terms of biodiversity, these wetlands provide refuges for fauna in times of flooding, are food reservoirs and breeding sites and also participate in the dispersion of plant and animal species.

The National Mission on Clean Ganga, Ministry of Jal Shakti, Government of India, with an objective of supporting conservation and sustainable management of Gangetic wetlands of Uttar Pradesh, sanctioned the technical assistance project to Uttar Pradesh State Forest Department. The technical report prepared by the Uttar Pradesh State Wetland Authority, Uttar Pradesh State Forest Department with the support of Wetlands International South Asia aims at ensuring overall objective of 'effective management of floodplain wetlands in River Ganga Districts' to ensure sustained provision of wide-ranging ecosystem services naturally provided by these ecosystems and securing diverse habitats.

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# MESSAGE

The sacred Ganga is the lifeline for all living beings in the state of Uttar Pradesh. This perennial river carries water from catchments to extensive areas downstream to meet not only the societal but also ecosystem requirements.

The Government of Uttar Pradesh constituted the Uttar Pradesh State Wetlands Authority as the nodal policy-making, regulation, and management organization of wetlands at the state level. With an objective of supporting conservation and sustainable management of Gangetic wetlands of Uttar Pradesh, The National Mission on Clean Ganga (NMCG), Ministry of Jal Shakti, Government of India sanctioned a technical assistance project on **"Conserving and Sustainably Managing Gangetic Floodplain Wetlands of Uttar Pradesh"**.

The project has an overall objective of 'effective management of floodplain wetlands in River Ganga Districts' to ensure sustained provision of wide-ranging ecosystem services naturally provided by these ecosystems and securing diverse habitats. The specific objectives of the project include • Define and characterize floodplain wetlands regimes within the Ganga Districts. • Put in place institutional arrangements for managing floodplain wetlands by notifying under Wetlands (Conservation and Management) Rules, 2017. • Develop stakeholder-led integrated management plans for securing ecosystem services and biodiversity values. • Design and implement a monitoring regime to enable periodic assessment of wetland ecosystem health and effectiveness of management. • Creating and developing the available infrastructure, capacity building and generation of awareness of the stakeholders.

This technical wetland management plan prepared by the Uttar Pradesh State Wetland Authority, Uttar Pradesh State Forest Department with the technical support of Wetlands International South Asia under the aegis of the NMCG funded project reflects the commitment of the Government of Uttar Pradesh for ensuring the conservation of floodplain wetlands of the state along the river Ganga.

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# FORWORD

The rivers are the life support systems that ensure functioning of the hydrological cycle and ecosystem services and the Ganga is most important sacred rivers of India. The river water is irrigation, drinking, bathing, industrial activities, hydropower generation, fisharies, etc.

The 'Vision Ganga' under the National Mission for Clean Ganga (NMCG) is an integrated conservation mission, approved as the 'Flagship Programme' by the Union Government of India. The mission is structured along four dimensions of the river system, namely: a) Aviral Dhara (uninterrupted flow), b) Nirmal Dhara (unpolluted flow), c) Geological entity, and d) Ecological entity.

India, as a signatory to the Ramsar Convention, is committed to achieving wise use of all wetlands in her territory. Wise use of wetlands is defined in the text of the Ramsar Convention as 'the maintenance of their ecological character, achieved through the implementation of ecosystem approaches, within the context of sustainable development.' Ecological character is 'the combination of ecosystem components, processes, and services that characterize a wetland.' Ecosystem management of wetlands thus seeks to achieve the goal of 'maintenance of ecological character' or 'wetland wise use'.

The Gangetic floodplain wetlands in Uttar Pradesh fall within three sub-basins of the River Ganga: a) Above Ramganga Confluence, b) Ghaghra Confluence to Gomti Confluence and c) Gomti Confluence to Muzaffarnagar. In line with this, the wetland management plans have been prepared at the sub-basin level, articulating description and evaluation of the ecological character, identification of threats and management needs, management objectives and outcomes, and actions. It is envisaged that a basin sub-level wetland plan will provide better synergies with water resource planning and implementation, as well as with district-level developmental planning. The current management plan provides a framework for action for conservation and wise use of floodplain wetlands located within the three sub-basins of the River Ganga.

The three sub-basin plans has been prepared by the Uttar Pradesh State Wetland Authority, Uttar Pradesh State Forest Department with the technical support of Wetlands International South Asia has been funded by the National Mission on Clean Ganga, Ministry of Jal Shakti, Government of India, with an objective of supporting conservation and sustainable management of Gangetic wetlands of Uttar Pradesh. We thank the Director General, National Mission on Clean Ganga, Ministry of Jal Shakti, Government of India for the financial and technical support for this project.

(B.Prabhakar)

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# 1. Background

River Ganga flows through 27 Districts of Uttar Pradesh covering a distance of 1140 km with its entry point at Kotwali in Bijnor District and exit at Dokti in Ghazipur District Map 1. The floodplains flanking the main channel provide an ecological and hydrological continuum rendering vital ecosystem services and biodiversity habitats. Effective management of these wetlands is crucial for achieving river integrity, and food and water security for the dependent communities.

The 'Vision Ganga' under the National Mission for Clean Ganga (NMCG) is an integrated conservation mission, approved as the 'Flagship Programme' by the Union Government of India. The mission is structured along four dimensions of the river system, namely: a) Aviral Dhara (uninterrupted flow), b) Nirmal Dhara (unpolluted flow), c) Geological entity, and d) Ecological entity. The main objectives of the Ganga River Management have been articulated to be: a) maintenance of environmental flows in rivers and tributaries to fulfill their geological, ecological, socio-economic and cultural functions; b) ensuring that water quality in all rivers and tributaries is consistent with their governing geological, ecological, socio- economic and cultural functions; c) judicial use of water and other aquatic resources to enable sustainable development in the entire basin; and d) transparent and inclusive review of all existing, ongoing and planned anthropogenic activities in the basin. Action programmes to realize the objectives have been organized around eight missions, namely: a) aviral dhara, b) nirmal dhara, c) ecological restoration, d) sustainable agriculture, e) geological safeguarding, f) disaster protection, g) river hazards management, and h) environmental knowledge building and sensitization.

Within any basin, including the River Ganga Basin (RGB), management of hydrological regimes and linked ecosystem processes, services and biodiversity values needs to be based on complementarity and interactions between lentic ecosystems (i.e., the wetlands) and lotic systems (i.e., the river). Floodplains, especially the active part, harbour significant riverine wetlands, which are unique, highly productive, and perform a wide range of functions such as flood control, water purification, carbon storage, groundwater recharge, and water storage. In terms of biodiversity, these wetlands provide refuges for fauna in times of flooding, are food reservoirs and breeding sites, and participate in the dispersion of plant and animal species. Owing to the variability of the geomorphological, physicochemical, and hydrogeological contexts in which they are created, riverine wetlands offer a unique diversity of ecological situations that has no equivalent in other wetlands on similar scales.

Conservation and wise use of wetlands, and recognition of their role and wide-ranging ecosystem services are essential aspects of river basin planning and management. Degradation and loss of wetlands, and rapid changes in the river basins of which these wetlands are integral elements, leads to the disruption of natural hydrological cycles, often leading to enhanced frequency and severity of flooding, drought and pollution, and imposing significant economic and social losses and costs to the human populations within these river basins. Proper consideration of the role and importance of wetlands in river basin management can significantly assist in securing safe, reliable sources of water and meeting development objectives identified within the Ganga Vision.



Map 1: River Ganga and her three sub-basins in Uttar Pradesh

The Government of Uttar Pradesh constituted the Uttar Pradesh State Wetlands Authority as the nodal policy-making, regulation and management organization at state level. With the objective of supporting conservation and sustainable management of Gangetic wetlands of Uttar Pradesh, the NMCG sanctioned a technical assistance project to Uttar Pradesh State Wetlands Authority. The project has an overall objective of 'effective management of floodplain wetlands in River Ganga Districts' to ensure sustained provision of wide-ranging ecosystem services naturally provided by these ecosystems and securing diverse habitats. The specific objectives were to:

- Define and characterize floodplain wetlands regimes within the Ganga Districts.
- Put in place institutional arrangements for managing floodplain wetlands by notifying under Wetlands (Conservation and Management) Rules, 2017.
- Develop stakeholder-led integrated management plans for securing ecosystem services and biodiversity values.
- Design and implement a monitoring regime to enable periodic assessment of wetland ecosystem health and effectiveness of management.
- Creating and developing the available infrastructure, capacity building and generation of awareness of the stakeholders.

The project was implemented by Uttar Pradesh State Wetlands Authority and APCCF (IT) with Wetlands International South Asia providing technical assistance in implementing the wetlands inventory and management planning components. This technical report summarizes the outcomes delivered under the project.

# 2. Project Components and Deliverables

The project was structured in three components, namely a) Wetlands Inventory and Assessment, b) Management Planning, and c) Wetlands Monitoring. Specific deliverables under each of these components is as below:

Project components	Overall Project deliverables	
Component 1: Wetlands inventory and assessment	<ul> <li>1.1 Inventory of floodplain wetlands</li> <li>1.2 Rapid wetland ecosystem services assessment</li> <li>1.3 Proposals for notification under Wetlands (Conservation and Management) Rules, 2017 (Preparation of brief documents for vetting by the State Government)</li> </ul>	
Component 2: Management planning	2.1 Management plans for priority wetlands	
Component 3: Wetlands monitoring	3.1 Wetlands Ecosystem Health Card for priority wetlands	

The project was sanctioned on December 19, 2019 with the inception workshop being held on January 21, 2020 at the Conference Hall of Kukrail Gharial Breeding Center. Project details including objectives, methodology for wetlands conditions assessment and inventory were discussed at the launch meeting. This was followed by a detailed meeting on project methods held in February 2020 at the Office of the PCCF-Wildlife. The implementation framework for the project is placed at Figure 1.



Figure 1: Implementation framework for Gangetic Floodplains assessment project

# 3. Project Outcomes

## **Component 1: Wetlands inventory and assessment**

### Wetlands Inventory

The Ganga River floodplain was delineated using the Global Surface Water data for 1984-2020 (Pekel et al., 2016<sup>1</sup>). The data provides occurrence, change, recurrence, transitions, and seasonality for 32 years and maximum extent at 30m resolution. The maximum extent of inundation was used as the active floodplain boundary. This was digitized using visual interpretation, and rectified at a constant scale of 1:1000 to ensure accuracy in capturing the landscape details (Rozo et al., 2014<sup>2</sup>).

Wetlands dynamics in the 10-km buffer was assessed using cloud-free post monsoon (October) Landsat images (30 m resolution) of 2000 and 2020. This spatial resolution is suitable for 1:50,000 scale mapping. Satellite images downloaded from USGS Earth Explorer were radiometrically and atmospherically corrected. The river channel was extracted from satellite imagery using a binary mask generated by a decision tree based on spectral band reflectance (SWIR 1; 1.57–1.65 m), Normalized Difference Vegetation Index (NDVI) (Rouse et al., 1974) and the Normalized Difference Water Index (NDWI) (Mcfeeters, 1996<sup>3</sup>).

The wetland mapping method used in the project was adapted from National Wetland Atlas (SAC, 2011<sup>4</sup>) and Sinha et al., (2017<sup>5</sup>) and is presented in Figure 2 Water-dominated areas (including wetlands, river channel, river bed, and aquatic vegetation) were extracted from the current LULC map (i.e., the Year 2020) in the GIS environment. Additional information pertaining to the wetland types mapped were derived from satellite imagery-based spectral indices including Normalized difference vegetation index (NDVI) (which indicates the extent of aquatic vegetation) and Normalized Difference Water Index (NDWI) (which depicts the open water extent within the wetland). Proximity to linear infrastructure was used to segregate the human-made waterlogged areas. To improve the accuracy of the land use and land cover classification, 2837 ground truth points were used, evenly dispersed across the study region. The overall accuracy of the land use and land cover maps was 98.49% (2020) and 98.2% (2000).

The active floodplain area for Above Ramganga Confluence (ARC) in 2020 was 1,01,414 ha (15% of the 10-km buffer area). The wetlands in this basin spanned 12,161 ha, of which 91% were within the active floodplain area and the rest outside Map 2 and Map 3. In 2020, riparian wetlands constituted most of the overall wetland area (91%), followed by isolated sumplands (8.5%). Similarly, the active floodplain in Upstream of Gomti to Muzaffarnagar Confluence spanned to 1,05,400 ha (11.67% of the 10-km buffer area). Total wetland area in the basin was 15,844 ha, of which 77% were located within the active floodplain area and the rest outside. For Ghaghara Confluence to Gomti Confluence Sub basin active

<sup>&</sup>lt;sup>1</sup> Pekel, J.-F & Cottam, Andrew & Gorelick, Noel & Belward, Alan. (2016). High-resolution mapping of global surface water and its long-term changes. Nature. 540. 10.1038/nature20584

<sup>&</sup>lt;sup>2</sup> Rozo, M. G., Nogueira, A. C. R. and Castro, C. S. (2014) 'Remote sensing-based analysis of the planform changes in the Upper Amazon River over the period 1986-2006', *Journal of South American Earth Sciences*, 51, pp. 28–44. doi: 10.1016/j.jsames.2013.12.004.

<sup>&</sup>lt;sup>3</sup> McFeeters, S.K. (1996). The use of the Normalized Difference Water Index (NDWI) in the delineation of open water features, International Journal of Remote Sensing, 17:7, 1425-1432.

<sup>&</sup>lt;sup>4</sup> SAC (2011) National wetland atlas.

<sup>&</sup>lt;sup>5</sup> Sinha, Rajiv, Shivika Saxena, and Manudeo Singh. "Protocols for Riverine Wetland Mapping and Classification Using Remote Sensing and GIS." Current Science 112, no. 7 (2017): 1544–52

floodplain area in 2020 was 47,600 ha (15% of the 10-km buffer area), and the total wetland area in 2020 was 8,529 ha, of which 73.45% is within the active floodplain area and the rest outside. In 2020, riparian wetlands constituted a majority of the overall wetland area (77%), followed by isolated sumplands (23%) in the basin.





The wetland area in Above Ramganga Confluence sub-basin has shrunk by 81% during 2000–2020 (from 64,000 ha to 12,000 ha). Irrigation canal-fed wetlands declined the most (99% since 2000), attributed to the concretization of the irrigation canals, which has subsequently reduced groundwater seepage. The reduction in wetland areas outside the active floodplain boundary (91%) was higher than that inside (72%). The wetland area Upstream of Gomti Confluence to Muzaffarnagar Sub basin has shrunk by 72% from 2000-2020 (from 57,310 ha to 15,844 ha). The reduction in isolated sumplands outside the active floodplain boundary (87% since 2000) was higher than in riparian wetlands inside (58%). The wetland area in Ghaghara Confluence to Gomti Confluence has shrunk by 71% during 2000–2020 (from 28,988 ha to 8,529 ha).

Between 2000 - 2020, 76 % of wetlands were lost primarily to agriculture Table 1. Within the ARC, 7,388 ha of irrigation canal-fed wetland area and 21,342 ha of riparian wetlands got converted to agricultural land in 20 years. The conversion of riparian wetlands may be related to the ephemerality of wetlands. Similarly, isolated sumplands observed an area of 14,140 ha change in the agriculture class during the past two decades. Riparian wetlands observed a maximum conversion into terrestrial vegetation of 9,156 ha compared to other wetland classes (1,741 ha from irrigation canal-fed wetlands and 2,650 ha from isolated sumplands).

LULC class	2000	2020	Change in Area (ha)	% Change
Agriculture	1406538.52	1422769.44	-16230.92	-0.86
Barren	48084.71	45179.55	2905.16	0.15
Vegetation	116142.30	218797.46	-102655.17	-5.47
Wetland	150683.51	36506.18	114177.33	6.08
River	91604.74	65329.78	26274.96	1.40
Built-up	63096.71	87568.06	-24471.36	-1.30
Total area	1878150.48	1878150.48		

Table 1: Change in the land cover and land use from 2000 to 2020 in the Ganga basin in Uttar Pradesh



Map 2: Wetland extent in the 10km buffer zone on either side of the River Ganga during the year 2000



Map 3: Wetland extent in the 10km buffer zone on either side of the River Ganga during the year 2020

Wetland conversion upstream of Gomti to Muzaffarnagar Confluence was much higher than in other basins, as 16,552 ha of riparian wetland were converted to agricultural land in twenty years, which can be related to the ephemeral nature of wetland ecosystems. Similarly, 20,646 ha of isolated sumplands were converted into agricultural land. From 2000 to 2020, isolated sumplands experienced a more incredible conversion of wetland area to terrestrial vegetation than riparian wetland areas (5,313 ha and 2,934 ha, respectively). Furthermore, isolated sumplands (1,126 ha) experienced a greater rate of urbanization than riparian wetlands (168 ha).

From the Ghaghara Confluence to Gomti Confluence, an area of 4,824 ha of riparian wetlands was converted to agricultural land. Similarly, isolated sumplands have added 12,755 ha to the agricultural class over the past 20 years. From 2000 to 2020, isolated sumplands experienced a more significant conversion of wetland area to terrestrial vegetation than riparian wetland areas (5558 ha vs. 436 ha, respectively). Similarly, isolated sumplands (709 ha) experienced a greater rate of urbanization than riparian wetlands (144 ha).

Inventory of 285 wetlands, identified on the basis of 2020 land use and land cover map of the 10-km buffer region was undertaken with the help of a rapid assessment tool (Annex 1). For each wetland, the following information was generated:

*Wetland settings*: Official and vernacular names, geographical location, extent, wetland type, and features of the surrounding area.

Description of wetland features: Catchment, hydrology (topography, geology, geomorphology, soil, land use, and land cover, climate, major sources of water, number and status of inlets and outlets, water depth, connectivity, inundation regime, water flow direction, water permanence, and usage), Species and habitats (habitat types, availability of bird counts, invasive species status, macrophytes, fish, reptiles, birds, amphibians, and mammals), and Communities (permanent and temporary settlements present on the shoreline, population and percentage of community dependence).

*Values and benefits*: provisioning services (freshwater - drinking, washing and domestic use, agriculture and livestock; food – fish and edible aquatic plants; fuel; fiber and fodder; natural medicines; ornamental resources; clay, sand, and mineral harvesting), regulatory (air quality regulation, local climate regulation, water regulation, flood hazard regulation, water during droughts, pest regulation, disease regulation – human and livestock, erosion regulation, water purification, pollination, salinity regulation, fire regulation and noise and visual buffering), supporting services (soil formation, primary production, nutrient cycling, water recycling and provision of habitat), and cultural services(cultural heritage, recreation and tourism, aesthetic value, spiritual and religious value, inspiration value, social relations, educational and research and transportation).

Threats: adverse changes faced in the ten years, major direct threats, and major indirect threats.

*Management:* Pattern of land ownership within the wetland, the pattern of land ownership in the area surrounding the wetland, and pre-existing rights and privileges in the wetland.

The inventory data of 285 wetlands was uploaded into an electronic database of the Uttar Pradesh Forest Department (upforest.org/wetland.aspx).

#### **Rapid Wetland Ecosystem Services Assessment**

An assessment of the ecosystem services of the 285 wetlands was undertaken using the Rapid Assessment of Wetland Ecosystem Services Tool (RAWES) (Ramsar 2018). RAWES has been developed to support ecosystem service assessment of wetlands recognizing practical time and resource limitations faced by operational staff, providing a simple, user-friendly, cost-effective approach supporting systemic assessment of the full range of wetland ecosystem services (McInnes and Everard 2017). RAWES addresses the four ecosystem service categories (provisioning, regulatory, cultural and supporting services) defined by the Millennium Ecosystem Assessment (2005<sup>6</sup>).

Expert assessors interacted with numerous local stakeholders, community groups, government officials, and non-governmental organisations. Consent to use anonymised feedback from interviewees was sought prior to interviews and meetings.

$$ESI = \frac{\sum (n_{+1.0} + n_{+0.5}) + \sum (n_{-1.0} + n_{-0.5})}{\sum n_{TOTAL}} |$$

Semi-quantitative importance of each service is scored on a scale from 'significantly positive' (++) through 'neutral' (0) to 'significantly negative' (-) or 'unknown' (?). Data captured in hand-written RAWES field assessment sheets were transposed into spreadsheet format, with some modification in dialogue amongst assessors and other experts where more information became available. Groups of ecosystem services (all 36 assessed services or within Millennium Assessment categories) were summed and divided by the number of services in that category (up to provisioning n=9, regulating n=14, cultural n =7, supporting n=6 but reduced where services were not relevant) to derive a single comparable ecosystem services index (ESI) (based on similar index methods by Butchart et al. (2010), calculated using Eq. 1. The potential ESI range is from +1 to -1 when calculated for each of the four ecosystem service categories, though compound values for all services can exceed these limits where benefits are realised at multiple geographical scales.



Training workshop on rapid wetland ecosystem services assessment

<sup>&</sup>lt;sup>6</sup> Millennium Ecosystem Assessment (2005). (Ed.): Rashid Hassan, Robert Scholes and Neville Ash. Published by Island Press, 1718 Connecticut Avenue, Suite 300, NW, Washington, DC 20009

A total five Training Workshops were held for surveyors (Wetland Managers) on application of HGM and RAWES protocol. Four workshops were held in the nodal districts (Meerut, Allahabad, Varanasi and Budaun) while one workshop was held on-line. Over 200 forest department officials from 27 districts were imparted training on wetlands delineation, rapid assessment of hydrological, ecological and socioeconomic features, evaluating ecosystem services, analysing threats and priority management needs. After the classroom session, field assessments were conducted at a wetland identified by the Forest Department. The process of water testing for select parameters was also conducted to replicate at the target wetland sites.

Based on the range of ESI scores for each of the services, combined ESI scores for all ecosystem services under each category i.e., within river channel wetlands, along irrigation canal wetlands and isolated sumplands for all 285 wetland sites were constructed including a breakdown of ESI for each service category (provisioning, regulating, cultural, supporting) (Figure 3).

### Preparation of brief documents

Brief documents of 282 wetlands have been uploaded into an electronic database of the Uttar Pradesh Forest Department (Table 2 and Link: upforest.org/wetland.aspx). The same has also been compiled as a Wetlands Brief Document. Each brief document has the following sections - Identification, location and Jurisdiction; Site characteristics; Biodiversity; Ecosystem services; Pre-existing rights and privileges; Present and potential threats; Activities proposed to be regulated; Activities proposed to be permitted and List of available scientific resources used. Apart from this, the document also contains the wetland site map and the map of the zone of influence.

Sub-basin	Districts	Number of wetland brief documents compiled
	Amroha (JP Nagar)	11
	Bijnor	14
	Bulandshahar	7
	Hapur	3
	Meerut	4
Abovo Romannao	Muzaffarnagar	13
	Aligarh	10
connuence	Badaun	9
	Kasganj	8
	Sambhal	4
	Shahjahanpur	6
	Farrukhabad	17
		106
	Hardoi	8
	Kannauj	5
Upstream of Gomti	Kanpurnagar	13
Confluence to	Unnao	21
Muzaffarnagar	Fatehpur	18
	Kaushambhi	5
	Pratapgarh	8

#### Table 2: Number of wetland brief documents compiled in respective sub-basins

	Prayagraj	15
	Raebareli	26
	Bhadohi	4
	Mirzapur	8
	Varanasi	9
		140
	Ballia	14
Ghaghra Confluence	Chandauli	9
to Gomti Confluence	Ghazipur	13
		36

## **Component 2: Wetland Management Planning**

### Management Planning

### Management Planning Approach and Method

Wetlands under the Gangetic floodplains evolve and function within physical templates, characteristics of which are determined primarily by the interaction between water and sediments. The ecological components, processes, and services are influenced by land and water management practices within the immediate as well as indirect catchments of the wetland complex. Management planning, therefore, calls for an approach that recognizes the interconnectedness of wetland biological diversity and ecosystem services with land and water management in the river basin taking into account the external, natural, and induced factors. The approach also needs to address climate change which has direct as well as indirect implications for wetland features as well as factors governing these features. The wise use principle encourages stakeholder engagement and transparency in negotiating trade-offs and determining equitable outcomes for wetland conservation while promoting maintenance of environmental, economic, and social sustainability.

The National Environment Policy (2006), Government of India, recommends the integration of conservation and wise use of wetlands into river basin management involving all relevant stakeholders, in particular local communities, to ensure maintenance of hydrological regimes and conservation of biodiversity. It further recommends the integration of wetland conservation into sectoral development plans for poverty alleviation and livelihood improvement, and link efforts for conservation and sustainable use of wetlands with all ongoing rural infrastructure development and employment generation programmes. If considered as a natural infrastructure capable of providing water and food security, buffering extreme events, and supporting adaptation to climate change, the ecosystem services of River Ganga can support achieving outcomes for several sectoral development plans, particularly for water resources, agriculture, rural development, and disaster risk reduction. The Wetlands (Conservation and Management) Rules, 2017; The River Ganga (Rejuvenation, Protection and Management) Authorities Order, 2016 (amended 2019), and the minimum environmental flows notification of 2018 provides the regulatory framework to prevent any fragmentation of hydrological regimes through hydraulic structures, diversions, encroachments, or impeding flow pathways.





Above Ramganga Confluence a)

b) Upstream Gomti Confluence to Muzaffarnagar



c) Gomti Confluence to Ghaghara Confluence

Figure 3: Comparative analysis of Ecosystem Services in three sub basins

Much of the region along the 10-kilometer buffer of the Ganga River channel is constituted by river floodplains (Map 2 and Map 3). The uniqueness of floodplain ecosystems lies within their near-linear form, the high dynamism of their geomorphology, and the ability to processes large fluxes of energy and material from upstream areas. Several conceptual models and frameworks have emphasized upstream-downstream linkages along the river corridor, the influence of river basin form and climate on downstream areas, their horizontal linkage across the floodplain between the river channel and the floodplain, the vertical interconnection within the floodplain between overbank flooding, groundwater, and rainfall. Amongst several factors, hydrological inputs to floodplains play a significant role through a) their influence on the arrangement of landforms and vegetation communities, and b) the impact of flooding regimes on the regeneration and turnover time of floodplain vegetation.

Floodplains apparently exist in two alternating phases. For most of the time, these ecosystems exist in a dry phase during which, at least superficially, is not substantively different from surrounding terrestrial ecosystems. However, during monsoons, these ecosystems are inundated wherein large, shallow floods driven by rainfall top up moisture in the soil, recharge the groundwater aquifers, and fill up depressions. This recharge provides the reservoir of water upon which the biota depends until the next flood event. These ecosystems have evolved to cope with these phase changes. Many aquatic plants have long-lived seeds that can withstand extended periods of drought. Similarly, many animals possess drought resistant stages in the life-cycle or the physiological capacity for diapause or, like waterbirds, adopt highly mobile strategies in order to track scarce resources.

The gradients of flooding frequency, soil moisture, and vegetation create conducive environments for wetlands within these floodplains. Located at the interface of terrestrial and aquatic ecosystems, combining features of both, wetlands arise when inundation by water produces soils dominated by anaerobic processes, which in turn, forces the biota, particularly rooted plants to adapt to flooding. Ramsar Convention, an inter-governmental treaty defines wetlands broadly as 'areas of marsh, fen, peatland or water, whether natural or artificial, permanent or temporary with water that is static or flowing, fresh, brackish or salt, including areas of marine water the depth of which at low tides does not exceed six meters.

The variable water regime in floodplains plays an important role in the structure and function of floodplain wetlands. Intermittent or seasonal floods transport organic matter and biota, triggering the life cycles of many aquatic and terrestrial organisms inhabiting wetlands. Wetting and drying are vital to the functioning of these ecosystems. During dry phases, eggs, and seeds of diapausing animals and plants remain in dry floodplain soils. Nutrients and energy to floodplain soils are also added by decomposing organic matter from leaf litter and stranded aquatic plants and animals. During floods, these organic reservoirs support emerging aquatic organisms and biota which colonise the newly inundated habitats. Heterotrophic organisms, in particular, assimilate these resources into the food webs, linking detritus to higher trophic levels. The temporal dynamics of water drive this complexity. Species like waterbirds and fishes depend on floodplain river connections to complete their life cycles.

Conservation and sustainable development of floodplain wetlands of Ganga require integrated planning and resource management at the river basin level recognizing the interconnectedness of the wetland system with its catchments. River basin level planning requires an understanding of the carrying capacity of the basin to produce desired outputs (goods and services) from a limited resource base and achieve an equitable quality of life while maintaining desired environmental quality in the region. The planning for management calls for trade-offs between desired production and consumption levels. It also emphasizes the development of supportive mechanisms within the generative capacity while maintaining the environmental quality. The challenge, therefore, is to conserve the ecological character and full range of ecosystem services of floodplain wetlands of Ganga while providing sustained benefits to the communities dependent upon the wetland for their sustenance.

The methodology for management planning is based on the New Guidelines for Management Planning for Ramsar Sites and Other Wetlands as adopted by the Contracting Parties to the Ramsar Convention on Wetlands in 2002. These guidelines also form the basis of the wetlands management planning guidelines of the MoEFCC's National Plan for Conservation of Aquatic Ecosystems (NPCA). In 2022, the Ministry also notified the Sahbhagita Guidelines – wherein a participatory and inclusive framework for wetland management has been outlined clarifying roles and responsibilities at various levels of administration.

The NPCA guidelines recommend following a diagnostic approach – wherein the selection of management interventions is guided by knowledge of wetlands features and factors governing these features, and their relationship with broader societal conservation and development goals that wetland wise use is contributing to (Figure 4). Wetlands features are its ecological, social, and institutional attributes, which collectively characterize a wetland. Wetlands are dynamic systems, and thus their features undergo cyclical and temporal changes. Factors (natural as well as anthropogenic) cause the wetland to move along a specific trajectory.

### **Management Planning Framework**

### Management Goal and Purpose

The overarching goal of managing the floodplain wetlands of River Ganga is conservation and wise use of wetland ecosystems so as to sustain their full range of ecosystem services and biodiversity values including their contribution to River Ganga ecosystem health".

The purpose is to: a) enhance river ecosystem health, b) enhance water security in the Upper-Ganga basin, c) reduce water-related disaster risks to communities living in and around the wetlands, d) provide livelihood opportunities to local communities based on sustainable use of wetland resources and e) sustain habitats and migration corridors of wetland-dependent species.



Figure 4: Framework for integrated management planning



Training workshop for Wetlands Managers on preparation of management plan

## Management Strategy

The ecological and hydrological connectivity of the floodplain wetlands with River Ganga provides the physical template in which these wetlands evolve and function. At the same time, the wetlands are also conditioned by the land use in the surrounding areas, traditional uses of the wetland, the cultural and relational linkages that communities have with wetland ecosystems, and the overarching regional developmental planning for different development sectors. Management of these floodplain wetlands is thereby proposed at two levels: a) the interventions at the sub-basin level which are aimed at ensuring that wetlands are embedded in the institutional and governance framework for water, land, and biodiversity management and b) interventions at wetland sites which address the direct drivers of adverse change.

### Strategies for integrating wetlands within sub-basin level plans and programmes

As land and water resources development plans and programmes at the sub-basin level have a bearing on the functioning of floodplain wetlands, the set of strategies at the sub-basin level will be aimed at ensuring consideration of the full range of wetland ecosystem services and biodiversity values in the sub-basin level plans and programmes. The following strategies are proposed:

- Including wetlands conservation within the mandate of the District Ganga Committee. The committees would maintain an overview of the ecosystem health of wetlands within their jurisdiction, review implications of sectoral plans and programmes, commission specific research to address the knowledge gaps and approve the implementation of interventions at specific sites.
- Inventory assessment and monitoring of sub-basin scale processes that influence wetlands. These include weather patterns, geology and geomorphology, water regimes (surface and groundwater), land use and land cover change, and other parameters.
- Ensures the convergence of wetlands conservation action within the district-level plans for the environment, disaster risk reduction, agriculture, fisheries, and other sectors.
- Commissioning strategic impact assessment of major infrastructural development projects in terms of their likely impacts on wetlands and identify necessary impact-mitigation and abatement measures and ensure the implementation through appropriate institutional arrangements including the District Ganga Committee.
- Enhances public awareness of wetlands ecosystem services and biodiversity values through coordinated district-level campaigns.

• Develop the capacity of wetland managers in determining water regime requirements for wetland ecosystem health and communicating and engaging with concerned government departments to ensure their implementation.

## Strategies for addressing drivers of adverse change within wetland sites

For the purpose of site management wetlands were classified using three descriptors - landscape setting, wetland use, and existing management regimes. Four management categories were identified, namely: a) Wetlands within Protected Areas; b) Ponds within jurisdiction of Village Panchayat; c) Urban and peri Urban Wetlands; and d) Agriculture floodplain wetlands.

# Wetlands within Protected Areas (PAs)

The management of wetlands located within Protected Areas rests with the State Department of Environment and Forests. The protected area status allows securing biodiversity habitats by limiting outside human disturbances supported by dedicated conservation funding from the department. Some wetlands as Tanda Dari Taal and Bhokawa Bandha wetland in Mirzapur district are sited within Reserve Forests and some enjoy protection of local committees as Kamleshwar Taal wetland situated in Balia district. Management of such wetlands is essentially targeted toward the protection and conservation of endangered wildlife species and their unique habitats. The strategy involves:

- Consolidation and demarcation of boundaries.
- Management zoning with the introduction of core and buffer zones.
- High biodiversity areas under private ownership can be recognized as 'Community Reserves' to strengthen the protected area network.
- Stricter enforcement of legal provisions and surveillance arrangements.
- Encourage long-term research by engaging local academic institutes and NGOs.
- Promoting livelihood options for local communities through sustainable ecotourism.

# Wetlands within the jurisdiction of Village Panchayat

Wetlands less than 5 ha are classified as ponds. Mostly these wetlands fall within the jurisdiction of a Gram Panchayat. Funds are earmarked as part of village development plans for the development of wetland and water resources. They can also be privately owned. Ponds (interchangeably used with the phrase 'wetlands within the jurisdiction of village panchayats') provide decentralized storage and local water security benefits to village communities.

The strategy involves:

- Systematic and regular capacity development for PRI members.
- Increased participation and contribution of communities to decision making by providing representation to PRIs in the District Wetlands Committee.
- Development of SOPs for wetlands conservation and sustainable use to guide village development planning.
- Mapping and building consensus on desired wetland conservation actions through Gram Panchayat Development Planning.
- Implementation of actions through Gram Sabha and convergence funds.
- Capacity development and involvement of village communities in monitoring and assessment activities.

## Urban and Peri-urban wetlands

The wetlands within urban limits are mostly managed by municipalities and line departments unless privately owned. The strategy for their management need to be aligned with master plans forming an integral part of the city and urban planning.

The strategy for their management involves:

- Mapping of present and historical wetland regimes including landscape connectivity and preparation of a wetland restoration plan for all urban centres in consultation with water managers and all stakeholders.
- Revival of urban/peri-urban wetlands through various restoration measures (Such as boundary notification, removal of encroachment, restoration of inlets and outlets through selective dredging and desilting, cleaning, water treatment measures, catchment conservation measures) by embedding the restoration plan within AMRUT and Smart Cities mission.
- Creation of infrastructure for the interception, diversion, and treatment of point sources of pollution to manage the water issues (sanitation and availability of safe drinking water) of the city.
- Establishment of a systematic, monitoring and evaluation system involving various stakeholders to gauge the effectiveness of the implementation of wetland restoration actions and their benefits.
- Augment aesthetics of the wetlands for recreational benefits while preserving the ecological character of wetlands and their catchments.
- Plan for species conservation, habitat improvement, and maintenance of migratory routes should be developed as a core part of environmental protection.
- Capacity building, communications and outreach should be made an integral part of wetlands management.

# Agricultural floodplains

Agricultural floodplains occupy peripheral areas around villages, rivers, roads. Located away from human settlements, many serve as buffer zones and as connectors and migration corridors between national parks, wildlife sanctuaries and reserved and protected forests. The management strategy involves:

- Awareness generation and incentivization to promote technology options such as the System of Rice Intensification (SRI) which are known to reduce water use by 40-50% and enhance productivity by 20-30%.
- Reducing the intensity of chemical fertilizer and pesticide use through promotion of organic cultivation and establishment of centers for the supply of quality agricultural inputs.
- Formation of SHG/farmers groups in villages to encourage adoption of alternate income generation programmes
- Incentives in the form of farming equipment, training, and soft loans to be provided to farmer groups for the adoption of sustainable agricultural techniques.
- Sensitization of farmers on reducing groundwater use in agriculture and on the role of wetlands in providing local water security and irrigation benefits, benefits of sustainable agricultural practices aligned with natural hydrology
- Monitoring and research activities pertaining to changes in land use and land cover within the wetland complex and basin, Overall water use pattern within the basin, Surface runoff, and trends in nutrient enrichment.

The management objectives and performance indicators and desired outcomes at the sub basin levels and site level are listed in Table 3

Level	Objectives	Performance indicators	Desired outcomes			
Sub-basin le	Sub-basin level					
	Integration of multiple values of wetlands in sectoral development plans is enhanced	The number of sectoral plans and programmes wherein convergence with wetlands conservation has been achieved	Plans for water resources development, irrigation, land resources management, fisheries, and tourism do not lead to adverse impacts on wetlands			
	A systematic wetland inventory assessment and monitoring system is used to inform management decisions and assess effectiveness.	Availability of long-term monitoring records on wetlands features Use of monitoring data and information to amend existing management framework	A hierarchical wetland monitoring and assessment system is functional Monitoring reports are produced periodically			
	Compliance with existing rules and regulations is maintained	Number of natural wetlands notified under the Wetlands (Conservation and Management) Rules, 2017 Number of violations recorded of extant rules and regulations	All provisions of the Wetlands (Conservation and Management) Rules, 2017 and other extant rules and regulations are fully complied with			
Site level						
Wetlands within PAs	Maintain hydrological connectivity with catchments	Duration of flood pulse and connectivity of river channels with wetlands	Inundation regimes (minimum and maximum) achieved in the past 30 years is maintained			
	Maintain water quality to support ecosystem processes and services	DO levels	4mg/l or more			
	Limit anthropogenically induced sedimentation	Sedimentation quantity and location	Natural profiles of inlets and outlets are maintained			
	Maintain the naturalness of shorelines	The extent of the wetland shoreline devoid of any built-up area	No concretization of the shoreline Maintenance of at least 50 m buffer around the wetland			

Table 3: Management objectives, performance indicators and desired outcomes

Level	Objectives	Performance indicators	Desired outcomes
	Maintain and improve habitat quality to support the diversity of wetland- dependent species	Habitat diversity	No species extirpation Migration corridors for fish and large mammals (Swamp Deer, Otters) are maintained Sighting of key species is maintained in the range of 20% deviation from the average of the last five years Counts of migratory waterbirds are maintained in the range of 20% deviation from the average of the last five years
	Maintain and enhance populations of species of high conservation significance	Species diversity, richness, and populations trends	Species diversity, richness, and populations trends remain stable or show an increasing trend
	Enhance awareness of wetlands biodiversity and ecosystem services amongst stakeholders	The number of affirmative actions by stakeholders for wetlands conservation and wise use	Increase in affirmative actions
	Species invasion threats are reduced	Area of wetland under invasive species	Habitat is conserved Species that are native, ecologically sensitive, and of conservation importance are protected
	Preserve the recreational and touristic value of wetlands	Tourist footfall and ecologically sensitive behaviour of tourists	Visitors are informed and aware Number of tourists increases
Floodplain agricultural wetlands	Maintain hydrological connectivity with the wetland catchment	Duration of flood pulse and connectivity of river channels with wetlands.	Inundation regimes (minimum and maximum) achieved in the past 30 years are maintained
	Promote good agricultural practices aligned with wise use of wetlands	Cropping practices that do not modify water regimes or deteriorate water quality or introduce exotic species	No structural modification of wetland No introduction of chemicals, fertilizers, and pesticides No introduction of exotic species. No intensive water abstraction

Level	Objectives	Performance indicators	Desired outcomes
	Maintain the naturalness of shorelines	The extent of the wetland shoreline, devoid of any built-up area	No concretization of the shoreline Maintenance of at least 50 m buffer around the wetland
	Maintain and improve habitat quality to support the diversity of wetland- dependent species	Habitat diversity	No species extirpation Migration corridors for fish and large mammals (Nilgai) are maintained Sighting of key species is maintained in the range of 20% deviation from the average of last five years Counts of migratory waterbirds is maintained in the range of 20% deviation from the average of last five years
	Enhance awareness of wetlands biodiversity and ecosystem services amongst stakeholders	The number of affirmative actions by stakeholders for wetlands conservation and wise use	Increase in affirmative actions
	Promote local stakeholder participation in wetlands management	Representation of local stakeholders in wetland management structures	Communities' views rights and capacities are reflected in wetland management decisions. Pro-active engagement of women, youth, and children in wetland management.
Urban and peri-urban wetlands	Maintain the naturalness of shorelines	The extent of the wetland shoreline, devoid of any built-up area	No concretization of the shoreline Maintenance of at least 50 m buffer around the wetland
	Maintain hydrological connectivity with the wetland catchment	Duration of flood pulse and connectivity of river channels with wetlands	Inundation regimes (minimum and maximum) achieved in the past 30 years is maintained
	Maintain water quality to support ecosystem processes and services	DO levels, heavy metal concentrations	4 mg/l or more Heavy metal conc. in sewage brought to permissible levels
	Limit anthropogenically induced sedimentation	Sedimentation quantity and location	Natural profiles of inlets and outlets are maintained

Level	Objectives	Performance indicators	Desired outcomes
	Maintain and improve habitat quality to support the diversity of wetland- dependent species	Habitat diversity	No species extirpation Migration corridors for fish and large mammals (Nilgai) are maintained Sighting of key species is maintained in the range of 20% deviation from the average of the last five years Counts of migratory waterbirds are maintained in the range of 20% deviation from the average of the last five years
	Preserve the scenic and aesthetic beauty of wetlands	Absence of built-up areas Landscape naturalness	Preserved naturalness of the landscape
	Preserve the recreational and touristic value of wetlands.	Tourist footfall and ecologically sensitive behaviour of tourists.	Registering higher revenues through tourism.
	Enhance awareness of wetlands biodiversity and ecosystem services amongst stakeholders	The number of affirmative actions by stakeholders for wetlands conservation and wise use	Increase in affirmative actions
	Promote local stakeholder participation in wetlands management	Representation of local stakeholders in wetland management structures	Communities views rights and capacities are reflected in wetland management decisions. Pro-active engagement of women, youth, and children in wetland management.
Ponds	Maintain the naturalness of shorelines.	The extent of the wetland shoreline, devoid of any built-up area.	No concretization of the shoreline. Maintenance of a 50 m buffer around the pond.
	Maintain water quality to support ecosystem processes and services	DO levels	4mg/l or more
	Maintain non-declining harvest of fish and wetland plants for economic use	Fish harvest (size, quantity, and diversity) Plant harvest (abundance and type)	No individuals of below minimum harvestable size in fish catch No use of illegal mesh size and gear in wetland fisheries. No harvest beyond regenerative capacity

Level	Objectives	Performance indicators	Desired outcomes
	Preserve cultural and spiritual values and traditional and customary practices aligned with the wise use of wetlands	Celebration of traditions and practices aligned with the wise use of wetlands	Continuation and perpetuation of wise use aligned with traditional and customary practices
	Enhance awareness of wetlands biodiversity and ecosystem services amongst stakeholders	The number of affirmative actions by stakeholders for wetlands conservation and wise use	Increase in affirmative actions
	Promote local stakeholder participation in wetlands management	Representation of local stakeholders in wetland management structures	Communities' views rights and capacities are reflected in wetland management decisions Pro-active engagement of women, youth, and children in wetland management

### Sub basin Management Plans

Three sub basin level management plans were developed (Annex 2, Annex 3 and Annex 4) under the project with actions to meet the management goal, purpose, and objectives proposed at two levels, namely the sub-basin level to be coordinated by the UPSWA and site level to be coordinated by wetland managers working under the ambit of District Ganga Committees.

### **Component 3: Wetlands monitoring**

### Ecosystem Health Report Card

For each wetland, the inventory information was used to develop an ecosystem health report card on the basis of five parameters related to wetland area, hydrology and catchments, biodiversity and governance. Data was collected for nine indicators. The estimates were compared with the desired level to determine extent of deviation, and a rank was assigned. An ecosystem health score was developed by weighting the assigned rank. Following weights were used: A = 1, B = 0.8, C = 0.6, D = 0.4, E = 0.2. An overall wetland ecosystem health indicator score was derived (Table 4). This is the sum of weighted scores divided by the total number of indicators. A transition towards a higher score in the report card was an indicator of improving ecosystem health, and a positive outcome for wetlands management.

Health Score		Above Ramganga Confluence	Upstream of Gomti Confluence- Muzaffarnagar	Ghaghra Confluence- Gomti Confluence	
Excellent	0.96-1.00	A+	0	0	0

#### Table 4: Health scores of surveyed wetlands in the three sub basins

Very Good	0.91-0.95	А	5	0	0
Good	0.86-0.90	B+	6	3	0
Moderate	0.81-0.85	В	12	0	0
Fair	0.76-0.80	C+	17	3	0
Bad	0.71-0.75	С	4	3	0
Very Bad	0.61-0.70	D	31	19	5
Worse	0.51-0.60	E	31	112	31
			106	140	36



Field training of forest personnel for testing water quality

### Wetlands Prioritization

A functional score (FS) was derived for key functions of the wetland like groundwater recharge potential, flood buffering and water purification using the hydro-geomorphic approach wherein the wetlands were ranked as per the significance of functional attributes like geomorphology, water source, water permanence, hydrodynamics, soil type and vegetation. The score was then aggregated with the ecosystem service index (ESI) derived from the ecosystem services assessment using the RAWES tool for the surveyed wetlands. The aggregate score was plotted in a quadrant chart against the threat score for the individual wetlands. Wetlands exhibiting High FS+ESI Score and High Threat Score were given High Priority for conservation and management. Wetlands having High FS+ESI Score and Low Threat Score and Low FS+ESI Score and High Threat Score were given Moderate Priority for conservation and management. Figure 6 a, b and c for all surveyed wetlands summarises the wetlands prioritised and categorized into three phases based on their significance for management interventions in the sub basin. Thus, Phase 1 corresponds to high priority, 2 to moderate priority and 3 to low priority (Annex 5)



Figure 5: Phasing justification diagram based on cumulative aggregate of ecosystem services index, functional scores and threat scores



Figure 6 a, b, c: Categorizing wetlands on the basis of their threat scores, ecosystem index and phasing
### 4. Annexes

#### Rapid Assessment Tool



RAWES protocol was developed as a simple, user-friendly, cost-effective approach supporting systemic assessment of the full range of wetland ecosystem services. It has five sections: Wetland details, Description of wetland features, Values & Benefits, Threats and Management. **For details, please visit** <u>upforest.org/wetland/Home.aspx</u>

Annex 1







## **Conserving and Sustainably Managing Gangetic**

# **Floodplain Wetlands of Uttar Pradesh**

Management Plan for Above Ramganga Confluence Sub-basin Uttar Pradesh



2023

Funded By National Mission for Clean Ganga, Government of India Ministry of Jal Shakti



#### Uttar Pradesh State Wetland Authority

The Uttar Pradesh State Wetland Authority (UPSWA) exercises powers to perform functions like preparing a list of all wetlands of the State or UT within three months from the date of publication of these rules, preparing a list of wetlands to be notified, within six months from the date of publication of these Rules, taking into cognizance any existing list of wetlands prepared/notified under other relevant State Acts, recommending identified wetlands, based on their Brief Documents, for regulation under these rules; preparing a comprehensive digital inventory of all wetlands within one year from the date of publication of these rules and upload the same on a dedicated web portal, to be developed by the Central Government for the said purpose; the inventory ought to be updated every ten years; developing a comprehensive list of activities, to be regulated and permitted within the notified wetlands and their zone of influence; recommending additions, if any, to the list of prohibited activities for specific wetlands; g) Define strategies for conservation and wise use of wetlands within their jurisdiction; reviewing Integrated Management Plan for each of the notified wetlands (including trans-boundary wetlands in coordination with Central Government), recommending mechanisms for maintenance of ecological character through promotional activities for land within the boundary of notified wetlands or wetlands complex have private tenancy rights.; identifying mechanisms for convergence of implementation of the management plan with the existing State/UT level development plans and programmes; ensuring enforcement of these rules and other relevant Acts, rules and regulations and on a half-yearly basis (June and December of each calendar year) inform the concerned State Government or UT Administration or Central Government on the status of such notified wetlands through a reporting mechanism; and coordinate implementation of Integrated Management Plans based on wise use principle through various line departments and other concerned agencies.



#### Wetlands International South Asia

Wetlands International South Asia Wetlands International South Asia is a non-government organisation working for sustaining and restoring wetlands, their resources and biodiversity in the South Asia region. Its office in New Delhi (India) was established in 1996 as a part of Wetlands International network. Wetlands International is a global, independent, non-profit organisation dedicated to conservation and restoration of wetlands, and presently works in over 100 countries through a network of 18 regional and national offices and expert networks headquartered in The Netherlands. Wetlands International is also one of the five International Organization Partners of the Ramsar Convention. In 2005, Wetlands International South Asia was registered under the Societies Registration Act of Government of India (retaining remit of South Asia region), consequently gaining an Indian legal entity while subscribing to the goals and targets of the Wetlands International network. The organisation endeavours to use a mix of approaches including technical knowledge, policy dialogue and field demonstrations for addressing various issues related to wetland management. To leverage change, the organisation works with national and state governments, knowledge centres, civil society as well as the private sector, often acting as catalysts to enable joined up actions. Given that securing a positive change in the status of wetlands and linked livelihoods takes considerable time, the organisation works for long-term engagement, forging strategic and innovative partnerships.

# Conserving and Sustainably Managing Gangetic Floodplain Wetlands of Uttar Pradesh

### Management Plan for Above Ramganga Confluence Sub-basin Uttar Pradesh





Uttar Pradesh Forest Department





Funded By National Mission for Clean Ganga, Government of India Ministry of Jal Shakti

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### Acronyms

ARC	Above Ramganga Confluence
BAPS	Basin Assessment and Planning System
BMTPC	Building Materials and Technology Promotion Council
BSI	Botanical Survey of India
CEPA	Communication Education Participation and Awareness
CIFRI	Central Inland Fisheries Research Institute
СРСВ	Central Pollution Control Board
DDMA	District Disaster Management Authority
DGPC	District Ganga Protection Committee
DWC	District Wetlands Committee
DRR	Disaster Risk Reduction
GOI	Government of India
HGM	Hydrogeomorphic classification system
HWLS	Hastinapur Wildlife Sanctuary
India-WRIS	India Water Resource Information System
KVKs	Krishi Vigyan Kendras
mbgl	below ground level
mg/l	milligrams-per-liter
MoEFCC	Ministry of Environment, Forest and Climate Change
NBSSLUP	National Bureau of Soil Survey and Land Use Planning
NCC	National Cadet Corps
NDMA	National Disaster Management Authority
NMCG	National Mission for Clean Ganga
NPCA	National Plan for Conservation of Aquatic Ecosystems
NSS	National Service Scheme
OA	Overall accuracy
PA	Producer accuracy
RGB	River Ganga Basin
RAWES	Rapid Assessment of Wetland Ecosystem Services
SAC	Space Application Centre
SMCG-UP	State Mission for Clean Ganga-Uttar Pradesh
SWaRDAC	State Water Resources Data Analysis Center
SwaRA	State Water Resources Agency
SWaRDAC	State Water Resources Data Analysis Center
SOI	Survey of India
UA	User accuracy
UPSBB	Uttar Pradesh State Biodiversity Board
UPSDMA	Uttar Pradesh State Disaster Management Authority
UPSWA	Uttar Pradesh State Wetlands Authority
UPWaMReC	Uttar Pradesh Water Management and Regulatory Commission
WWF – India	World Wildlife Fund – India
ZSI	Zoological Survey of India

### 1. Introduction

### Background

River Ganga flows through 27 Districts of Uttar Pradesh covering 1180 km, entering the state at Kotwali in Bijnor District and exiting at Dokti in Ballia District. The floodplains flanking the main channel provide an ecological and hydrological continuum rendering vital ecosystem services and biodiversity habitats. Effective management of these wetlands is crucial for achieving river integrity, and food and water security for the dependent communities.

The 'Vision Ganga' under the National Mission for Clean Ganga (NMCG) is an integrated conservation mission, approved as the 'Flagship Programme' by the Union Government of India. The mission is structured along four dimensions of the river system, namely: a) Aviral Dhara (uninterrupted flow), b) Nirmal Dhara (unpolluted flow), c) Geological entity, and d) Ecological entity. The main objectives of the Ganga River Management have been articulated to be: a) maintenance of environmental flows in rivers and tributaries to fulfill their geological, ecological, socio-economic, and cultural functions; b) ensuring that water guality in all rivers and tributaries is consistent with their governing geological, ecological, socioeconomic and cultural functions; c) judicial use of water and other aquatic resources to enable sustainable development in the entire basin; and d) transparent and inclusive review of all existing, ongoing and planned anthropogenic activities in the basin. Action programmes to realize the objectives have been organized around eight missions, namely: a) aviral dhara, b) nirmal dhara, c) ecological restoration, d) sustainable agriculture, e) geological safeguarding, f) disaster protection, g) river hazards management, and h) environmental knowledge building and sensitization.



Chahdwala wetland provides immense ecological subsidies

Within any basin, including the River Ganga Basin (RGB), management of hydrological regimes and linked ecosystem processes, services, and biodiversity values needs to be based on complementarity and interactions between lentic ecosystems (i.e., the wetlands) and lotic systems (i.e., the river). Floodplains, especially the active part, harbour significant riverine wetlands, which are unique, highly productive, and perform a wide range of functions such as flood control, water purification, carbon storage, groundwater recharge, and water storage. In terms of biodiversity, these wetlands provide refuges for fauna in times of flooding, are food reservoirs and breeding sites, and participate in the dispersion of plant and animal species. Owing to the variability of the geomorphological, physicochemical, and hydrogeological contexts in which they are created, riverine wetlands offer a unique diversity of ecological situations that has no equivalent in other wetlands on similar scales.

Conservation and wise use of wetlands, recognition of their role, and wide-ranging ecosystem services are essential aspects of river basin planning and management. Degradation and loss of wetlands, and rapid changes in the river basins of which these wetlands are integral elements, which lead to the disruption of natural hydrological cycles, often leading to enhanced frequency and severity of flooding, drought and pollution, and imposing significant economic and social losses and costs to the human populations within these river basins. Proper consideration of the role and importance of wetlands in river basin management can significantly assist in securing safe, reliable sources of water and meeting development objectives identified within the Ganga Vision.

The Government of Uttar Pradesh constituted the Uttar Pradesh State Wetlands Authority as the nodal policy-making, regulation, and management organization at the state level. The NMCG, with an objective of supporting conservation and sustainable management of Gangetic wetlands of Uttar Pradesh, sanctioned a technical assistance project to UPSWA. The project has an overall objective of 'effective management of floodplain wetlands in River Ganga Districts' to ensure sustained provision of wide-ranging ecosystem services naturally provided by these ecosystems and securing diverse habitats. The specific objectives were to:

- Define and characterize floodplain wetlands regimes within the Ganga Districts.
- Put in place institutional arrangements for managing floodplain wetlands by notifying under Wetlands (Conservation and Management) Rules, 2017.
- Develop stakeholder-led integrated management plans for securing ecosystem services and biodiversity values.
- Design and implement a monitoring regime to enable periodic assessment of wetland ecosystem health and effectiveness of management.
- Creating and developing the available infrastructure, capacity building and generation of awareness of the stakeholders.

This management plan has been prepared under the aegis of the NMCG funded project and reflects the commitment of the Government of Uttar Pradesh for ensuring the conservation of floodplain wetlands of the state. The Gangetic floodplain wetlands in Uttar Pradesh fall within three sub-basins of the River Ganga: a) Above Ramganga Confluence, b) Ghaghra Confluence to Gomti Confluence and c) Gomti Confluence to Muzaffarnagar (Map 1). In line with this, the wetland management plans have been prepared at the sub-basin level, articulating description and evaluation of the ecological character, identification of threats and management needs, management objectives and outcomes, and actions. It is envisaged that a basin sub-level wetland plan will provide better synergies with water resource planning and implementation, as well as with district-level developmental planning. The current management plan provides a framework for action for conservation and wise use of floodplain wetlands located within the above Ramganga Confluence (ARC) sub-basin.

#### Management planning purpose and objectives

India, as a signatory to the Ramsar Convention, is committed to achieving wise use of all wetlands in her territory. Wise use of wetlands is defined in the text of the Ramsar Convention as 'the maintenance of their ecological character, achieved through the implementation of ecosystem approaches, within the context of sustainable development.' Ecological character is 'the combination of ecosystem components, processes, and services that characterize a wetland.' Ecosystem management of wetlands thus seeks to achieve the goal of 'maintenance of ecological character' or 'wetland wise use'.

Wise use is the longest established example amongst inter-governmental processes, implementation of which have become known as ecosystem approaches for conservation and sustainable development of natural resources, including wetlands (Finlayson et al. 2011). The approach recognizes the human interdependency with wetland functioning and accommodates sustainable utilization of these ecosystems for the benefit of humankind in a way compatible with the maintenance of natural properties of the ecosystem. Wise use encourages stakeholder engagement and transparency in negotiating trade-offs and determining equitable outcomes for wetland conservation while promoting maintenance of environmental, economic, and social sustainability (Finlayson 2012). The purpose of management planning is to outline the pathway through which wetland wise use can be achieved (Ramsar 2010).

The term 'wise use' is often misinterpreted to indicate that the Ramsar Convention promotes the human use of all wetlands. However, wise use as a wetland management approach is much wider than the use of a wetland. The phrase 'in the context of sustainable development' recognizes that development, which may be inevitable in some cases, is not an objective for every wetland. Whenever development is to take place, it has to be facilitated in sustainable ways by approaches elaborated in the Ramsar Convention. 'Ecosystem approaches include the elements elaborated by the Convention on Biological Diversity – integrated management, stakeholder's participation in the decision-making process, transparency about trade-offs, and equitability of the outcomes. In totality, wise use is about 'maintaining the capability of the wetland' to support human well-being at present and in the future, rather than 'use' or 'development' at present.



Map 1: River Ganga and her three sub-basins in Uttar Pradesh

The wetland management plan aims at putting in place effective management arrangements which enable integration of biological diversity and ecosystem service values of these wetlands in river basin conservation and developmental planning. The following are specific objectives:

- Describe the wetlands in terms of their ecological character and their governing factors.
- Assess the risk of adverse change in wetlands and their underpinning reasons.
- Define monitoring requirements for detecting changes in ecological character.
- Define management objectives and strategies for achieving these objectives.
- Support resource mobilization.
- Enable communication within and between sites, organizations, and stakeholders.
- Ensuring compliance with local, national, and international policies and regulatory frameworks.

#### Management planning approach and method

Wetlands under the Gangetic floodplains evolve and function within physical templates, characteristics of which are determined primarily by the interaction between water and sediments. The ecological components, processes, and services are influenced by land and water management practices within the immediate as well as indirect catchments of the wetland complex. Management planning, therefore, calls for an approach that recognizes the interconnectedness of wetland biological diversity and ecosystem services with land and water management in the river basin taking into account the external, natural, and induced factors. The approach also needs to address climate change which has direct as well as indirect implications for wetland features as well as factors governing these features. The wise use principle encourages stakeholder engagement and transparency in negotiating trade-offs and determining equitable outcomes for wetland conservation while promoting maintenance of environmental, economic, and social sustainability.

The National Environment Policy (2006), Government of India, recommends the integration of conservation and wise use of wetlands into river basin management involving all relevant stakeholders, in particular local communities, to ensure maintenance of hydrological regimes and conservation of biodiversity. It further recommends the integration of wetland conservation into sectoral development plans for poverty alleviation and livelihood improvement, and link efforts for conservation and sustainable use of wetlands with all ongoing rural infrastructure development and employment generation programmes. If considered as a natural infrastructure capable of providing water and food security, buffering extreme events, and supporting adaptation to climate change, the ecosystem services of Kanwar can support achieving outcomes for several sectoral development plans, particularly for water resources, agriculture, rural development, and disaster risk reduction. The Wetlands (Conservation and Management) Rules, 2017; The River Ganga (Rejuvenation, Protection and Management) Authorities Order, 2016

(amended 2019), and the minimum environmental flows notification of 2018 provides the regulatory framework to prevent any fragmentation of hydrological regimes through hydraulic structures, diversions, encroachments, or impeding flow pathways.

Much of the region along the 10-kilometer buffer of the Ganga River channel is constituted by river floodplains (Map 2 and Map 3). The uniqueness of floodplain ecosystems lies within their near-linear form, the high dynamism of their geomorphology, and the ability to processes large fluxes of energy and material from upstream areas. Several conceptual models and frameworks have emphasized upstream-downstream linkages along the river corridor, the influence of river basin form and climate on downstream areas, their horizontal linkage across the floodplain between the river channel and the floodplain, the vertical interconnection within the floodplain between overbank flooding, groundwater, and rainfall. Amongst several factors, hydrological inputs to floodplains play a significant role through a) their influence on the arrangement of landforms and vegetation communities, and b) the impact of flooding regimes on the regeneration and turnover time of floodplain vegetation.

River floodplains are specific areas typical of grid dynamics of natural, especially fluvial processes co-existing within anthropogenic influences and intensive use. There are several basic definitions to delimit the floodplains corresponding to the scientific disciplines concerned. From a geomorphological perspective, floodplains are accumulation plains along a watercourse constituted by unconsolidated sediment, transported by and deposited in this stream, usually partially or fully flooded during high floods. The geomorphological view of the floodplains emphasizes its genesis and relief morphology, bringing to focus two systems of fluvial processes i.e., erosional fluvial processes with predominant removal of material and accumulation fluvial processes, with predominant sedimentation. Geological definitions describe the floodplain as "flat valley floor activated during the flooding of a stream"; the floodplain is composed of horizontal young (Holocene), gravel, sandy, loamy, or clay sediment, often displaying irregularities caused by braiding of a stream, origin of islands, meanders, alluvial fans, and delta plains, debris, landslides, etc. (Shi et al., 1995). Hydrological definition views floodplains as natural inundation areas suitable for water retention in the landscape during floods. In times of such high flood discharges, water is over-burdened with suspension loads, depositing in the inundation area. Floodplain regions are also characterized by the occurrence of fluvisols and gleysols. Ecological boundaries of floodplains are defined on the basis of the regionalization of floodplains, biochores, ecosystems, and plant and animal communities. Floodplains are indispensable ecological corridors for plant and animal migration and have other vital ecological functions in the landscape (such as climate moderation, water retention, and others).



Map 2: Wetlands within the active floodplain boundary on the either side of River Ganga in the ARC Sub-basin



Map 3: Section wise details

Floodplains apparently exist in two alternating phases. For most of the time, these ecosystems exist in a dry phase during which, at least superficially, is not substantively different from surrounding terrestrial ecosystems. However, during monsoons, these ecosystems are inundated wherein large, shallow floods driven by rainfall top up moisture in the soil, recharge the groundwater aquifers, and fill up depressions. This recharge provides the reservoir of water upon which the biota depends until the next flood event. These ecosystems have evolved to cope with these phase changes. Many aquatic plants have long-lived seeds that can withstand extended periods of drought. Similarly, many animals possess drought-resistant stages in the life-cycle or the physiological capacity for diapause or, like waterbirds, adopt highly mobile strategies in order to track scarce resources.

The gradients of flooding frequency, soil moisture, and vegetation create conducive environments for wetlands within these floodplains. Located at the interface of terrestrial and aquatic ecosystems, combining features of both, wetlands arise when inundation by water produces soils dominated by anaerobic processes, which in turn, forces the biota, particularly rooted plants to adapt to flooding. Ramsar Convention, an inter-governmental treaty defines wetlands broadly as 'areas of marsh, fen, peatland or water, whether natural or artificial, permanent or temporary with water that is static or flowing, fresh, brackish or salt, including areas of marine water the depth of which at low tides does not exceed six metres. All wetlands exhibit certain common indicators such as the presence of water permanently or seasonally, saturated soils, and hydrophytic vegetation. Hydrology, in particular, serves as a driving force for these ecosystems through its disproportionate impact on abiotic and biotic characteristics of wetlands. Abiotic characteristics such as soil texture and colour, water quality depend on the distribution and movement of water as do the abundance, diversity, and productivity of the range of species that use the wetlands as habitats.

The variable water regime in floodplains plays an important role in the structure and function of floodplain wetlands. Intermittent or seasonal floods transport organic matter and biota, triggering the life cycles of many aquatic and terrestrial organisms inhabiting wetlands. Wetting and drying are vital to the functioning of these ecosystems. During dry phases, eggs, and seeds of diapausing animals and plants remain in dry floodplain soils. Nutrients and energy to floodplain soils are also added by decomposing organic matter from leaf litter and stranded aquatic plants and animals. During floods, these organic reservoirs support emerging aquatic organisms and biota which colonise the newly inundated habitats. Heterotrophic organisms, in particular, assimilate these resources into the food webs, linking detritus to higher trophic levels. The temporal dynamics of water drive this complexity. Species like waterbirds and fishes depend on floodplain river connections to complete their life cycles.

The analysis of floodplain processes tends to be dominated by discussions of geomorphological, hydrological, and hydraulic processes which provide the physical background to the evolution of floodplain areas. However, floodplains are also subjected to a high degree of development and often urbanization which tend to significantly modify their natural properties and functions. A basic differentiator

of the impact of human activities is whether these occur on or off the floodplain. Development on the floodplain such as the intensification of agriculture can greatly alter the morphology of the region. The effect of the development of the floodplain can be just as significant in that they can have "downstream effects" on floodplain areas lower down the catchment. The urbanization that is not planned with in-built local storage for flood flows tends to increase both the volume of runoff and the speed of concentration. This means that the flood severity can increase in the floodplain storage areas downstream, while at the same time the lead time before the floodwater arrives decreased. Again, the flood damage potential is increased and the opportunities for ameliorative action during flood events are reduced.

Conservation of floodplain wetlands needs to be based on maintaining the carbon and biotic balance through appropriate water regimes and land management practices. The concentration of carbon, organic matter, dissolved oxygen, density, and diversity of micro-invertebrates as well as recruitment in fish, plants, and water birds can serve as key indicators of floodplain wetland ecosystem health. Wise use of floodplain wetlands entails that the underpinning ecological and hydrological processes, particularly the flood pulse are maintained in line with natural regimes. From this perspective, the management of floodplain wetlands is closely interlinked with the management of river systems within their basin and linked developmental planning.

Conservation and sustainable development of floodplain wetlands of Ganga require integrated planning and resource management at the river basin level recognizing the interconnectedness of the wetland system with its catchments. River basinlevel planning requires an understanding of the carrying capacity of the basin to produce desired outputs (goods and services) from a limited resource base and achieve an equitable quality of life while maintaining desired environmental quality in the region. The planning for management calls for trade-offs between desired production and consumption levels. It also emphasizes the development of supportive mechanisms within the generative capacity while maintaining the environmental quality. The challenge, therefore, is to conserve the ecological character and full range of ecosystem services of floodplain wetlands of Ganga while providing sustained benefits to the communities dependent upon the wetland for their sustenance.

The methodology for management planning is based on the New Guidelines for Management Planning for Ramsar Sites and Other Wetlands as adopted by the Contracting Parties to the Ramsar Convention on Wetlands in 2002. These guidelines also form the basis of the wetlands management planning guidelines of the MoEFCC's National Plan for Conservation of Aquatic Ecosystems (NPCA). In 2022, the Ministry also notified the Sahbhagita Guidelines – wherein a participatory and inclusive framework for wetland management has been outlined clarifying roles and responsibilities at various levels of administration.



Figure 1: Framework for integrated management planning

The NPCA guidelines recommend following a diagnostic approach – wherein the selection of management interventions is guided by knowledge of wetlands features and factors governing these features, and their relationship with broader societal conservation and development goals that wetland wise use is contributing to (Figure 1). Wetlands features are its ecological, social, and institutional attributes, which collectively characterize a wetland. Wetlands are dynamic systems, and thus their features undergo cyclical and temporal changes.

Factors (natural as well as anthropogenic) cause the wetland to move along a specific trajectory. The afore-mentioned wetland management planning method was implemented in the following steps in accordance to the NMCG project (implemented over 2020 – 2022):

a) Mapping and inventory of wetlands within 10km buffer along either side of the Ganga River channel: Inventory of 285 wetlands (of which 93 wetlands were in the ARC sub-basin) (Map 4)., identified on the basis of 2022 land use and land cover map of the 10-km buffer region was undertake with the help of a rapid assessment tool. For each wetland, the following information was generated

**Wetland settings:** Official and vernacular names, geographical location, extent, wetland type, and features of the surrounding area.

**Description of wetland features:** Catchment, hydrology (topography, geology, geomorphology, soil, land use, and land cover, climate, major sources of water, number and status of inlets and outlets, water depth, connectivity, inundation regime, water flow direction, water permanence, and usage), Species and habitats (habitat types, availability of bird counts, invasive species status, macrophytes, fish, reptiles, birds, amphibians, and mammals), and Communities (permanent and temporary settlements present on the shoreline, population, and percentage of community dependence).



Map 4: Location of surveyed wetlands within 10 km buffer zone for the ARC Sub-basin

Values and benefits: provisioning services (freshwater - drinking, washing & domestic use, agriculture and livestock; food – fish and edible aquatic plants; fuel; fibre and fodder; natural medicines; ornamental resources; clay, sand, and mineral harvesting), regulatory(air quality regulation, local climate regulation, water regulation, flood hazard regulation, water during droughts, pest regulation, disease regulation – human and livestock, erosion regulation, water purification, pollination, salinity regulation, fire regulation, and noise and visual buffering), supporting services (soil formation, primary production, nutrient cycling, water recycling, and provision of habitat), and cultural services(cultural heritage, recreation and tourism, aesthetic value, spiritual and religious value, inspiration value, social relations, educational and research, and transportation).

**Threats:** adverse changes faced in the ten years, major direct threats, and major indirect threats.

**Management:** Pattern of land ownership within the wetland, the pattern of land ownership in the area surrounding the wetland, and pre-existing rights and privileges in the wetland.

The inventory data of 285 wetlands was uploaded into an electronic database of the Uttar Pradesh Forest Department (upforest.org/wetland.aspx).

**b) Preparation of wetlands health cards:** For each wetland, the inventory information was used to develop an ecosystem health report card on the basis of nine indicators related to wetland extent, hydrology and catchments, biodiversity, ecosystem services, and governance.

**c) Hydrogeomorphic classification and priorisation**: Wetlands were prioritised on the basis of scores generated for threats, and a cumulative score of ecosystem service index and hydro-geomorphic function score.

A systematic classification of wetlands is a necessary step for their management and conservation. The current classification system used for mapping wetlands by Space Application Centre (SAC) are based on a three-tier system wherein at the first level, the wetlands are classed into inland and coastal categories, at the second level into natural and human-made categories and at the third level, the wetlands are placed either of the twenty categories (thirteen natural and seven humanmade). This classification system is largely based on ecosystem structure attributes (such as hydrology or plant communities) and does not readily lend itself to attribution of ecosystem functions (such as groundwater recharge, flood buffering and water purification). The latter is of critical importance for integrating wetlands in management of River Ganga. The project, therefore, uses a hydrogeomorphic (HGM) classification system to enable focus on wetland functions within a given landscape.

The hydrogeomorphic (HGM) classification of wetlands emphasizes the wetland hydrological processes and functions and their ecological significance within a generalized landscape context (Semeniuk et al., 2016). The HGM classification

renders the wetlands classes which have distinctive ecological character as they represent the hydrogeomorphic functions of wetlands. The classification system used in the project has been modified from those applied in Australia, South Africa and other countries and uses landform and water characteristics as the dominant features and wetland size and vegetation as descriptors.

d) Stakeholder Consultations: Significant data was generated based on preliminary consultations with relevant stakeholder groups, Government department(s), and/or agencies from varied relevant sectors for wetlands conservation and management planning. The varied sectors considered for consultation and their corresponding stakeholder groups included wetlands management (State Wetlands Authority, District Ganga Committees, Nodal departments entrusted for management of wetlands), Biodiversity conservation (State Biodiversity Board, Forest Department), Water resources (Water resources department, State Pollution Control Board), Agriculture (State Agriculture Department), Fisheries & Animal Husbandry (State Fisheries and Animal Husbandry Department), Climate Change (Science and Technology Council), Planning (Department of Planning), Disaster Management (State Disaster Management Authority, District administration), Culture & Tourism (Department of Culture & Tourism, Religious bodies present around wetlands, Tour Operators (public and private), Hoteliers and Hotel Associations), Research and Academia (College, Universities and research institutes conducting research & monitoring on wetlands), State governance (Elected political representatives, District Administration), Civil society (NGOs engaged in developmental and conservation activities around wetlands) and Resource users (Fishing communities and others which depend directly on wetlands) respectively.

#### **Management Plan Structure**

The management plan follows the format prescribed by the MoEFCC and is organized in three sections with eight chapters. Following the introduction, Section one of the plan (comprising Chapters 2, 3, and 4) contains a description and evaluation of the wetlands. Chapter 4 includes an analysis of current institutional arrangements in terms of the capability of addressing the risk of adverse change identified in Chapter 2 and 3 and ensuring wetlands wise use. Section 2 of the plan (containing chapters 5 and 6) discusses the management framework (management goal, purpose, strategy and objectives, and monitoring arrangements thereof. Section 3 (comprising chapters 7 and 8) includes the detailed action plan, budget for five years and possible financing arrangements.

### 2. Description of Wetlands Features

### Wetland location, and extent

The ARC sub-basin is situated between 77.72° E and 80.28° E longitudes and 27.22° N and 31.44°N latitudes and spans ~40,471 km<sup>2</sup>, encompassing about 3.7% of the Ganga basin area. The 10 km buffer zone on either side of the Ganga river channel falls within 12 districts (Muzaffarnagar, Bijnor, Meerut, Amroha, Hapur, Bulandshahr, Sambhal, Aligarh, Budaun, Kasgang, Shahjahanpur and Farrukhabad) and spans 6,732km<sup>2</sup>.

The Ganga River floodplain was delineated using the Global Surface Water data for 1984-2020 (Pekel et al., 2016). The data provides occurrence, change, recurrence, transitions, seasonality for 32 years and maximum extent at 30m resolution. The maximum extent of inundation was used as the active floodplain boundary. This was digitized using visual interpretation, and rectified at a constant scale of 1:1000 to ensure accuracy in capturing the landscape details (Rozo et al., 2014).

Wetlands dynamics in the 10-km buffer was assessed using cloud-free postmonsoon (October) Landsat images (30 m resolution) of 2000 and 2020. This spatial resolution is suitable for 1:50,000 scale mapping. Satellite images downloaded from USGS Earth Explorer were radiometrically and atmospherically corrected. The river channel was extracted from satellite imagery using a binary mask generated by a decision tree based on spectral band reflectance (SWIR 1; 1.57–1.65 m), Normalized Difference Vegetation Index (NDVI) (Rouse et al., 1974) and the Normalized Difference Water Index (NDVI) (Mcfeeters, 1996).



Section of Haiderpur wetland in Muzaffarnagar district, Uttar Pradesh

The wetland mapping method used herein has been adapted from National Wetland Atlas (SAC, 2011) and Sinha et al., (2017)) and is presented in Figure 2. Water-dominated areas (including wetlands, river channel, river bed, and aquatic vegetation) were extracted from the current LULC map (i.e., the Year 2020) in the GIS environment. Additional information pertaining to the wetland types mapped were derived from satellite imagery-based spectral indices including Normalized difference vegetation index (NDVI) (which indicates the extent of aquatic vegetation) and Normalized Difference Water Index (NDWI) (which depicts the open water extent within the wetland). Proximity to linear infrastructure was used to segregate the human-made waterlogged areas. To improve the accuracy of the land use and land cover classification, 2837 ground truth points were used, evenly dispersed across the study region. The overall accuracy of the land use and land cover maps was 98.49% (2020) and 98.2% (2000).



Figure 2: Classification approach used in the study

The active floodplain area in 2020 was assessed to span 1014 km<sup>2</sup> (15% of the 10km buffer area). In 2020, wetlands spanned 12,161 ha, of which 91% were located within the active floodplain area and the rest outside. Spatially, the wetlands were distributed in three broad classes: a) wetlands located along river channels (riparian wetlands); b) wetlands along irrigation canals (irrigation canal-fed wetlands) and c) wetlands located in isolated shallow depressions (isolated sumplands). In 2020, riparian wetlands constituted a majority of the overall wetland area (91%), followed by isolated sumplands (8.5%) (Map 5).

The wetland area in ARC has shrunk by 81% during 2000-2020 (from 64, 000 ha to 12, 000 ha). The maximum reduction was observed in irrigation canal-fed wetlands (99% since 2000) which may be attributed to concretization of the irrigation canals which has subsequently reduced groundwater seepage. It was also observed that the reduction in wetland area outside the active floodplain boundary (91%) was higher as compared to those located inside (72%). From 2000, the irrigation canal-fed wetlands area reduced due to concretization of irrigation canals, of which 7388 ha of land was used for agriculture in 2020. Within riparian wetlands, area converted to agriculture was 21342 ha from 2000 to 2020, which may be related to ephemerality of wetlands. Similarly, isolated sumplands observed an area of 14140 ha of change to agriculture class during the past two decade. Riparian wetlands observed maximum conversion into terrestrial vegetation 9156 ha as compared to other wetland classes (1741 ha from irrigation canal-fed wetlands; and 2650 ha from isolated sumplands (Figure 3 and Figure 4).



Figure 3: Wetland conversion within two decades to other land use type in Above Ramganga Confluence



Map 5: Wetland extent in the 10km buffer zone on either side of the river Ganga in the ARC sub-basin during the years 2000 (left) and 2020 (right)



Figure 4: Wetland area within area categories for Above Ramganga Confluence

### **Wetland Catchments**

The ARC sub-basin forms the catchment of the River Ganga Floodplain wetlands. The sub-basin can be divided into three distinct parts namely steep mountainous reaches, the Bhabar-Terai region, and the flat alluvial plains. The high mountain peaks are covered with glacial ice from the northern reaches of the sub-basin. The glaciers are the source headwater tributaries of the River Ganga, the Alaknanda, Dhauliganga, Nandakini, Pindar, Mandakini, and Bhagirathi rivers. Gangotri glacier is the largest glacier in the basin having an area of about 256 km<sup>2</sup>. After flowing through steep valleys, River Ganga flows through the Bhabar belt region consisting of gravel and unsorted sediments that form the northern boundary of the alluvial plains. The Terai region situated south of Bhabar is a region of diffused drainage along foothills where streams that had disappeared beneath rocky boulders in the Bhabar terrain reappear.

The river Ganga descends from the Himalayas at Haridwar (Elevation 283m). From here, the river travels a distance of 27 km to enter Uttar Pradesh in the Bijnor district. The Terai region skirts the northern most of the Bijnour district. The elevation is 271 m at Najibabad. The Muzaffarnagar district located on the west bank of the river Ganga has an average elevation of 242 m. River Ganga does not receive any major tributary from Haridwar till it meets River Ramganga near Kannauj. The river Ganga has a concave-shaped long profile. The alignment of the sub-basin changes from NE-SW to first south as the river enters the plains at Haridwar to Bijnor, and then south-easterly as it travels towards the Bay of Bengal. The sub-basin is broad and globose in shape in the mountainous region but becomes narrow and elongated once the river descends in the plains (Map 6).

The topographic gradient drops from above 7010m in Uttarkashi district to below 150m at Farukkhabad as the river travels a distance of 724km along a steep elevation gradient (Figure 5). In the Upper Ganga segment from Gaumukh to Rishikesh, the river flows mostly on a steep bed with an average approximate slope of 1 in 70. The river Ganga has high flow and high velocities in most parts of this segment. The slope reduces to 1 in 8 and lesser as the river descends to the plains (Map 7).

The basin mostly has homogeneous terrain in plains leading to a level plain or a very gentle slope in general. The basin slopes down from northwest to southeast. There is another greater declivity from the northeast corner towards the center of the buffer zone, the highest points being on the banks of the Ganga where steep sloping slopes greater than 16% are encountered.



Figure 5: Elevation gradient in the ARC Sub-basin



Map 6: Elevation profile of ARC Sub-basin



Map 7: Topography map of the Above Ramganga Sub-basin

#### **Geology and Geomorphology**

The Gangetic basin is a geologically active basin subject to crustal movements. Garhwal Himalayas constitute the mountainous wetlands catchments. The entire Himalayan region is undergoing rapid tectonic uplift with the collision and subsidence of the Indian subcontinental plate underneath the Eurasian crust. The subsidence is accompanied by a large-scale erosion brought by complex glacial and fluvial processes and an extension of the Himalayan foreland basin that acts as a receptacle for sediments transported by the rivers

Extending for about 200 km from the hills of Peninsular India in the south to the foothills of the Himalayas in the north, Gangetic plains are one of the largest areas of quaternary sedimentation in the world. As documented, the Ganga River system ranks 18th worldwide in terms of basin area and second in terms of the total suspended load.

Geomorphology of the terrain and river systems is consequent upon the complex subsurface geology, stream power of the rivers draining the plains, and sediment supply from the catchment areas which in turn, are controlled by varied climatic and tectonic settings.

In the upstream catchment areas, the geomorphological landforms in the Himalayan glaciers are highly diverse, including avalanche and snowfall-fed cirque and valley glaciers, and very steep hanging glaciers. Supraglacial debris is deposited on Himalayan glaciers that are derived from the valley sides. At an altitude of between 3000-3300m, this glacial matter is in the form of sorted ground moraines and at a higher altitude of between 3300-3600m, the glacial matter is in the form of unsorted lateral moraines. As the river flows through the catchment, valleys are formed as the river passes through narrow gorges. Erosion has led to the formation of steep gullies and deeply dissected valleys in the central Himalayas.

In the plains of Uttar Pradesh, predominant geological formations are quaternary alluvium consisting mainly of sand of various grades silt, clay, and Kankar. Alluvial plains are composed of the Bhangar or upland which is the old alluvium that is now at a considerable elevation above the rivers. The uplands between Yamuna and Ganga are slightly higher and act as a water divide between the rivers. This is also commonly known as the Doab region. Bhur land is associated with the Bhangar region. It is an undulated aeolian sandy deposit, slightly higher than the floodplains, formed due to the accumulation of sand along the banks of upper Ganga and Yamuna as a result of winds during hot dry months. The plains are rich in calcareous concretions known as Kankar (Map 8).

The Gangetic Rivers are characterized by various stream power peaks. These peaks are the zone of the erosion processes and extensive sediment transport. These peaks mostly lie in the Higher Himalayan area, which explains the high sediment supply from this region. The stream power of all rivers decreases as they descend from the mountainous region to alluvial plains causing extensive deposition in the alluvial plains as well as along and within river beds..



Map 8: Geomorphology map of the Above Ramganga Confluence sub-basin

Wetland formation processes in the Ganga floodplain region are linked with river meandering and aggradation. The sediment accumulation rates generally exceed the subsidence rates, leading to the aggradation of river beds. River aggradation is intermittently interrupted by fluvial impulses creating meanders, leading to oxbow wetland formations. Channel movement through avulsion and cut-offs are characteristic features of most rivers of the Ganga system, although with a difference in scale and frequency. In contrast in the Upper Ganga plains, the modern Ganga and Yamuna rivers are deeply incised into the surface and are not actively depositing sediments on most parts of the 'megafan'. The Ganga 'megafan' is a relict feature formed during Late Pleistocene, when coarse-grained sediment and higher sediment and water discharge were available.

The Ganga and its tributaries exhibit three distinct types of fluvial systems that have played an important role in the evolution of the river plains, viz. mountain-fed, foothills-fed, and plains-fed. Mountain-fed rivers such as the Ganga, Yamuna, Gandak, and Kosi are generally multi-channel, braided systems, characterized by discharge (1500-3000 m<sup>3</sup>/sec) and sediment loads that are many times higher than those of the single-channel, sinuous foothills-fed, and plains-fed river systems. The foothills fed rivers such as Ramganga and Rapti have lower discharges (70-500 m<sup>3</sup>/sec), and are braided only in the upstream regions; the plains-fed rivers e.g., Burhi Gandak drain the interfluve region between megafans of the large rivers and are meandering throughout their length.

The Gangetic rivers of Uttar Pradesh are not as dynamic as the north-Bihar rivers. However, major movements have been recorded due to neotectonics. For e.g., between Bithur and Kanpur railway bridge the main stem of the Ganga has recorded major movements, from 1857 till the present attributed to the irregular shape of the valley in the area.

The fluvial systems are characterized by the presence of different geomorphic 'elements' such as active/inactive channels, lakes/swamps, gullies, and aeolian features. In a study from the Farrukhabad – Kannauj area, five major geomorphic units were identified - major active channel belt, active flood plains of major channels, active minor channels and floodplains, inactive minor channels and floodplains, and slightly dissected surface in the upstream regions of the Ganga-Ramganga confluence. Dissected surfaces are found south of Ganga. They are said to have developed due to floodplain degradation in response to incisions by the major rivers. Active minor channels are found in the basin of Kali River which arises in the foothills 250 km northwest of Fatehgarh district and flows east-west before joining River Ganga.

The present river course is through the younger alluvium plain. It is mainly represented by sand and loam. It is further divided into the present flood plain and the old flood plain. The river flows through the present floodplains that are subjected to periodic flooding. This region along the Ganga River is 5-10 km wide. The old floodplain, also called *Khader* is characterized by the presence of fluvial landforms such as meander scars, cut-off meanders, and palaeo channels. The *Khader* belt is broader in the north part of the study area and gets narrow towards
the southeast. The development of *Khader* is most prominent on the eastern bank of Ganga, while on the western bank it is restricted and its boundary aligns with the uplands. Extensive meanders and oxbow lakes are formed in Kasganj district between the Lower Ganga canal and the active floodplains of Ganga from Narora in Bulandshahar District till Bajidpur in Kasganj District. However, these have either disappeared or reduced in the last three decades.

Extensive waterlogged areas are also formed in the interfluve region upstream of Solani River confluence between Morna in the Muzaffarnagar district and the Bijnor segment. Most of the upstream shallow floodplains have been converted to permanent agricultural fields in the last two decades that get flooded during heavy rainfall events in the catchment and remain inundated for some part of the year. At Bijnor, the Madhya Ganga barrage diverts water into the Madhya Ganga Canal but only during monsoon months. At Narora, there is a further diversion of water into the Lower Ganga Canal by Narora Barrage. The area between the Madhya Ganga canal and the Lower Ganga canal are regions of wetland formations due to canal seepage

The main types of soil found are silty soil, sandy loam, and loamy soil in the catchment (Table 1 and Map 9). The rich loam or 'Domat' soil in the upland Ganga Yamuna Doab region is highly fertile. 'Bhur' soil constitutes deposits of blown sand and fine silt. The general soils around the wetlands are basically clays and are known as *Chiknot* or *Bhabra*. These ill-drained soils are extensively developed along the foothill Terai region. The present river floodplains contain sand, silt, and silty clay soil with clay pockets.

The Ganga River is one of the world's largest sediment dispersal systems transporting an extremely high suspended sediment load of  $356 \times 10^6$  t year<sup>-1</sup>. A monsoonal climate with heavy rainfall leads to severe erosion and landslides in the catchment. This is accentuated by construction activities and denudation of Himalayan hill slopes. Some soils in the Ganga basin are highly susceptible to erosion. Mountain soils, submontane soils, and alluvial soils, covering 58 % of the basin area, have very high erodibility.

The soil in Uttar Pradesh has very high erodibility. The soil is susceptible to degradation by water erosion. Large parts of Muzaffarnagar, Bijnor, and Jyotiba Phule Nagar (Amroha) in Uttar Pradesh are affected by this problem. In the Bijnor district, 37,731 ha are degraded or 8.31% of the district area is degraded as assessed by the Soil and Land Use Survey of India. The majority of the degraded areas are formed along the Ganga River. Shallow ravines have developed in some areas located close to the river system, due to differential erosion. Also, Kankarlenses present form a challenge for groundwater availability (Table 2 and Map 10).

Soil Code	Class Name	Texture	Texture Class	% GRAVEL	% SAND	% SILT	% CLAY	Hydraulic conductivity (m/s)
3661	Dystric Cambisols	Fine	Clay	19	22	31	47	1.28e <sup>-6</sup>
3671	Eutric Cambisols	Medium	Loam	9	42	36	22	6.94e <sup>-6</sup>
3675	Eutric Cambisols	Medium	Loam	9	42	36	22	6.94e <sup>-6</sup>
3717	Lithosols	Medium	Loam	26	43	34	23	6.94e <sup>-6</sup>
3739	Calcaric Fluvisols	Medium	Loam	10	35	47	18	6.94e <sup>-6</sup>
3798	Orthic Luvisols	Medium	Loam	4	47	32	21	6.94e <sup>-6</sup>
3810	Orthic Luvisols	Medium	Loam	4	47	32	21	6.94e <sup>-6</sup>
3851	Dystric Regosols	Medium	Loam	20	42	37	21	6.94e <sup>-6</sup>
3854	Eutric Regosols	Medium	Loam	27	47	34	19	6.94e <sup>-6</sup>
6998	Glaciers							
11378	Leptosols	Medium	Loam	13	43	36	21	6.94e <sup>-6</sup>
11730	Leptosols	Medium	Sandy loam	13	56	38	6	3.45e <sup>-5</sup>
11765	Leptosols	Medium	Sandy loam	13	56	38	6	3.45e <sup>-5</sup>
11926	Rock Outcrops							
11930	Glaciers	Ì						
Source: NBSSLUP;Mao et al., 2019								

Table 1: Soil characteristics of Above Ramganga Confluence Basin

#### Table 2: District wise area under erosion

Districts	Catchment area with soil erosion > 15-20 t/ha/yr (in %)
Muzaffarnagar	68
Bijnour	41.2
Jyotiba Phule Nagar	35
Meerut	22.8
Bulandsahar	22.2
Etah	21
Aligarh	19.7
Ghaziabad	18.8
Shahzahanpur	15.8
Badaun	14.6
Moradabad	4.3
Farukkhabad	1
Saharanpur	0
Hardoi	0

Source: Based on analysis of NBSS&LUP Data.



Map 9: Soil map of the Above Ramganga Confluence sub-basin



Map 10: Soil erosion map of the Above Ramganga Confluence sub-basin

#### **Climatic set-up**

The Above Ramganga Confluence sub-basin experiences a monsoon-influenced humid subtropical climate characterized by many hot summers and colder winters. Summers last from early April to late June and are extremely hot. The monsoon arrives in late June and continues till the middle of September. Temperatures drop slightly, with plenty of cloud cover but with higher humidity. Temperatures rise again in October and then a mild, dry winter season from late October to the middle of March. June is the warmest month of the year. The temperature in June averages 35.81°C. In January, the average temperature is 14.32°C. It is the lowest average temperature of the whole year. The average annual temperature is 25.6°C. The rainfall averages 809 mm. The driest month is November, with 4 mm of rain. The highest precipitation falls in July, with an average of 234.45 mm. The subbasin receives nearly 170 days of rainfall annually (Figure 6 and Map 11).

Recognizing Uttar Pradesh's climate vulnerability, rapid urbanisation, rising poverty, and increased drought and flood make this densely populated, agriculturally dominated state a very vulnerable landscape (Saxena, 2020). The anticipated increase by 20% in rainfall and rise in maximum temperature to 2°C by 2050's is alarming for water security (UP-SAPCC, 2014). The frequency of extreme temperature and rainfall events are constantly on the rise along with annual variation in rainfall (Tripathi, 2016). Climate change exacerbates water-related risks. Climate change exacerbates water insecurity by limiting per-capita supplies, water guality, consumption disputes, and deterioration of wetlands ecosystems. Climate change in the region has altered the precipitation regime, intensity rates, and indirectly impacting the flux and storage of water in wetlands (UP-SAPCC, 2014). Wetlands dynamics is impacted most by the changing climate, increasing temperatures and changing climatic patterns have led to drying up of wetlands in Uttar Pradesh. To combat the impacts of climate change, Uttar Pradesh has formulated action plan for seven missions (1) Sustainable agriculture mission (2) Solar Mission (3) Energy Efficiency Mission (4) Green UP Forestry Mission (5) Jal Mission (6) Strategic Knowledge Mission (7) Sustainable Habitat Mission (UP-SAPCC, 2014). The Jal Mission is of profound importance in this context as 70% of agriculture in the state is dependent on irrigation. Semi-arid and arid regions in the state are especially vulnerable to climate change and are anticipated to suffer decline in water resources. The expected annual precipitation variance would result in frequent and prolonged waterlogging, as well as saline intrusion into aquifers (UP-SAPCC, 2014).



Figure 6: Correlation between precipitation and temperature for ARC Sub-basin during 2020



Map 11: Spatial variation in annual precipitation during 2020 for ARC Sub-basin

#### Hydrological Set-Up

The Above Ramganga Confluence sub encompass 4.84% of the drainage area of the Ganga basin. The river Ganga originating from Guamukh at Gangotri in Uttarkashi district as Bhagirati and joins Alaknanda in Devprayag to form Ganges is the main component forming in this sub-basin. This sub-basin contains the main rivers like the Bhagirathi, the Alaknanda, and other small rivers like the Nayar, the Song, and the Pinder. These all rivers meet to form the main Ganga River in this sub-basin. Wetlands in this sub-basin are majorly formed within the changing course of the river channels, along the linear embankments built for water supply, and isolated wetlands formed in the natural depressions that source its major water supply from precipitation and catchment runoff. The drainage density of the sub-basin recorded is 0.207km<sup>2</sup> (India-WRIS).

There are three main canal systems viz., Upper Ganga Canal, Madhya Ganga Canal, and Lower Ganga Canal. The river Ganga is characterized by a distinct braided channel with a braid-channel ratio of about 2.97, while, at some points reaching as low as 2.0. The mean width of the primary channel is 350 m while the smaller channel has a width in the range of 20 to 30 m respectively. The river channel cross-section varies significantly from Fatehgarh (upstream) to Ankinghat (downstream) stations. The channel becomes much wider and shallower at Ankinghat manifested in a sharp increase in w/d ratio from 80 at Fatehgarh to 266 at Ankinghat. At several locations such as Farrukhabad and Kannauj, the Ganga River section is deeply incised forming 10 to 18 m high cliffs along its southern bank. The river remains straight with a sinuosity index of < 1; however, the braiding increases considerably from 3.79 to 4.53.

The flow of Ganges River is regulated by reservoirs and dams in this sub basin. There are three dams (Tehri dam, Koteshwar dam and Maneri dam), nine barrages/weirs and seven reservoirs within the sub-basin and are primarily used for irrigation. Madhya Ganga barrage and the Narora barrage are the two major barrages in the sub-basin. The flood, discharge of water, sediment and water quality are frequently measured at various stations present in the catchment, as shown in Map 12.

#### Flow direction and inundation regime

The inundation regime in the ARC sub-basin is governed by the extent of river channels in different seasons, water logging due to the seepage through canals and embankments and the depressions formed due to geographical and topographic features. The wetlands in the surveyed 10 km buffer zone on either side of the river Ganga have different extent of inundation at various months of the year.



Map 12: Hydrological monitoring stations and drainage map of the ARC Sub-basin

The results for a sample of 93 wetlands indicates that 38% wetlands remain permanently inundated while 53% are seasonally inundated (Map 13). Of the surveyed wetlands, 18.28% were connected with the river and streams throughout the year while 12.90% were connected seasonally i.e., during monsoons only. 68.80% wetlands remain completely isolated (Map 14). Perennial connectivity of wetlands with rivers was recorded for wetlands within river channels and along irrigation canals. Inlets and outlets were recorded maximum (n=32 and n=20) for wetlands falling under the isolated category of surveyed wetlands.

Nearly 64% (4035km<sup>2</sup>) of the ARC sub-basin falls within the flood risk hazard zone as per the vulnerability map of Uttar Pradesh made by BMTPC, SOI and GOI (Map 15). A snapshot of how flooding occurs in river cross-sections having embankments and not having embankments are shown in Figure 7. The maximum extent of inundation is shown in Map 16, prepared using 35 years of inundation data by Peckel et al., 2016.

Geographically isolated wetlands or wetlands that are completely surrounded by uplands might normally lack surface water connections, they can be hydrologically connected to downstream waters through intermittent surface flow or groundwater. Horizontal flow reflects connection between rivers and wetlands or between wetlands through flood pulses or inundation. Vertical flow reflects water flow between wetlands holding surface water to groundwater. 76 % of the surveyed wetlands are losing water to vertical flow 11 % exhibit horizontal flow in the surface and 13% have both vertical and horizontal flows.





Map 14: Connectivity and inundation regime of the surveyed wetlands





Figure 7: Rising surface water levels in relation to water logging in the neighboring areas (Bonsor et al., 2016)



Map 15: Flood hazard risk zone of ARC Sub-basin



Map 16: Maximum water extent in the 10km buffer zone on either side of the River Ganga in the ARC Sub-basin

The study by Peckel et al., 2016 also highlights the transition of water from one form to another in terms of inundation. Within the 10km buffer zone on either side of the river Ganga, it is estimated that over the past 3 decades only 0.42 percent has remained permanent and unchanged. While most of the water (up to 52.7%) is ephemeral seasonal (i.e., land replaced by seasonal water that subsequently disappears) and 26.4% is new seasonal water which is the conversion of land into seasonal water (Figure 8 and Map 17).

The wetlands that do not fall within the river channel experience seasonal behaviour as they are cut off from the main channel. Nearly 23 % of these wetlands have an unchanging seasonal wetland, 29% of these wetlands are ephemeral seasonal wetlands 26% of these wetlands are new seasonal wetlands formed due to fragmentation and 20% of seasonal have been lost to conversion.



Figure 8: Transition of water within the 10 km buffer zone on either side of the river Ganga



Map 17: Transitions of Water

Monitoring of water quality parameters is important to understand the interactions between parameters and its effect on aquatic life, their growth, and health. Each water parameter individually may not cause alarming situation, but several parameters together can reveal dynamic processes taking place in the wetland.

One time sampling was conducted in 2020 following standard protocols. Water sample was collected from 93 wetlands. Water quality analysis was carried out at the respective regional laboratory, Uttar Pradesh Pollution Control Board. Samples were tested for DO, pH and nutrient load.

The results indicate that DO ranges from 0 to 11.5, the maximum number of wetlands have a DO ranging from 3 to 7 mg/l. The range of DO in the surveyed wetlands across the districts falling within 10 km from either side of River Ganges in ARC sub-basin are shown in Figure 9. Water sample of wetlands surveyed within the river channel (n=14) and along the irrigation canal (n=16) tested acidic with average value of 5.97 and 6.03 respectively. Whereas water sample of wetlands surveyed as isolated category (n=63) tested alkaline (Map 18).

The DO varied largely across the districts from a very high value in Kasganj to extreme low values in Aligarh. This can also be attributed to the levels of algae and other nutrient loads present in the wetlands of Aligarh wherein most of the wetlands are Eutrophic. Of the sample of 93 surveyed wetlands, 31.18% wetlands were recorded as eutrophic Figure 10.



Demonstration of water quality testing



Map 18: Variation in DO, pH and nutrient load for surveyed wetlands in ARC Sub-basin



Figure 9: DO in the surveyed wetlands in different districts within 10 km buffer in ARC Subbasin



Figure 10: Trophic status of surveyed wetlands in different districts within 10 km buffer in ARC Subbasin

## **Groundwater levels**

Groundwater in the 10 km buffer zone on either side of the river Ganga along the 12 districts in Uttar Pradesh, ranges from 0 to 40 mbgl. The distribution pattern remains fairly the same throughout the year. Most of the area within this buffer zone, access to groundwater is within 10m from the surface primarily due to the

proximity to the river that has water throughout the year and the sandy and sandyloam subsurface strata.

The groundwater has steadily declined in parts of Uttar Pradesh over the past decade as seen in Map 19. Groundwater which was once available at ground level to 3 m below subsurface at majority of the catchment has been pushed to 10-20 m in a decade. This can be attributed to the rising abstraction of groundwater for catering to the needs of growing population and the ease of abstraction. As groundwater is a readily available pollution free water there is a stark shift from the use of surface water to groundwater. This has led to the drawdown of groundwater way more than the recharge that is consistently leading to the decline in groundwater levels



Gangetic floodplains along Meerut district, Uttar Pradesh



Map 19: Groundwater levels in different parts of Uttar Pradesh over the past decade

# **Species and Habitats**

Many plant and animal species live in the wetlands, including a number of rare and endangered species. Such species are characteristic to their environment and often described as indicator species that are used to monitor environmental changes, assess the efficacy of management, and provide warning signals for impending ecological shifts. Reed (1988) first described the indicator status of a species (floral or faunal) through its expected occurrence in the wetland as follows:

Obligate wetland species	Occur almost always (estimated probability >99%) under natural conditions in wetland habitat
Facultative wetland species	Usually occur in wetlands (estimated probability 67%–99%), but occasionally found in non-wetlands habitat
Facultative	Equally likely to occur in wetlands or non-wetland habitat (estimated probability 34%–66%)
Facultative upland	Usually occur in non-wetland habitat (estimated probability 67%–99%), but occasionally found in wetlands (estimated probability 1%–33%)
Obligate upland	Occur almost always (estimated probability >99%), under natural conditions in the non-wetland habitat

## Plant species occurrence

The Gangetic ecosystem forms a unique environment for hydrophytic, semihydrophytic, and submerged floral association. The vegetation pattern in the Ganga basin varies according to seasonal changes, hydrology, flood level, and different soil types. These factors have a sharp influence on plant species distribution and composition.



Remarkable congregation of cormorants, sandpiper and other waterbirds in Haiderpur wetlands, Uttar Pradesh



Figure 11: Hydrophytic plant species recorded in the Gangetic floodplains, Uttar Pradesh

The present study was conducted in the Above Ramganga Confluence sub-basin. 93 wetlands across the 12 districts were sampled. 27 wetland plant species representing 25 families were identified (Annex 1). Family Amaranthaceae and Apiaceae were recorded as dominant. The plant species were grouped as; emergent, free-floating, moisture-loving, and submerged (Figure 11). The occurrence of emergent hydrophytes was recorded maximum (32%). Water hyacinth *Eichhornia crassipes*, Hornwort *Ceratophyllum demarsum*, and Hemp *Cannabis sativa* were recorded as major invasive wetland plant species.

Amongst the three wetland categories plant, species occurrence varied significantly. Vetiver grass was recorded only from along wetlands within the river channel which were also dominated with Phragmites sp. while Cattail and Typha sp. dominated the wetlands formed along the irrigation canals. Herbs like Ipomea were recorded mostly in the wetlands formed along the irrigation canals followed by isolated wetlands.

Wetland vegetation, despite offering high resource availability is often affected by habitat loss and fragmentation. In the present study, it was recorded that wetlands are being cleared for farming. As a result, runoff from agricultural fields forms the main source of nonpoint pollution. Overuse of resource extraction was also recorded. It has brought about adverse impacts giving the rise to spread of invasive plant species leading to eutrophication indicating a non-conducive ecological regime.

Comprehensive information on the aquatic biodiversity and various ecological aspects of the river Ganga has been documented but the status of wetlands faunal elements in Uttar Pradesh state remains feebly documented. Studies have largely been conducted to document the distribution, habitat use, and breeding of the Sarus Crane *Grus antigone*, a globally vulnerable species and India's only resident



Flora species occurrence

breeding crane (Rahmani et. al. 2019; Sundar 2006). Few other noteworthy studies include patterns of fish diversity (Jha and Das, 2019); amphibians and their ecological importance (Kanaujia and Kumar, 2013), and, the status and abundance of freshwater turtles in Uttar Pradesh (Singh et. al. 2009).

In the present study, the occurrence of fauna was documented based on direct sightings during field visits and secondary data in the form of peer-reviewed published articles was also referred to. Species conservation status was described following the IUCN Red List. Of the 93 wetlands sampled, a significant proportion (23%) fall within the protected area management regime. These are wetlands falling within the Hastinapur Wildlife Sanctuary and reserve forest areas of Meerut, Hapur, Amroha, and Bulandshahr districts respectively. The 80 km river stretch Garhmukteshwar to Narora barrage comprises shallow waters with intermittent deep-water pools and reservoirs, is a designated Ramsar site.

Faunal assemblage also varied amongst the three wetland categories. The occurrence of species such as Swamp deer *Cervus duvacelli*, Hog deer *Axis porcinus*, Smooth-coated Otter *Lutra perspicillata*, and Indian soft-shelled Turtle *Nilssonia gangetica* was recorded only along wetlands within the river channel. A total of eight species of fish (Annex 2), two species of amphibians (Annex 3), eight species of reptiles (Annex 4), eight species of mammals (Annex 5), and 152 species of birds were recorded (Annex 6). 14 species of high global conservation significance were recorded from this sub-basin (Figure 12).



Figure 12: Biodiversity within the ARC Sub-basin

The walking catfish *Clarias batrachus* was recorded as a dominant fish species. It is a freshwater fish species that require wetlands as spawning grounds and as nursery areas for their young. Juvenile Gharial Gavialis gangeticus released in the River Ganga in Hastinapur Wildlife Sanctuary have been observed to seek refuge in oxbows from harsh conditions. The Floodplain region of Ganga along the district Meerut, Hapur, Bulandshahr, and Muzaffarnagar form an important habitat for Marsh Crocodile Crocodylus palustris and over 150 bird species, including at least 40 water birds. Riverine turtles such as the vulnerable Ganges softshell turtle have been recorded to move between rivers and wetlands to find suitable foraging, mating, nesting, rearing, and overwintering habitat throughout the year. Floodplain wetlands are effective in improving habitat quality by mitigating the effects of fragmentation. Wetlands serve as suitable corridors linking habitats for free movement and recolonization of species. One such example is the 115 km corridor linking Jhilmil Jheel, a habitat in the Haridwar forest division in Uttarakhand to Hastinapur Wildlife Sanctuary in Uttar Pradesh (Map 20). This riverine-wetland continuum forms the natural migration route of Swamp deer Cervus duvacelli, a critically endangered species. The stretch is also reported to support a sizable population of Otter Lutra perspicillata. and Hog deer Axis porcinus.

#### Wetlands Ecosystem Services and Livelihoods

#### **Regulating services**

A key indirect value of floodplain wetlands to the communities living in the vicinity is their ability to buffer extreme events. Gangetic floodplains are some of the most susceptible areas in India prone to flooding and experience frequent loss of life and property. It was recorded that around 64% of wetlands and their complex were recgonzied as providing a buffer to bank inundations by absorbing the flows and thereby reducing the risk of damages within the settlements around the complex. Wetlands like Haiderpur and Ishhakwala in Muzaffarnagar district and Hakimpur wetland in Bulandshahr district significantly provide a buffer from floods. Fifty percent of wetlands which are largely village ponds are reported to retain water and thus recharge groundwater and support agriculture during lean seasons (Figure 13).



Figure 13: Number of surveyed wetlands utilized for regulating services by communities



Map 20: Hastinapur wildlife sanctuary showing migratory corridor with wetland linkages

#### **Provisioning services**

The survey zone across the 12 districts lies in the highly fertile floodplains of the River Ganges, hence agriculture is the key economic activity, accounting for nearly 65.18% of the land use. Private land ownership within the wetland area has led to the expansion of agricultural activities Migrant laborers are employed for tilling the fields. *Nishad* or *Mallah* Caste are common and practice boat rowing. They are also dependent on fishing (Figure 14).



Figure 14 : Number of surveyed wetlands utilized for provisioning services by communities

Fishing forms the base of livelihoods of largely 5.3% of respondent households. While *Mallahs* form an exclusive occupation of caste fishers, locals living in close proximity to wetlands also resort to occasional fishing. Changes in inundation pattern and decline in connectivity with riverine environments impact fishing practices. The deeper areas are used for net fishing, whereas traps are used in the marsh areas located in the margins. Also, the reduction in areas under permanent and seasonal inundation has led to competition with conflicts arising on fishing rights. Wetlands are given on lease by Gram Panchayat and the lease period ranges from six months to one year. Locals also reported that fisheries have transformed from a high-value mix of Indian Major Carps to low economic value air-breathing fishes like Magur and Snake-head fish. The use of very small mesh (mosquito size nets) and traps has further impacted species recruitment. Fishing is reported to be restricted in wetlands lying within protected areas such as the Hastinapur Wildlife Sanctuary and in wetlands considered sacred like Harpadi Soron in Kasganj District.

For the villages adjacent to the wetlands most predominant human use of aquatic vegetation is that of macrophytes mainly as food, fodder for the cattle, and fuel. Plant of *Nelumbo nucifera* (Lotus), leaves, and stem of *Ipomoea aquatica* (Besharam) are harvested from the wetland complex and used as vegetables. 14% of wetlands leased by the Gram Panchayat are used for harvesting fruits of *Trapa natans* (Water Chestnut). Wetlands such as Mandawar in Bijnor district and Niwadi Khadar in Bulandshahr district are used for sourcing medicinal plants. *Eichhornia crassipes* (Jal kumbhi) and *Cyperus* spp. (Mootha) are the major species used as

fodder. Dried Saccharum spontaneum (Kans ghass) and Phragmites karka (Narkul) are extensively used as fuelwood.

#### Cultural, educational and recreational services

The Ganges is the most sacred freshwater ecosystem in India. The aesthetics, mythological connotations, and spiritual appeal have made it the popular world over. 24% of wetlands are revered for local ritualistic purposes. On festivals such as Kartik Amavasya and Ganga Dussehra, the floodplains are crowded with pilgrims. Wetlands like Tigri in Amroha district, Karanwas in Bulandshahr, and Haripadi Soron in Kasganj district hold an important place in the local culture, with several festivities and celebrations taking place nearly all the year-round.

Biodiversity assessments have been carried out in wetlands like Haiderpur which form a part of larger Protected Areas such as Hastinapur Wildlife Sanctuary. Events like World Wetlands Day and Wildlife Week are celebrated by the local forest department in different districts which involves engaging with schools are involved in promoting conservation education and awareness programs. Annual assessment of the population status of Sarus Crane is undertaken by the Sarus Protection Society under the aegis of the Uttar Pradesh Government.

Wetland sites such as Rustampur Bhikund in Meerut district and Karanwas in Bulandshahr district form a major tourist attraction owing to their archaeological significance dating back to the Mahabharata era. These wetlands being connected to River Ganga also support rich biodiversity including the Gangetic dolphins, Crocodiles, and migratory birds that add to the scenic beauty (Figure 15).



Figure 15: Number of surveyed wetlands utilized for cultural services by communities

# 3. Evaluation of Wetland Features

### **Ecological character**

Wetlands are managed for their wise which is the maintenance of their ecological character, achieved through the implementation of ecosystem approaches, within the context of sustainable development. Ecological character description is one of the key elements of the definition of 'wise use', incorporating the combination of the ecosystem components, processes, and services that characterise the wetland at a given point in time. Ecological character is the maintenance of wetland values and functions, while at the same time delivering ecological services and benefits now and into the future, for human well-being. Wise use, in promoting maintenance of environmental, economic, and social sustainability, encourages compromise (or trade-offs) between individual and collective interests. To achieve sound decisions on wetland, use, and management, decision-makers at local, regional, and national levels need to enable participation by relevant stakeholders and to balance a variety of objectives and perspectives.

Ecological character definition allows identification of critical components, processes and services, and identifies changes thereof, which require management intervention. Ecological character is an indicator of health of the wetland ecosystem, and thereby is an important benchmark for management. Changes to ecological character of the wetlands, outside natural variation may signal that uses of the site are unsustainable, and may lead to the breakdown of the ecological, biological and hydrological functioning of the wetland system (Ramsar Convention 1996, Resolution VI.1).

The framework used for describing ecological character for Ganga floodplain wetlands build on the Ramsar Framework (Resolution X.15) modified to the suit the local context. The following definitions have been used:

**Ecosystem components** include the living (biotic) and non-living (abiotic) constituents of wetland ecosystem.

- Geomorphic setting (landscape, catchment, river basin)
- Climate (precipitation, temperature)
- Physical setting (area, boundaries, topography, shape, bathymetry, habitat type and connectivity)
- Water regime (inflow, outflow, balance, surface groundwater interactions, inundation regime, quality)
- Wetlands Soil (Texture, Colour)
- Biota (Plant and animal communities)

**Ecosystem processes** comprise of processes that occur between organisms and within and between populations and communities, including interactions with nonliving environment, that result in existing ecosystem state and bring about changes in ecosystems over time. These are:

- Physical processes (water stratification, mixing, sedimentation, erosion)
- Energy nutrient dynamics (primary production, nutrient cycling, carbon cycling, decomposition, oxidation reduction)
- Processes that maintain animal and plant population (recruitment, migration)
- Species interaction (Competition, predation, succession, herbivory)

**Ecosystem services** are benefits obtained by humans from wetland ecosystems. These are:

- Provisioning (fisheries, use of aquatic vegetation for economic purpose, wetland agriculture, biochemical products)
- Regulating (maintenance of hydrological regimes)
- Cultural (recreation and tourism, spiritual, scientific and educational value)
- Supporting (Soil formation, Primary production, Nutrient cycling, Water recycling, Provision of habitat).

The 93 surveyed wetlands of the ARC sub-basin based on their local and hydrological characteristics can be placed under the following three categories (Table 3):

- a) Riparian wetlands (sampled number of wetlands equals 14): which are located within the active floodplains and are directly or indirectly connected with the flood pulse of the river Ganga.
- b) Irrigation canal-fed wetlands (sampled number of wetlands equals 16): which are located along the irrigation canal network with their hydrological regimes connected with leakages from the canals and consequent waterlogging.
- c) Isolated sumplands (sampled number of wetlands equals 63): which are located in depressions in the landscape with their hydrology sustained by catchment flows.

Wetland	Landforms	Hydrology & hydrodynamics	Vegetation	Soil	Function	Representative
Category						examples
Riparian	Oxbows and	Precipitation and river fed,	Macrophytes largely	Predominantly	Significance as	Haiderpur
wettands	Predominantly flats	during monsoon, horizontal water	water up to 80%.	ioam.	around water	(wuzanamagar).
	aligned with the	flow, mostly inundated for less than			recharge.	
	channels.	6 months.				
Irrigation canal-fed wetlands	Predominantly flats aligned with the irrigation canal.	Fed by precipitation and overflows from the canal, Isolated patches, mix of horizontal and verticals water flows, water permanence exceeds six months.	Heavy infestation of macrophytes, open water up to 20 – 30 %.	Predominantly clay.	Significance for water purification and ground water recharge.	Ishhakwala (Muzaffarnagar).
Isolated Sumplands	Isolated shallow depressions.	Fed by precipitation and basin flows, isolated patches, predominantly vertical flows, seasonally inundated wetlands.	Heavy infestation of macrophytes, open water up to 20 – 30 %.	Mix of clay and loam.	Significance for ground water recharge	Sikandarpur khurd (Kasganj).

Table 3: Categories of wetlands in the 10-km buffer around River Ganga

The ability of riparian wetlands to sustain its ecosystem services and biodiversity values is dependent on the following ecosystem processes:

- Connectivity of the wetland (lateral, horizontal and vertical) with the riparian environment enabling exchange of sediments, water, nutrients and aquatic organisms.
- Ecological integrity of the migratory corridors to suit the life-cycle requirements of migratory species.
- Landscape aesthetics which supports its touristic and recreational value.
- Cultural, spiritual, and religious values reflected in local practices like offering of libations to the gods, ritual bathing and others.

Sustaining the aforementioned ecosystem services and biodiversity values require:

- Prevention of floodplain fragmentation.
- Protection of species breeding, feeding, spawning grounds, and dispersal routes.
- Responsible tourism aligned with the ecosystem fragility restricting adverse anthropogenic footprint into the wetland.
- To promote relational values that communities hold with the river and its floodplains.
- Governance regimes that enable mainstreaming full range of ecosystem services and biodiversity values within developmental plans, programmes and investments.

The ability of the irrigation canal-fed wetlands to sustain its ecosystem services and biodiversity values is dependent on an optimal balance between area of open water with area under vegetation cover. This provides a diversity of habitats suited for a wide range of species. Sustaining this requires:

- Periodic harvesting of invasive macrophytes.
- Prevent adverse land use change, especially to non-wetland usages.

The ability of the isolated sumplands to sustain its ecosystem services and biodiversity values is dependent on:

- Hydrological connectivity with the catchments.
- Pollution loading.
- An optimal balance between open water and macrophyte dominated areas.
- Landscape aesthetics and recreational value.

Sustaining the aforementioned ecosystem services and biodiversity values require:

- Maintain the inlets and outlets as per natural gradient.
- Abate pollution within the catchment.
- Maintain and enhance recreational and educational values of the wetland.

A description of ecological character in terms of key wetland features is presented in Table 4.

Table 4: Status and trends in ecological character of surveyed wetlands with reference to them in the 10km buffer zone on either side of the river Ganga in the sub-basin Above Ramganga.

Wetlands	Descriptors	Data	Current condition of management categories					
Features		Source	Riparian wetlands	Irrigation canal-fed wetlands	Isolated sumplands	Γ		
Physical regime	Types	Sampled Data	Predominated by Oxbow lakes (35.71%), followed by Permanent freshwater marshes (28.57%), Ponds (21.42%), and Permanent lakes (14.29%).	Predominated by Permanent freshwater marshes (56.25%), followed by Ponds (25%), and Permanent lakes (18.75%).	Predominated by Ponds (63.49%), followed by Permanent freshwater marshes (20.63%), Oxbow (9.52%), Permanent lakes (3.17%), and Aquaculture Ponds (3.17%).			
	Area (ha) (Range and Average)	Sampled Data	1.18-6900 ha; 3.04 ha (Median)	1.34-225.16 ha; 49.12 ha (Median)	0.28-88.36 ha; 1.56 ha (Median)			
	Depth (m) (Range and Average)	Sampled Data	0-7.68 m; 2.10 m (avg.)	0-7 m; 1.65 m (avg.)	0-40 m; 2.53 m (avg.)			
	Loss (Decline in area since 2000) (Units and %)	Basin Wide	27026 wetlands accounting for 45278.01 ha area	11 wetlands accounting for 9523.18 ha area	17837 wetlands accounting for 59658.85 ha area			
Hydrological regime	Water regimes	Sampled Data	Predominated by seasonally inundated wetlands (64.29%), followed by permanently inundated (28.57%) and intermittently inundated types (7.14%).	Dominated by permanently inundated (37.5%) and seasonally inundated wetlands (37.5%), followed by seasonally waterlogged type (25%).	Permanently inundated (39.68%); Seasonally inundated (53.97%); Seasonally waterlogged (6.35%)			
	Connectivity	Sampled Data	Covered equally by perennial and seasonal wetland types. Majority have inlets (78.57%) while only 26.67% have outlets.	Dominated by perennial wetlands (31.25%), followed by Seasonal types (12.5%). 43.75% of them have inlets while 31.25% have outlets.	Dominated by perennial wetlands (9.52%), followed by seasonal types (6.35%). Majority have inlets (50.79%) while about 31.75% have outlets.			
	Hydrodynamics	Sampled Data	Majority house flowing water (57.14%) with horizontal flow direction (57.14%) while the rest house static water (43.75%) with vertical flow direction (43.75%).	Majority house flowing water (56.25%) with vertical flow direction (62.50%) while the rest house static water (43.75%) with horizontal flow direction (37.50%).	Majority house static water (79.37%) with vertical flow direction (20.63%) while the rest house flowing water (20.63%) with horizontal flow direction (20.63%).			

Wetlands	Descriptors	Data	Current condition of management categories					
Features		Source	Riparian wetlands	Irrigation canal-fed wetlands	Isolated sumplands			
	Sediment	Sampled	Low increment in sedimentation	High increment in	Moderate increment in			
	regimes	Data	(21.43%).	sedimentation (43.75%).	sedimentation (31.75%).			
	Water chemistry	Sampled	Acidic pH (5.97 avg.), moderate DO	Slightly acidic pH (6.03 avg.),	Slightly basic pH (7.40 avg.),			
	(Range and	Data	(2.73 avg.) with high mesotrophic	low DO (1.16 avg.) with both	high DO (5.50 avg.) with majorly			
	Average)		nutrient concentration (71.43%),	eutrophic and mesotrophic	mesotrophic (58.73%) followed			
			followed by eutrophic	nutrient concentrations in equal	by eutrophic nutrient			
			concentration (28.57%).	proportions i.e., 50%.	concentration (41.27%).			
Catchments	Climate Details	Sampled	A humid subtropical climate	A humid subtropical climate	A humid subtropical climate			
l		Data	reporting moderate temperature,	reporting moderate	reporting moderate temperature			
l			ranging from 3 to 45 °C with an	temperatures in the range 5-46	in the range 3-46°C with an avg.			
			avg. of 24.8 °C and moderately	°C with an avg. of 25.47 °C and	of 26 °C and moderately higher			
			higher rainfall in the range 2-700	lower rainfall in the range 3-720	rainfall in the range 0.09-850			
			mm with an avg. of 173 mm.	mm with an avg. of 99.98 mm.	mm with an avg. of 189 mm.			
	Geology and	Basin	Bhabar-Terai Belt (Muzaffarnagar, Bijnor and some parts of Meerut) and Alluvial Plains (Some parts of					
	Geomorphology	Wide	Meerut, Amroha, Hapur, Bulandshahr, Sambhal, Aligarh, Budaun, Kasganj, Farrukhabad, Shahjahanpur).					
	Land use and	Sampled	Largely dominated by Major	Dominated equally by Major	Dominated by Road (23.81%),			
	Land-cover of	Data	settlements + Road + Agriculture	settlements + Road +	followed by Major settlements			
	drainage basin		(85.72%), followed by Major	Agriculture, Road + Agriculture	(15.87%), Agriculture (11.11%),			
			settlements + Road + Agriculture +	+ Canal and Agriculture + Canal,	Agriculture + Canal (9.52%),			
			Dam/Barrage (7.14%) and Road +	each at 18.75%, followed by	Major settlements + Road and			
			Dam/Barrage (7.14%) respectively.	Road + Agriculture and Major	Railway at 7.94% each,			
				settlements + Road +	Dam/Barrage, Major			
				Agriculture + Canal at 12.5%	settlements + Agriculture, Major			
				and Major settlements + Road,	settlements + Road +			
				Major settlements + Agriculture	Agriculture + Dam/Barrage +			
				and Road + Dam/Barrage at	Canal + Railway and Canal at			
				6.25% each.	4.76% each and Major			
					settlements + Road + Railway,			
					Major settlements + Road +			
					Agriculture + Railway and Major			
					settlements + Road +			

Wetlands	Descriptors	Data Source	Current condition of management categories					
Features			Riparian wetlands	Irrigation canal-fed wetlands	Isolated sumplands			
					Agriculture + Railway at 1.59% each respectively.			
Species and Habitats	Species occurrence	Sampled Data	21.43% of wetlands house flagship obligate faunal species like Axis porcinus, Nilssonia gangetica, Lutrogale perspicillata, etc while 100% wetlands house dominant obligate floral species like Trifolium repens, Phragmites australis, etc.	37.5% of wetlands house flagship obligate faunal species like <i>Pseudibis papillosa,</i> <i>Ephippiorhynchus asiaticus,</i> etc while 100% wetlands house dominant obligate floral species like <i>Trifolium repens,</i> <i>Phragmites australis, Persicaria</i> <i>hydropiper</i> etc.	15.87% of wetlands house flagship obligate faunal species like <i>Pseudibis papillosa, Mycteria</i> <i>leucocephala</i> , etc while 100% wetlands house dominant obligate floral species like <i>Nymphaea caerulea, Zostera</i> <i>spp., Lemnoideae spp.</i> , etc.			
	Species conservation status	Sampled Data	7.14% of wetlands house critically endangered faunal species ( <i>Gavialis gangeticus</i> ), 7.14% house endangered animal species ( <i>Prionailurus viverrinus, Axis</i> <i>porcinus</i> , and <i>Erethizon dorsatum</i> ), 64.28% house vulnerable faunal species ( <i>Naja melanoleuca,</i> <i>Panthera pardus, Nilssonia</i> <i>gangetica</i> , etc.) while 35.71% house near threatened species ( <i>Python</i> <i>sebae</i> ).	0 % of wetlands house critically endangered faunal species while 18.75% house endangered animal species (Prionailurus viverrinus, Axis porcinus), 56.25% house vulnerable faunal species ( <i>Naja</i> <i>melanoleuca</i> , <i>Crocodylus</i> <i>palustris</i> , <i>Grus antigone</i> , etc.) and 43.75% house near threatened species ( <i>Python</i> <i>sebae</i> , <i>Mycteria leucocephala</i> , <i>Anhinga melanogaster</i> , etc.).	0 % of wetlands house critically endangered faunal species and endangered animal species while 42.85% house vulnerable faunal species ( <i>Naja</i> <i>melanoleuca, Lissemys punctata,</i> <i>Grus antigone,</i> etc.) and 30.16% house near threatened species ( <i>Pseudibis papillosa, Anhinga</i> <i>melanogaster, Python sebae,</i> etc.).			
	Invasive species	Sampled Data	78.57% of wetlands house invasive species like <i>Cyprinus carpio</i> , etc. while 100% house invasive floral species ( <i>Eichhornia crassipes</i> ).	62.50% of wetlands house invasive species like <i>Cyprinus</i> <i>carpio</i> , etc. while 75% house invasive floral species ( <i>Eichhornia crassipes</i> , <i>Ipomea</i> <i>spp.</i> , <i>Nymphaea caerulea</i> , etc.).	66.67% of wetlands house invasive species like <i>Cyprinus</i> <i>carpio</i> , etc. while 100% house invasive floral species ( <i>Eichhornia crassipes, Ipomea</i> <i>spp., Cannabis sativa ssp., etc.</i> ).			
Wetlands	Descriptors	Data	Current condition of management c	ategories				
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Features		Source	Riparian wetlands	Irrigation canal-fed wetlands	Isolated sumplands			
Livelihoods and Ecosystem Services	Livelihoods	Sampled Data	92.86% of wetlands have minimal dependency <i>i.e.</i> , <20% while 7.14% of wetlands have 20-40% dependency.	87.5% of wetlands have minimal dependency <i>i.e.</i> , <20% while 6.25% have about 20-40% dependency and the rest have > 40% dependency.	77.78% of wetlands have minimal dependency <i>i.e.</i> , <20% while 19.05% have about 20- 40% dependency and the remaining 3.17% have > 40% dependency.			
	Provisioning Services	Sampled Data	Majorly serves as freshwater for livestock (57.14%), provides fiber and fodder (50%), food - fish (14.29%), and freshwater for agriculture (7.14%).	Primarily provides freshwater for livestock (56.25%) and fibre and fodder (50%), followed by providing freshwater for agriculture (37.5%) and food - fish (25%), edible aquatic plants (18.75%), natural medicines or pharmaceuticals (12.5%), fuel, Ornamental resources and Clay, sand, mineral harvesting of about 6.25% each.	Primarily provides freshwater for livestock (61.90%), followed by food-fish (41.27%), fiber and fodder (36.51%) and freshwater for agriculture (17.46%), food - edible aquatic plants (15.87%), fresh water for drinking, washing & domestic use, fuel and natural medicines or pharmaceuticals, each at 4.76%.			
	Regulatory Services	Sampled Data	Mainly aids in air quality regulation and pest regulation (85.71%), followed by water during droughts and salinity regulation (78.57%), air quality regulation and flood hazard regulation (71.43%), followed by water purification and local climate regulation (50%) followed by fire regulation and erosion regulation (35.71%). They also help minorly in disease regulation of both livestock and humans, noise, and visual buffering.	Mainly aids in local climate regulation (75%), followed by air quality regulation and water regulation (68.75%), disease regulation in livestock and salinity regulation (62.5%), followed by water purification and pest regulations (56.25%), disease regulations in humans, erosion regulations and flood hazard regulations (50%), fire regulation (4.75%). They also aid in noise and visual buffering, provides water during droughts and pollination.	Primarily aids in water regulation and flood hazard regulation (65.08%), followed by pest regulation (61.9%), air quality regulation (53.97%), air quality regulation (52.38%), local climate regulation (52.38%), and pollination (52.38%). They also aid in fire regulation, disease regulation, noise, and visual buffering.			

Wetlands	Descriptors	Data	Current condition of management categories			
Features		Source	Riparian wetlands	Irrigation canal-fed wetlands	Isolated sumplands	
	Cultural Services	Sampled Data	Primarily adds to the aesthetic value, spiritual and religious value, and social relations (28.57%), followed by adding to the cultural heritage (21.43%), further followed by education and research and transportation (7.14%)	Aids significantly to the aesthetic value (43.75%) and inspirational value (37.50%), followed by recreation and tourism (18.75%), education and research (12.5%), transportation, and spiritual and religious value (6.25%).	Primarily aids in adding to the spiritual and religious value (28.57%), aesthetic value and social relations (20.63%), followed by cultural heritage (7.94%), recreation and tourism (7.94%), inspirational value (4.76%) and education and research (4.76%).	
	Supporting Services	Sampled Data	Primarily helps in soil formation (42.86%), followed by primary production, habitat facilitation and nutrient cycling (35.71%), followed by water recycling (7.14%).	Primarily helps in soil formation (87.5%), followed by habitat facilitation (62.5%), water recycling (56.25%), nutrient cycling (50%) and primary production (37.5%).	Primarily helps in primary production (41.27%), followed by soil formation and habitat facilitation (36.51%), followed by nutrient cycling (34.92%), and water recycling (17.46%).	
	Pre-exisiting rights and priveleges in the wetland	Sampled Data	Primarily used for bathing or wallowing of domestic animals (78.57%), grazing (78.57%) religious practices (35.71%), withdrawal of water for agriculture of fisheries (21.43%), community fishing (without any lease) (14.29%), fishing under lease from the government department (14.29%), followed by harvest of plants under lease from the government department (14.29%), harvest of plants (without any lease) (14.29%), plying of boats (14.29), agriculture or horticulture within the wetland (7.14%) and withdrawal of water for domestic use (7.14%).	Primarily used in grazing (100.00%), bathing or wallowing of domestic animals (93.75%), withdrawal of water for agriculture or fisheries (75.00%), agriculture or horticulture within wetland (62.5%), community Fishing (without any lease) (62.50%), plying of boats (56.25%), followed by withdrawal of water for domestic use (56.25%), religious practices (50.00%), the harvest of plants (without any lease) (43.75%), finally followed by fishing under lease from the government department (6.25%) and harvest of plants	Primarily used for grazing (87.30%), bathing or wallowing of domestic animals (82.54%), religious practices (41.27%), harvest of plants (without any lease)(30.16%), community Fishing (without any lease)(26.98%), withdrawal of water for agriculture or fisheries (25.40%), withdrawal of water for domestic use (20.63%), fishing under lease from government department (17.46%), followed by agriculture or horticulture within wetland (15.87%), plying of boats (14.29%) and harvest of plants	

Wetlands	Descriptors	Data	Current condition of management categories			
Features		Source	Riparian wetlands	Irrigation canal-fed wetlands	Isolated sumplands	
				under lease from the government department (6.25%).	under lease from government department (12.70%).	
Institutions and Governance	Land tenure and administration: Pattern of land ownership within the wetland	Sampled Data	Dominated by Government Gram Panchayats-Full (35.71%) and Partial (35.71%), followed by Government Revenue Land-Partial (28.57%) and Full (21.43%), Government Revenue Land-Full 1(4.29%), Government Irrigation DeptPartial (7.15%), and finally Government Forest Department- Partial (7.14%).	Dominated mainly Government Revenue Land-Full (56.25%), followed by Government Gram Panchayat-Full (25%), Government Revenue Land- Partial (12.5%), Government Gram Panchayat-Partial (12.5%), Private-Partial (6.25%), and Government Irrigation DeptPartial (6.25%).	Primarily dominated by Government Gram Panchayat- Full (60.32%), followed by Government Revenue Land-Full (12.70%), Government Gram Panchayat-Partial (7.94%), Private-Full (6.35%), Government Revenue Land-Partial (4.76%), and Private-Partial (3.17%). A significant portion is Not Clear (12.70%).	
	Land tenure and administration: Pattern of land ownership outside the wetland	Sampled Data	Dominated by Private-Full (50%), followed by Private-Partial (21.43%), Government Revenue Land-Partial (14.29%), Government Revenue Land-Full (7.14%), Government Gram Panchayat-Full (7.14%), Government Gram Panchayat-Partial (7.14%), and Government Forest Department- Full (7.14%).	Dominated by Private-Partial (56.25%) and Government Revenue Land-Partial (43.75%), followed by Government Gram Panchayat-Partial (25%), Government Revenue Land-Full (18.75%), and Government Gram Panchayat-Full (12.5%), Private-Full (12.5%).	Dominated by Private-Full (69.84%), followed by Private- Partial (14.29%), Government Gram Panchayat-Partial (11.11%), Government Gram Panchayat-Full (6.35%), and Government Revenue Land- Partial (3.17%). A small fragment is not clear (11.11%).	
	Management Plans	Sampled Data	Managed primarily under the Village Development Plan (42.86%), followed by Village Development Plan+Irrigation Water Management Plan (21.43%), Forest Working Plan+Village Development Plan+Irrigation Water Management Plan (14.29%), Forest Working Plan+Village Development Plan	Managed mainly by the Village Development Plan+Irrigation Water Management Plan (56.25%), followed by Village Development Plan (31.25%), and the Forest Working Plan+Village Development Plan+Irrigation Water Management Plan (12.5%).	Largely managed by the Village Development Plan (95.24%), followed by Irrigation Water Management Plan (57.14%) and the Forest Working Plan (44.44%).	

Wetlands	Descriptors	Data	Current condition of management of	Current condition of management categories			
Features		Source	Riparian wetlands	Irrigation canal-fed wetlands	Isolated sumplands		
			(14.29%), and Irrigation Water Management Plan (7.14%).				
	Laws and Regulation	Sampled Data	Equally governed by District Adminis	tration and Forest and Wildlife Prot	ection Act.		
	Monitoring programmes	Sampled Data	Monitored by the District Ganga Con	Monitored by the District Ganga Committee.			
	Formal and	Sampled	Networks include District	Networks include District	Networks include District		
	informal instituitions and networks	Data	Administration (100%), Elected political representatives (100%), Local Forest Department (100%), Panchayati Raj Institutions (100%), State Agriculture Department (100%), State Biodiversity Board (100%), State Culture & Tourism Department (100%), State Fisheries and Animal Husbandry Department (100%), State Pollution Control Board (100%). Followed by Accademia/Colleges, Universities	Administration (100%), Elected political representatives (100%), Local Forest Department (100%), Panchayati Raj Institutions (100%), State Agriculture Department (100%), State Biodiversity Board (100%), State Culture & Tourism Department (100%), State Fisheries and Animal Husbandry Department (100%), State Pollution Control Board (100%), Irrigation Department (81.25%), Accademia/Colleges,	Administration (100%), Elected political representatives (100%), Local Forest Department (100%), State Agriculture Department (100%), State Biodiversity Board (100%), State Culture & Tourism Department (100%), State Fisheries and Animal Husbandry Department (100%), State Pollution Control Board (100%), Panchayati Raj Institutions (85.71%), Irrigation Department (65.08%), Accademia/Colleges,		
			and Research Institutes 992.86%), NGOs (57.14%), Irrigation Department (50%), Hoteliers and Hotel Association (35.71%), and religious bodies present in the area near to wetlands (21.43%).	Universities and Research Institutes (56.25%), NGOs (37.5%), Hoteliers and Hotel Association (12.5%), and Religious bodies present in the area near to wetlands (6.25%).	Universities and Research Institutes (61.90%), NGOs (42.86%), Hoteliers and Hotel Association (14.29%), and Religious bodies present in the area near to wetlands (1.59%).		

# Functional assessment and ecosystem services potential mapping

The 10–km buffer region around River Ganga channel has primarily the following three landform types which serve as host to the wetlands and determine its size and shape:

- River and irrigation channels linear, though not necessarily straight open depression formed by River Ganga, its tributaries and linked irrigation channels.
- Flats flat or slightly undulating terrain adjoining the channels which also serve as the floodplains.
- Basins contained, closed depressions in the landscape forming a trough.

Water distinguishes wetland habitats from other terrestrial habitats and influences biological response by its presence, depth, chemistry and movement. The period of water availability in the wetland also termed as 'hydro-period' usually characterized in terms of its permanence or intermittence, reflects the balance between precipitation and evaporation, recharge and discharge, permeability of underlying sediments and shape of the wetland. Generally, a mix of two hydrological conditions is seen in the landscape: inundated (free standing water over soils with soil below the surface being saturated), and waterlogged (soils that are saturated with water yet water does not inundate the soil surface). Therefore, three types of water permanence can be discerned in the landscape:

- Permanently inundated water covers the land surface throughout the year.
- Seasonally inundated surface water is present for extended periods especially post monsoon but gradually recedes by the end of winters or early summers.
- Seasonally waterlogged substrate is saturated for extended periods with surface water being seldom present.

Combining the various type of landforms with various types of water permanence provides five major wetland types, which are shown in the Table 5.

Hydrology Landform	Permanently inundated	Seasonally inundated	Seasonally waterlogged
Basin	Lake/Swamp/Marsh	Sumpland	Dampland
Flat		Floodplain	Palusplain
Channel	River	River / Irrigation Canal	River / Irrigation Canal

Table 5: Hydro-geomorphic classes of wetlands in River Ganga floodplains

Wetlands were further classed on the basis of macrophytic vegetation / tree cover as sparsely vegetated (<20 %), moderately vegetated (20 – 40%), and abundantly vegetated (>40 %). The latter two categories are termed as 'marsh' or 'swamp' depending on whether the predominant vegetation is herbaceous or woody. All wetlands having area ≤5ha and with emergent vegetation cover of up to 30% in the study landscape have been classed as ponds (Richardson et al., 2022). The category of river and canal are mentioned with reference to Ramsar classification system; however, these were not included within the current project. A wetland function score was derived for functions like flood buffering, groundwater recharge and water purification for each of the 93 wetlands surveyed in this sub basin. The classification scheme was based on 7 components (a) geomorphology (b) water source (c) water permanence (d) hydrodynamics (e) soil type (f) vegetation cover (g) wetland area. The properties of these following components were given weights with respect to the significance of their delivery to the function as shown in the Table 6. Wetlands were classified as per the properties of each component and the properties were rated as per their significance of the property to deliver the respective functions. The ratings are as shown in the Table 7. The functional score was estimated using the equation given below

$$FS = \sum W_C \times R_C$$

In terms of water purification, flood buffering and groundwater recharge performed by the wetlands, the following assumptions have been used:

- Depressions and flats offer a certain degree of water storage as per the depth. Deeper the depression, more will be the water stored in the wetland.
- Wetlands that a greater ability to store precipitation and surface run off offer better groundwater recharge.
- Wetlands having a horizontal mobility of water offer better water purification due to exposure to sunlight and horizontal flushing.
- Soil with high permeability have more hydraulic conductivity, thereby storing and transporting more groundwater. High permeability also allows water to flow through a porous media which act as a filtration unit. It can also help in storing excess water during flooding event.
- Vegetation along wetlands trap excess sediments and heavy metals thereby helping in flood buffering and purification of water. However, a lesser vegetation cover facilitates greater groundwater recharge owing to the fact that vegetation cover is inversely proportional to the surface area of water in the wetland. The influence gradient for each category on the functions has been listed in Figure 16 and Figure 17



Figure 16: Functional score gradient of major identified functions based on its characteristics features

Components/Functions	Flood buffering	Groundwater recharge	Water purification
Geomorphology	0.6	0.6	0
Water source	0	0.6	0
Water permanence	0.6	0	0.6
Hydrodynamics	0.6	0.6	0.3
Soil type	0.3	1	0.6
Vegetation Cover	0	1	1
Wetland Area	1	0.6	1

Table 6: Weights of the components to deliver the respective wetland function

Table 7: Ratings of the properties of components to deliver the respective wetland function

<b>Components/Functions</b>	Properties	Flood	Groundwater	Water
		buffering	recharge	purification
Geomorphology	Flat	5	5	5
	Depression	10	10	10
Water source	Only			
	precipitation	10	10	10
	Precipitation			
	and surface			
	runoff	5	5	5
	Groundwater	1	1	1
	Surface water			
	and			
	groundwater	8	8	8
Water permanence	Seasonal	1	1	1
	Intermittent	5	5	5
	Permanent	10	10	10
Hydrodynamics	Horizontal	10	5	10
	Vertical	5	10	5
Soil type	Soil with high			
	permeability	10	10	10
	Soil with low			
	permeability	5	5	5
Vegetation Cover	Total	10	1	10
	Partial	8	5	8
	Peripheral	5	8	5
	No Vegetation	1	10	1
Wetland Area	<1 ha	1	1	1
	1 to 5 ha	3	3	3
	5 to 10 ha	5	5	5
	10 to 20 ha	7	7	7
	20 to 30 ha	8	8	8
	>30 ha	10	10	10









Figure 17: Functional scores for each function of all wetland classes



Field sampling for Rapid Assessment of Wetland Ecosystem Services (RAWES)

An assessment of the ecosystem services of the 93 studied wetlands was undertaken using the Rapid Assessment of Wetland Ecosystem Services (RAWES) approach (Ramsar Convention 2018;

RRC-EA in press). RAWES was developed to support ecosystem service assessment of wetlands recognizing practical time and resource limitations faced by operational staff, providing a simple, user-friendly, cost-effective approach supporting systemic assessment of the full range of wetland ecosystem services (McInnes and Everard 2017). RAWES addresses the four ecosystem service categories (provisioning, regulatory, cultural and supporting services) defined by the Millennium Ecosystem Assessment (2005).

Expert assessors interacted with numerous local stakeholders, community groups, government officials, and non-governmental organisations. Consent to use anonymised feedback from interviewees was sought prior to interviews and meetings.

Semi-quantitative importance of each service is scored on a scale from 'significantly positive' (++) through 'neutral' (0) to 'significantly negative' (-) or 'unknown' (?). Data captured in hand-written RAWES field assessment sheets were transposed into spreadsheet format, with some modification in dialogue amongst assessors and other experts where more information became available. Groups of ecosystem services (all 36 assessed services or within Millennium Assessment categories) were summed and divided by the number of services in that category (up to provisioning n=9, regulating n=14, cultural n =7, supporting n=6 but reduced where services were not relevant) to derive a single comparable ecosystem services index (ESI) (based on similar index methods by Butchart et al. (2010), calculated using Eq. 1. The potential ESI range is from +1 to -1 when calculated for each of the four ecosystem service categories, though compound values for all

services can exceed these limits where benefits are realised at multiple geographical scales.

$$ESI = \frac{\sum (n_{+1.0} + n_{+0.5}) + \sum (n_{-1.0} + n_{-0.5})}{\sum n_{TOTAL}}$$

Based on the range of ESI scores for each of the services, the Figure 18 below was constructed illustrating the combined ESI scores for all ecosystem services under each category i.e., within river channel wetlands, along irrigation canal wetlands and isolated sumplands for all 93 wetland sites, as well as a breakdown of ESI for each service category (provisioning, regulating, cultural, supporting). As revealed from the data analysis, riparian wetlands reported maximum ESI scores (mean: 0.41), followed by irrigation canal-fed wetlands (mean: 0.39), followed by the isolated sumplands (mean: 0.33).



Figure 18: ESI scores of the services



Experts conducting community training for assessing ecosystem services index

## **Ecosystem health assessment**

Wetland Health Cards for the surveyed wetlands were prepared to help identify immediate threats and identify priority areas for future conservation works. The scores assess wetlands using nine indicators across four broad categories - Area, Hydrology, Biodiversity and Governance. The wetland health scores were categorized from A+ to E as per Table 8. The results indicate that nearly one third of the wetlands have very bad health score but the riparian wetlands exhibit better health as compared to isolated sumplands in the basin (Figure 19 and Map 21).

	Excellent	0.96-1.00	A+
	Very Good	0.91-0.95	А
	Good	0.86-0.90	B+
Haalth Saara	Moderate	0.81-0.85	В
Health Score	Fair	0.76-0.80	C+
	Bad	0.71-0.75	С
	Very Bad	0.61-0.70	D
	Worse	0.51-0.60	E

Table 8: Categorization of health score based on the ecosystem health assessment

In the upper reaches of the Above Ramganga Confluence sub basin, the riparian wetlands recorded good health scores. The wetlands here exhibit better health due to ambient water regimes, renewal and flushing of water and sediments and presence of regulating and management institutions. The isolated sumplands that lie within Protected Areas such as Shahpur in Muzaffarnagar district and Manshapur in Bijnour District too exhibit good health. This stretch of wetlands is part of the Hastinapur Wildlife sanctuary.



Figure 19: Health scores of surveyed wetlands



Map 21: Surveyed wetlands under different categories of health score in the 10km buffer zone on either side of the river Ganga in the sub-basin Above Ramganga Confluence in Uttar Pradesh

Further downstream, the health scores of wetlands were found to be poor in Bulandshahar District. The entire river stretch from Brijghat to Narora barrage is a Ramsar site. However, the water quality (DO) was observed to be below 4 mg/l. Besides, the wetlands do not have proper governance mechanisms in place such as a management plan leading to poor health scores. The poor quality of water is attributed to the effluents discharge from sugar, chemicals, fertilizers, engineering, cotton factories and tanneries and untreated domestic sewage from adjoining areas.

The health of irrigation canal-fed wetlands and riparian wetlands deteriorates even further below the Narora barrage, where the lower Ganga canal takes off. As observed, the wetlands sampled in Aligarh district recorded DO as low as 0 mg/l and were Eutrophic (cf. Section Wetlands water quality, Chapter 2). Riparian wetlands like Narupura in Badaun district and Sikri in Aligarh district and irrigation canal-fed wetlands as Bani Nagla -1, Sisai, Gangbas, Ajwaindher in Aligarh district all have worst health scores. It has been reported that the flow in the river is considerably reduced because of the diversions. Cities like Narora are heavily polluted (CPCB 2013).

As reported in 2020, the STP at Narora was not utilising its potential capacity due to lack of full household sewer connectivity and around 5 MLD of untreated sewage was being discharged in to the river. Besides poor water quality the wetlands in this have been subjected to agricultural conversions. Nutrient runoff from farms was cited to contribute to pollution loading in the wetlands. Absence or insufficiency of governance also adds to poor health rankings.



Landscape view of a section of the river stretch from Brijghat to Narora barrage

# **Risk of Adverse Change**

Gangetic floodplain wetlands in Uttar Pradesh have been subjected to a wide range of anthropogenic disturbances accentuated by rapid and unregulated development along with an increase in use of chemicals in agricultural inputs since advent of green revolution. As an offshoot of the same, the region saw an increase in population due to rapid economic activities with repercussions for natural ecosystems including wetlands.

Assessments of change in land use and land cover has brought to fore the loss of wetlands to the tune of 52535.18 ha amounting to 81.12% for the landscape, assessed for the period of 2000-2019. The primary causes underpin conversion to non-wetland uses, pollution, declining groundwater levels and unsustainable harvest as major stressors that have contributed to this loss of wetlands. Also, embankments constructed as a response to annual flood inundation regime of River Ganga which covers an area of 310 km (With over ~60%) in the state, has caused a significant reduction in riverine connectivity and have adversely influenced hydrodynamics of floodplain wetlands.

Requirements of water intensive crops introduced by green revolution has led to development of extensive network of irrigation canals that have added to fragmentation caused by linear infrastructure while simultaneously giving rise to a new set of wetlands that are sited along these structures, receiving their inflows from these canals. It has also added to non-judicious abstraction of groundwater often influencing the local hydrodynamics of the region. Also, indiscriminate use of chemical inputs like pesticides and fertilizers, required for achieving higher agricultural productivity of such crops, have increased the risk of their leaching into wetlands with consequences like excessive nutrient loading, proliferation of invasive floral species and eutrophication for the ecosystem with implications for population of native species and ecosystem's life sustaining functions.

Increasing upstream demand for water for agriculture and fragmentation of hydrological regimes through the construction of dykes and channels have caused an overall reduction in water availability, Increase in sedimentation, and shrinkage in the wetland floodplain area.

It was also observed during baseline survey that overall vulnerability of wetlands was also increased due to a general lack of awareness about values and functions of wetlands amongst shoreline communities, that at many places consider them as mere "wastelands". This attitude of apathy amalgamated with broader governance and management issues has led to overall deterioration in condition and functions of wetlands in the landscape.

Identification of direct drivers of adverse change in wetlands is an important step in designing of efficient and cost-effective strategies for management of such threats. For the wetlands located within landscape, 25 direct drivers of threat (parameters) were identified, based on secondary research and field data collected on the same by means of semi-qualitative primary survey. These parameters were further classified under 4 broad classes and 9 sub-classes based on the schematic

threat analysis provided by "Global Wetlands Outlook" 2018, as shown below in Table 9:

The threat data obtained through survey was then graded on a scale of 0-3, with 0 signifying none to 3, high level of threat faced by wetlands.

Scoring was done by considering highest score in respective sub class and then calculating percentile score based on sum of highest score attained and a grading system generated for the same based on following criteria.

Score Range	Assigned grade	Threat level
14 and above	A+	Very High
11	А	Very High
9	B+	High
7	В	High
4	C+	Moderate
3	С	Moderate
2	D	Low
1	E	Very Low

Table 9: Threat levels ascertained based on the score range and consequent threat grade.

All 93 sampled wetlands were assigned grades based on the threat scores and further analyzed for selection of corrective management interventions required for checking identified drivers of adverse change.

Baseline survey showed that extent of risk of adverse change was determined by the location of wetlands that influenced socio-economic, hydrological and developmental factors. Wetlands sited within river channel are found to be comparatively less threatened than those located along irrigation canals or as isolated systems within the landscape. Although the nature of anthropogenic threats was found to be somewhat similar across the three categories, the extent of vulnerability varied. A brief description of major threats, based on sample survey of 93 wetlands has been provided below:

Wetlands sited within river channel are found to be threatened most by introduction of pollutants majorly due to discharge of nutrient rich run-off from agriculture and dumping of solid waste. In certain wetlands, discharge of untreated wastewater was also witnessed. Almost 78.5% of wetlands were found to be affected with wastewater discharge with 42.8% having moderate levels of such introduction. While wetlands like Balawali in Bijnor witness moderate pollution load due to wastewater discharge and nutrient run-off from agriculture, others like Sikri wetland in Aligarh have reported higher loads owing to leaching of cattle and human waste. Over harvesting of resources was another threat that these wetlands are reported to be exposed to, with abstraction of water for irrigation from within and shoreline, being cited as a dominant threat. Almost 27% of surveyed wetlands were used for such sourcing of water. Most of these wetlands have agriculture as preeminent land use in surrounding region that makes them susceptible to such trends of water abstraction. Balawali wetland in Bijnore and Tigri in Amroha exemplify such trends with high levels of water abstraction. Fish harvesting has also been reported as a threat in almost 35.4% of wetlands with Naraura barrage reporting very high levels of fish catch.

Wetlands located along irrigation canal are majorly found to be threatened by introduction of invasive plant species like Eichhornia crassipes, Ipomoea aquatica etc. with almost 44% of sampled wetlands having various levels of invasion. Mahmoodpur in Muzaffarnagar have high presence of such species while Nandpur talab in Bulandshahar and sisai in Aligarh have moderate and low levels of invasive flora respectively. Major cause for their proliferation has been attributed to excessive nutrient loading ascribable to agricultural run-off from adjoining cultivated fields and leaching of animal waste. Another significant threat that endangers very existence of these wetlands is physical regime change being brought about by excess sedimentation. It afflicts around 75% of such wetlands and can lead to change in wetland attributes like depth and quality of water along with affecting mix of ecological communities that the wetland supports. Wetlands of Muzzafarnagar like Isshakwala and Samana are highly prone with moderate levels of threat. Conversion due to encroachments were found in more than 30% of wetlands, with expansion of agricultural land and linear infrastructure cited as a major reason for such a trend as witnessed in wetlands like Nandpur talab in Bulandshahr and Isshakwala in muzzafarnagar district respectively.

Wetlands categorized as "others" dominantly constitute isolated sumplands. Introduction of pollutants by discharge of wastewater, toilet sewage and solid waste disposal from the settlements present on the shoreline is reported to be the most dominant threat being faced by these wetlands. Of the surveyed wetlands, around 64.5% found at risk due to such introduction. It is also a major factor behind deterioration of water quality and has perilous impact on ecosystem services rendered by these ecosystems. Behsuma talab in Meerut, Gesupur wetland in Bulanshahr and Gajraula wetland in Amroha exemplify such vulnerable wetlands. Conversion to non-wetland uses was also found to be comparatively highest in this category owing to illegal encroachments and filling of wetlands for personal use by members of shoreline communities as seen in Khanpur khadar in Bijnor, Rampur Dhafarpur and Kuthila jheel in Farrukhabad district. Overall, 27% of surveyed wetlands were found to be encroached within the landscape.

Physical regime changes in terms of change in quantity of water inflows and outflows along with an increase in frequency of drying of wetlands was found to be highest within this category, which was ascribed to obstruction of flows, sedimentation and increase temperature due to climate change. Nakara in Kasganj district and Lalpur wetland in Meerut are examples of wetlands afflicted by such threats. Owing to their proximity to human settlements, dependency on these wetlands for resources like water, edible aquatic plants, fodder, fuel, soil etc. were found to be much higher, leading to risk of their over-exploitation. Primary assessments show that around 27% of wetlands are used to source water for irrigation while only 6.3% were used for domestic purposes. Poor water quality in majority of wetlands of this category was cited as a significant reason for such pattern of water use. Also, while overharvesting of fish was reported from 41.2% of surveyed wetlands such as Gesupur in Bulandshahr, excessive harvesting of wetland plants was found in around 10% of wetlands like Manshahpur and Chahadwala wetlands situated in Bijnor district. Unregulated and surplus extraction of soil was also reported as threat in almost 35% of surveyed wetlands. Although the perception of threat for this parameter was mostly low for majority of wetlands, few like Amilpur and Ravannaguljar bag wetlands in Farrukhabad reported high and moderate threat levels respectively (Figure 20 and Map 22).



Figure 20 : Comparative analysis of threats amongst three ecological categories



Map 22: Threat scores in the 10 Km buffer zone on either side of the river Ganga in the sub-basin Above Ramganga Confluence in Uttar Pradesh

# 4. Institutional Arrangements

Institutions play an important role in governing and coordinating relationships between various wetland stakeholders, and thereby their fit with ecological character has an important influence on wise use outcomes. Institutional requirements for conservation and sustainable management of the wetland complex are defined by the ability to ensure integration of site management within broad-scale environmental management and development programming including river basin management, and enabling participatory management, particularly ensuring involvement of local communities whose livelihoods are linked to wetland ecosystem.

This section of the management plan presents an analysis of existing institutions and governance settings with the intent of arriving at recommendations for the management of Ganga floodplain wetlands of Uttar Pradesh. The chapter includes an overview of existing settings and emerging lessons and gaps, and recommendations for enhancing the effectiveness of the regimes to secure wise use of floodplain wetlands.

## Existing institutional and governance arrangements

#### Policy and regulatory frameworks

The National Environment Policy of 2006 articulated the core policy elements of wetlands: including their inclusion in poverty alleviation and rural development strategies, and taking into account explicit impact of developmental projects on wetlands. The National Water Policy of 2012 (currently under revision) recommends adoption of a basin approach for water resources management and identifies conservation of river corridors, water bodies and associated ecosystems as an essential action area. The National Action Plan for Climate Change includes wetland conservation and sustainable management in the National Water Mission and the Green India Mission. The National Disaster Management Plan takes into account several non-structural measures for flood and cyclone risk reduction measures and makes direct reference to wetlands.

Provisions of the Indian Forest Act, 1927, the Forest (Conservation) Act, 1980 and the Indian Wild Life (Protection) Act, 1972 define the regulatory framework for wetlands located within forests and designated protected areas. The Indian Fisheries Act, 1897, The Water (Prevention and Control of Pollution) Act, 1974, and The Biological Diversity Act, 2002 provide instruments for regulating various development threats on wetlands. Further, under the Biological Diversity Act, 2002, the Central Government can issue directives to State Governments to take immediate ameliorative measures to conserve any area rich in biological diversity, biological resources and their habitats especially when the area is being threatened by overuse, abuse or neglect. The said Act also gives State Governments the powers to notify areas of biodiversity importance as biodiversity heritage sites. In 2017, the Ministry notified the Wetlands (Conservation and Management) Rules under The Environment (Protection) Act, 1986. The MoEFCC issued an Office Memorandum on March 8, 2022, reiterating that the 2,01,503 wetlands (>2.25 ha) as per the National Wetland Inventory and Assessment (NWIA), 2011 should be protected as per Rule 4 of the Wetlands (Conservation and Management) Rules, 2017. This regulation thus protects wetlands from development threats by prohibiting a range of activities such as discharge of untreated sewage, and construction within 50 meters of high flood lines. The Environment (Protection) Rules, 1986, empowers the Central government to prohibit or restrict the location of industries and carrying on of processes and operations in different areas including wetlands.

The Ministry of Water Resources, River Development, and Ganga Rejuvenation Notification of October 7, 2016, namely the River Ganga (Rejuvenation, Protection and Management) Authorities Order, 2016 sets the overarching regulation and management framework for the Ganga River System, including tributaries, floodplains and connected surface and groundwater regimes. The order defines floodplains as 'areas of River Ganga or its tributaries which comes under water on either side of it due to floods corresponding to its greatest flow or with a flood of frequency once in hundred years'. Rule 4 (ix) provides that the entire floodplain zone to be construction free zone to reduce pollution sources, pressures and to maintain its natural ground water recharge functions.

Several statutes of the Government of India and the Uttar Pradesh state government directly or indirectly support wetland conservation in Uttar Pradesh. These are described below in Table 10.

Regulation	Purpose	Scope	Key implications for
			management of Ganga
			floodplain wetlands
Wetlands	Provides the regulatory	All wetlands >2.25 ha	Prohibits:
(Conservation	framework for	except those covered	Conversion for non-wetland
and	conservation and	under the Indian Forest	uses
Management)	management of	Act, 1927, the Wild life	solid waste dumping
Rules, 2017	wetlands in the country	(Protection) Act, 1972,	discharge of untreated
under		the Forest	waste and effluents from
Environment		(Conservation) Act, 1980	cities and towns
(Protection) Act,			poaching
1986			
The River Ganga	Constitutes authorities	Applies to the states	National Mission for Clean
(Rejuvenation,	at central, state and	comprising River Ganga	Ganga, authority is
Protection and	district levels to take	Basin including Uttar	constituted under the Act. It
Management)	measures for	Pradesh	has administrative, appraisal
Authorities	prevention, control and		and approval powers and
Order, 2016,	abatement of		duties, functions and
amended 2019	environmental pollution		powers to identify specific
	in River Ganga and to		threats to River Ganga and
	ensure continuous		remedial actions, make the
	adequate flow of water		River Ganga Basin

Table 10: Key regulatory frameworks relevant for Ganga floodplain wetlands

Regulation	Purpose	Scope	Key implications for
			management of Ganga
			floodplain wetlands
	so as to rejuvenate the River Ganga to its natural and pristine condition		Management Plan to maintain adequate ecological flows in the River Ganga and tributaries and provention control and
			abatement of environmental pollution.
The Indian Wildlife (Protection) Act, 1972 and The State Wildlife Protection Rules, 2020	Protection of wild animals, birds and plants and for matters connected in addition to that	Applies to all wild habitats, protected areas, wild animals, specified plants, wildlife trade and related matters	Regulatory framework for management of all protected areas like National Parks, Wildlife Sanctuaries and Critically Endangered and Endangered Species.
Environment Protection Act, 1986	Umbrella law to provide for the protection and improvement of the environment, and for matters connected therewith	Covers all forms of pollution and empowers the central government to take any all measures for improving environment quality and lay down standards for emissions and discharges throughout the country	The EPA, 1986 and related Acts as the Water Act, 1974, the Water Cess Act 1977, the Wetland (Conservation and Management) Rules 2017 lay the framework of regulatory tools to deal with pollution from industries, towns and settlements located along the Ganges and wetland management. The provision of the Act can be invoked to make new statutes. The NMCG was constituted under the provisions of EPA,1986. The Act has been used to designate Ecological Zones and to specify the land uses that are permitted around Protected Areas.
The Water (Prevention and Control of Pollution) Act of 1974	Aims to prevent and control water pollution and to maintain/restore wholesomeness of water by establishing central and state pollution control board to monitor and enforce the regulations	National (Rules pertain to the State of Uttar Pradesh)	Lays down effluent discharge standards of sewage and sullage Provides for the constitution of State Level Boards for enforcement of various provisions of the Act.
The Indian Forest Act, 1927	An Act to consolidate the law relating to forests the transit of forest-produce and the duty leviable on timber and other forest produce.	Applicable to whole of India. Wetlands lying within notified forest areas are regulated as per the provisions of the Indian Forest Act of 1927, Forest	Reserved/Protected status is accorded to the wetlands. Acts that are detrimental to forest (wetlands included) health are prohibited and punishable. It applies to all protected areas.

Regulation	Purpose	Scope	Key implications for management of Ganga floodplain wetlands
		Conservation Act of 1980	
The Forest (Conservation) Act, 1980, amended in 1988,1996	Places a restriction on the de-reservation of forests or use of forest land for non-forest purpose by the state governments.		
The Biological Diversity Act, 2002	Conservation of biological diversity, sustainable use of its components and fair and equitable sharing of the benefits arising out of the use of biological resources, knowledge and for matters connected in addition to that or incidental thereto	National	Prohibits, without approval of the National Biodiversity Authority Obtaining any biological resource or knowledge associated thereto for research or for commercial utilisation or for bio-survey and bio-utilisation Transferring results for monetary consideration Application for intellectual property rights
The Uttar Pradesh Urban Planning & Development Act, 1973	Administration, protection, conservation and development of urban water bodies	Extends to the whole of Uttar Pradesh, excluding Cantonment areas and lands, owned, requisitioned or taken on lease by the Central Government for the purposes of defence	Legal basis for constitution and functioning of Development Authority Recommends activities to be undertaken or regulated
The Uttar Pradesh Fisheries Act, 1948	Protection, conservation and development of fisheries in the State of Uttar Pradesh	Extends to State of Uttar Pradesh	Vests all fishery with the Department of Fisheries, including powers to allocate rights, regulate fishing, and prohibit detrimental fishing Regulates fishing periods and practices; the formation of association of societies and the collection of funds for the uplift of fishermen and promotion of the fishing industry and designates fishery officer to investigate fishing offences
The Uttar Pradesh Water Management and Regulatory Commission Act, 2008 repealed in the year 2012 and re-enacted in	To regulate water resources within the State of Uttar Pradesh, facilitate and ensure judicious, equitable, and sustainable management, allocation and optimal utilization of water resources, fix	Applicable to Uttar Pradesh	The Act empowers the commission to Approve the integrated state water plan/Basis plans prepared by State Water Resources Agency (SWaRA) Determine the allocation and distribution of entitlements of various

Regulation	Purpose	Scope	Key implications for
			management of Ganga
			floodplain wetlands
year 2014 by ACT No. 321(2)/LXXIX-V- 1-14-1(Ka)2- 2014	rates for water use and cess on lands benefitted by flood protection through appropriate regulatory instruments according state water policy		categories of water use at utility, project level and between various water use entity. Review and accord clearances to new water resources projects proposed at the river basin level/sub basin level. Monitor conservation of environment and development of framework for preservation and protection of surface and groundwater quality Promote sound water management practices throughout the state
Northern India	To act and regulate	Guides the management	Defines the functions of the
Canal and	irrigation, navigation and	of irrigation canals and	Uttar Pradesh Irrigation and
Drainage Act No	drainage in northern	engineering structures in	Water Resource Department
8 of 1873	India. The Act entitles	the states of Uttar	in the Ganga basin that
	the provincial	Pradesh and the	includes construction of
	governments to use and	territories which	public works for irrigation,
	control for public	immediately before 1st	drainage and flood control
	purposes the water of	Nov. 1956 were	and navigation, develop
	all rivers and streams	comprised in the states	hydropower, supply water
	flowing in natural	of Punjab and Delhi and	for irrigation, assess
	channels and of all lakes	applies to all lands	irrigation revenues, settle
	and other natural	including permanently or	disputes and provide famine
	collections of still water.	temporarily settled or free from revenue.	reliet.

# Major organisations and programmes relevant to wetlands conservation

# A) Government Departments

# Department of Environment and Forest

Uttar Pradesh State Wetland Authority

In line with the notification of the Wetlands (Conservation and Management) Rules, 2017 the Government of Uttar Pradesh constituted the State Wetland Authority with the Hon'ble Minister (Environment) as the Chairperson and Principal Chief Conservator of Forest (Wildlife) as the Member Secretary.

With reference to Rule 5 (6)(b) of Wetlands Rules, the UPSWA has constituted a Technical Committee and a Grievance Committee. The Technical Committee reviews the Brief Documents, Management Plans and advise on any technical matter referred by the State Wetlands Authority. The Grievance Committee consists of four members to provide a mechanism for hearing and forwarding the grievances raised by the public to the UPSWA. The Uttar Pradesh State Wetland Authority (UPSWA) meets at least thrice in a year.

According to Rule 5 (4) of Wetlands Rules, the State Wetlands Authority exercises following powers to perform the said functions: a) Prepare a list of all wetlands of the State or UT within three months from the date of publication of these rules; b) Prepare a list of wetlands to be notified, within six months from the date of publication of these Rules, taking into cognizance any existing list of wetlands prepared/notified under other relevant State Acts; c) Recommend identified wetlands, based on their Brief Documents, for regulation under these rules; d) Prepare a comprehensive digital inventory of all wetlands within one year from the date of publication of these rules and upload the same on a dedicated web portal, to be developed by the Central Government for the said purpose; the inventory ought to be updated every ten years; e) Develop a comprehensive list of activities, to be regulated and permitted within the notified wetlands and their zone of influence; f) Recommend additions, if any, to the list of prohibited activities for specific wetlands; g) Define strategies for conservation and wise use of wetlands within their jurisdiction; h) Review Integrated Management Plan for each of the notified wetlands (including trans-boundary wetlands in coordination with Central Government), i) Recommend mechanisms for maintenance of ecological character through promotional activities for land within the boundary of notified wetlands or wetlands complex have private tenancy rights;; j) Identify mechanisms for convergence of implementation of the management plan with the existing State/UT level development plans and programmes; k) Ensure enforcement of these rules and other relevant Acts, rules and regulations and on a half-yearly basis (June and December of each calendar year) inform the concerned State Government or UT Administration or Central Government on the status of such notified wetlands through a reporting mechanism; I) Coordinate implementation of Integrated Management Plans based on wise use principle through various line departments and other concerned agencies; m) Function as a nodal authority for all wetlandspecific authorities within the State or UT Administration; n) Issue necessary directions for the conservation and sustainable management of wetlands to the respective implementing agencies. o) Undertake measures for enhancing awareness within stakeholders and local communities on values and functions of wetlands; and p) Advise on any other matter suo-motu, or as referred by the State Government/UT Administration.

Some of the recent major decisions of the UPSWA include:

- Notification of important wetlands under the provisions of Wetlands (Conservation and Management) Rules, 2017.
- Preparation of wetlands brief documents and their health report cards.

• 1,33,484\* wetlands have been notified in the State Revenue Records which gives protection from being used for any non-wetland use. (\*Ref. F.No. J-22012/36/2020-CS(W): Report submitted to National Green Tribunal).

# UP State Biodiversity Board

The Uttar Pradesh State Biodiversity Board (UPSBB) was constituted in the year 2006 (notification no. 1498/14-5-2006-57/2006) under the provisions of Section 22 of the Biological Diversity Act, 2002. The UPSBB meets twice a year under the Chairmanship of the Principal Secretary, Forest Department, Government of Uttar Pradesh.

The main functions of the UPSBB include:

- Advising the State Government, subject to any guidelines issued by the Central Government on matters relating to the conservation of biodiversity, sustainable use of its components and equitable sharing of the benefits arising out of the utilisation of biological resources.
- Regulating by granting of approvals or otherwise requests for commercial utilisation or bio-survey and bio-utilization of any biological resource by Indians.
- Performing such other functions as may be necessary to carry out the provisions of this Act as may be prescribed by the State Government.

Some of the recent major decisions of the UPSBB include:

- Formulation of the Uttar Pradesh State Biological Diversity Rules, 2010 vide notification no. 570/XIV-5-2010-57/2006 dated April 9, 2010.
- Constitution of Biodiversity Management Committees level for preparing, maintaining and validating People's Biodiversity Register (PBR) in consultation with the local people.
- Development of the state biodiversity strategy and action plan for 2030 & 2050

# District Ganga Protection Committee

The District Ganga Protection Committee (DGPC) are constituted vide notification by the Central Government in consultation with concerned State Ganga Committee in every specified district abutting River Ganga and its tributaries. The DGPC play a vital role in the prevention, control and abatement of environmental pollution in the river Ganga. The DGPC in each specified district consists of the District Collector as the Chairperson and the Divisional Forest Officer as the Convener. It is mandated that at least one meeting of the DGPC is convened every three months. The superintendence, direction and control of the management of the DGPC (including financial and administrative matters) however vests with the National Mission for Clean Ganga which may be exercised by it either directly or through the State Ganga Committee or any of its officer or any other authority specified by it.

The DGPC have the following powers and functions, namely: (a) identifying activities which may be threats in the area of specified district abutting the river

Ganga for protection of the river and its tributaries or its river bed and making a plan for remedial action and take remedial action in respect thereof; (b) taking remedial action at its own end for protection of river Ganga and its tributaries or its river bed abutting in the specified District (excluding enforcement of the provisions of this Order) (c) in the event of its inability to take remedial action, reporting (electronically as well as by sending written communication in hard copy) to the National Mission for Clean Ganga and concerned State Government, the State Ganga Committee, as the case may be, for issue of direction for protection of river Ganga and to formulate appropriate management or remedial actions. (d) taking suitable administrative and other measures, to give effect to the provisions of this order so as to prevent the environmental pollution in the river Ganga and its tributaries, not being inconsistent with the provisions of this order, or any law for the time being in force.

#### District Wetlands Committee

In 2009, the Government of Uttar Pradesh constituted the district-level wetland committees which were brought under the ambit of the State Wetlands Authority. The District Wetlands Committee works in association with the District Ganga Committee focusing at the basin level conservation efforts for water resources management. The District Wetlands Committee is entrusted with the task of surveying and demarcating wetlands of the district, creating a database on their current situation, and priority ranking for conservation and management needs based on traditional, social, and economic contexts. The committee is directed to forward the list of surveyed wetlands to the Principal Chief Conservator of Forests (Wildlife) for final notification.

The most significant informal institution engaged with the District Wetlands Committee in the management and conservation of Wetlands in Uttar Pradesh is the District Ganga Committee concerned with basin-level conservation efforts for water resources management. This organisation guides the engagement of the District Wetlands Committee with the multi-stakeholder forum through short-term and long-term action plans and work progress is evaluated through expert consultative meetings and workshops. The District Wetlands Committee also ensures to involve the network of Ganga Prahari and Wetland Mitras and empowers stakeholders to contribute to wetlands conservation. Ganga Praharis are motivated and trained volunteers from among the local communities working for biodiversity conservation and cleanliness of the Ganga River with the ultimate objectives of restoring the Nirmal and Aviral Dhara. These 'praharis' are selected through a series of site-level consultative meetings and workshops held in villages located on the banks of the Ganga River and its select tributaries. The local communities have been approached through other agencies too like State Forest Departments, Educational Institutes, National Cadet Corps (NCC), National Service Scheme (NSS) Mahila Mangal Dal, Yuva Mangal Dal, Nehru Yuva Kendras, and Ganga Vichar Manch, etc. to identify the potential Ganga Praharis. Wetland Mitras or 'Friends of Wetlands' Motivated volunteers from diverse stakeholder groups working together to protect wetlands, and actively engage in conservation initiatives to manage natural resources.

## Department of Namami Gange and Rural Water Supply, Govt. of UP

State Mission for Clean Ganga-Uttar Pradesh (SMCG-UP)

It is an extended arm of the National Mission for Clean Ganga (NMCG) for the state of Uttar Pradesh and implements the Namami Gange and other programmes through various executing agencies. At the state level it is implementing arm of the State Ganga Committee constituted vide S.O. 3187 E dated 7th October 2016 under Environment protection act 1986.

The primary obligation of society include:

- To coordinate and implement the activities of networking of sewerage and sewage treatment structures, remedial steps for treatment of wetland area, river conservation works including using other measures, development of river banks (riverfront), etc. at the state level.
- To ensure the state government's consent on the programmes and structures of the National Ganga River Basin Authority and obtain approval of the state government's share in these programmes.
- To generate public awareness by information, education, and publicity drive regarding abatement of water pollution, control, and treatment, environmental cleanliness of River Ganga.

#### Department of revenue and land records

State Disaster Management Authority

According to the guidelines laid down by the National Disaster Management Authority (NDMA), the Uttar Pradesh State Disaster Management Authority (UPSDMA) was set up in the year 2005. Following this, District Disaster Management Authority (DDMA) was instituted. The UPSDMA is accountable for various actions as envisaged in the National Disaster Management Act, as per Section 18 (2). It lays down guidelines to be followed by the different state and district departments for the purposes of integration of measures for prevention of disasters and mitigation in their development plans and projects and provides necessary technical assistance therein.

A committee was set up under the chairmanship of Principal Secretary Planning for mainstreaming Disaster Risk Reduction (DRR) into development. A Government Order on 'DRR Mainstreaming in development' was issued by the Chief Secretary on the basis of a study on entry points for DRR mainstreaming in development was conducted in the year 2013-4. The departments where mainstreaming initiatives are being carried out include; the Planning Department, Health Department, Fire Department, Civil Defence, Education Department, Panchayati Raj, State institute of health & family welfare, and State institute of rural development.

Integration of wetlands conservation and restoration in the district disaster management plan can be ensured which is critical for the long-term availability of

water resources to meet various development needs. The government of Uttar Pradesh has created a state disaster mitigation fund.

# Irrigation and Water Resources Department

The irrigation works started in Uttar Pradesh with the establishment of the first Irrigation Office in Saharanpur in 1823. Since then, the department has been responsible for execution, design and planning of irrigation and drainage and flood prevention works and overall water management in the state.

Canal irrigation in Uttar Pradesh is handled by the Civil organisation that operates under an Engineer-in-Chief (Project). The individual canal systems are overseen by respective Chief Engineers. In the ARC sub basin, the Upper Ganga canal in the canal started functioning in 1854 and its operation in Uttar Pradesh is supervised by the Chief Engineer (II) - Ganga, Meerut office.

The department focus has been on supply side management of water resources and diverting water from the Ganges to meet the growing demands of cities as Delhi, Noida, Greater Noida and Agra, thermal power plants, agriculture as well as for pilgrimage purposes. Canal irrigation is guided by a colonial era law<sup>1</sup> when water demands were low. Similarly, other water projects in the basin have received environmental clearances without adequate considerations for the ecological needs of the River and its floodplains. As assessed, water diversions from the river<sup>2</sup> amounts to 60 % of the annual runoff for Ganga up to Allahabad. Dependence on ground water in Ganges canal command has increased with reduced water availability for surface diversion. This in turn has led to lowering of groundwater tables. Lateral seepage from the boundary streams has gone up as consequence regenerated flows in river downstream is reduced.

The State Water Resources Agency (SWaRA) was created in June 2001 for management, planning and sectoral allocation of Water Resources (both Surface & Ground) to various agencies and to give legal base to the above preparation and use of Surface/Ground water and to work as a technical secretariat to the State Water Board. State Water Resources Data Analysis Center (SWaRDAC) has been setup to provide water related data to the State Water Resources Agency (SWaRA) and other Central/State water plans for all river basins of the State.

The Uttar Pradesh Water Management and Regulatory Commission (UPWaMReC) was created as an executing and enforcement, regulatory and advisory body in 2014 to regulate and recommend the tariff for water used for agriculture, industrial, drinking power and other purposes and also for levying cess on land benefited by flood protection and drainage works from the owners of land

 $<sup>^1</sup>$  the Northern India Canal and Drainage Act No 8 of 1873 and its UP-specific amendments  $^2$  Water amounting to 27.3 BCM per year

<sup>(</sup>https://www.rid.go.th/thaicid/\_6\_activity/Technical-Session/SubTheme2/2.15-Ravindra\_K.pdf)

benefited through appropriate regulatory instruments according to State Water Policy to assist the State for making policies and execution of the water resources within the State.

The State Water Resources Agency (SwaRa) in collaboration with an Israeli Consultancy firm undertook River Basin Assessments and Planning for all Major River Basins in Uttar Pradesh including the Ganga basin in 2020. The plan has identified encroachment of floodplains in the absence of demarcation of floodplains that is reducing groundwater recharge, Sand mining causing destruction of aquatic and riparian habitat, riverbed coarsening and degradation and other physical impacts as the major issues. The report also mentions the lack of coordination between different water user departments at the planning stage is the biggest hurdle in managing the water resources.

A more holistic approach to water management has been prescribed. The plan recommends the maintenance of Minimum Environmental Flow downstream of all possible diversions in the streams. Currently, there are no national guidelines available for such diversions. Most of such diversions are dealt with on case-tocase basis. Wetland specific actions proposed in the Ganga Basin plan are "Wetland development for recharge and environmental & socio-economic benefits such as drinking, fisheries, recreation etc." in 60419.52 ha area, estimated to provide an additional recharge of 101.54 MCM with estimated cost of Rs 4495.21 crores (at 2017 price level) to be implemented by the UPIWRD, Rural Development Department, Fisheries Department, Agriculture Department, Integrated watershed development with emphasis on soil and water conservation in 383676 ha area will provide an additional recharge of 63.52 MCM with cost of Rs 1918.38 crores is proposed to be implemented by the UPIWRD, the Rural Development Department and the Agriculture Department. State Water Resources Data Analysis Center (SWaRDAC) has developed the web-based Basin Assessment and Planning System (BAPS).

#### State Department of Culture & Tourism

The department promotes responsible wetland tourism supporting the local economy to protect habitat from disturbing activities. The state government is promoting major wetlands as tourism, recreation, and water sports hubs. These include the Ramsar sites also and are being accorded more importance than National Parks as these are repositories of rich and diverse biodiversity. Many of these wetland sites have spiritual and religious significance. The promotion of wetlands as a popular recreational and tourism destination will also provide local livelihood opportunities. Uttar Pradesh has the maximum number of nine Ramsar sites among the 49 designated sites in India. The development plan includes establishing boarding and lodging facilities and access to recreational activities like boating and water sports. The sites are being developed under the financial collaboration of the central and the state government.

In the sub-basin Above Ramganga Confluence, the state tourism department has promoted wetland sites as eco-tourism destinations. These include the Haiderpur

wetland in Muzaffarnagar district, the Upper Ganga Ramsar site in Bulandshahr, and the Shukr Taal in Hastinapur village in Meerut district. Some of the major tourist attractions in the precinct of the Hastinapur Wildlife Sanctuary in Meerut district are the remnants of the Mahabharata period, the holy pilgrimage site of the Jains Jambu Dweep, the famous temple of Shuk Dev in Shukr Taal, a temple with 72 feet high statue of Lord Hanuman and the bathing ghats at Garhmukteshwar.

# Panchayati Raj Department

The Gram Panchayat Development Plans serve as the vehicle for consolidated development of the village in the state popularly known as - Hamari Yojana hamara Vikas. The GPDP processes implementation started in the state in the year 2015-16. As per 15th Finance Commission recommendations, Rs. 1.42 Lakh Crore tied grant were given to Panchayats for Water & Sanitation during 2021-22 to 2025-26 in the country. Uttar Pradesh has received Rs 22,808 crore as grants for the above period. This is huge push to address issues of sanitation and environmental pollution as it will enable Gram Panchayats to shoulder the responsibility for potable water supply to every household and community centres and plan and take actions for greywater management, solid waste management, maintenance of open-defecation free status and improved sanitation in villages which will have a positive bearing on wetland health.

## **Fisheries Department**

Uttar Pradesh Fisheries Department was established in the year 1947, under Animal Husbandry Department with a view to carry out fisheries development in a planned manner. Central Sector Scheme "Blue Revolution: Integrated Development and Management of Fisheries" has been launched in the year 2016-17, bringing all the centrally sponsored /centrally funded schemes in one umbrella, under which various programs of fisheries development can be conducted. The Blue Revolution or the Neel Kranti Mission guidelines aims to create an enabling environment for integrated development of the full potential of fisheries of the country while ensuring the sustainability of, bio-security and address environmental concerns for enabling sustainability of the fishing industry and has been formulated at a total central outlay of Rs 3000 crore for five years. The tentative fund allocation for the Financial Year of 2019-20 for the state of Uttar Pradesh was Rs 30 crores.

#### Department of Rural development

The Mahatma Gandhi National Rural Employment Guarantee Act 2005 requires preparation of a district labour budget for next financial year estimating the anticipated demand for unskilled labour work in the district and a plan for need based works as approved by the Gram Sabha based on the Gram Panchayat Development Plans for the engagement of workers therein. The labour budget includes a component on Natural Resource Management. Under the scheme, 100% of funds in the pre monsoon months can be utilised for water conservation works. The work is taken in convergence and with other programmes of watershed development and irrigation.

Creation of Natural Resource Management assets has led to several positive environmental impacts as increase in groundwater levels, improved water quality. However, scientific planning for wetland conservation is a critical factor mostly lacking as the communities need to have the knowhow of local landscape or hydrology. Supervision of assets being created (whether external or internal) under MGNREGA, maintenance of asset quality and capacity development of the persons involved in planning and execution is needed to for ensuring better outcomes for wetland conservation. For the financial year 2022-23 the approved labour budget is Rs 2600 lakhs in Uttar Pradesh. 730 lakh person days have been generated so far (MGNREGA Portal dashboard as accessed on 20/6/22).

The Uttar Pradesh government plans to construct 789 ponds, each of 0.4 ha in the state under the newly launched national Mission Amrit Sarovar that will help in increasing the availability of water, both on surface and under-ground. The first Amrit Sarovar of the country was inaugurated in April 2022 in Rampur, Uttar Pradesh.

#### Department of Agriculture

The Prime Minister's Agriculture Irrigation Scheme (Per Drop More Crop) is a micro irrigation program that encourages the adoption of drip and sprinkler irrigation system in various crops. The scheme covers all the districts of Uttar Pradesh. The priority areas include clusters of ponds constructed/renovated under intervention of drop more crop in addition to overexploited, critical, semi critical blocks. The benefit of the scheme is admissible to farmers, members of cooperative societies, Self Help Groups, incorporated companies, Panchayati Raj Institutions, non-cooperative institutions, trusts, members of group of producer farmers on a first come first serve basis. The amount of grant is directly transferred to the beneficiary's account by Direct Benefit Transfer.

## B) Research & Accademia

Educational institutions specializing in different aspects of floral and faunal ecology carry out short and long-term studies supporting the conservation and management of ecosystems. Uttar Pradesh Environment and Forest Department in collaboration with the Wildlife Institute of India, Dehradun; Department of Wildlife Sciences, Aligarh Muslim University; Chaudhary Charan Singh University, Meerut, and IIT-Kanpur has carried out substantial research on aspects of wetlands conservation in Hastinapur Wildlife Sanctuary. Although the studies have been carried out in silos, sharing and updating information and knowledge among different sectors is important. To address the data and information needs for management planning, strong and effective linkages need to be established amongst different sectoral institutions.

Krishi Vigyan Kendras have been functioning as Knowledge and Resource Centres of agriculture technology supporting initiatives of public, private and voluntary sector for improving the agricultural economy in each district of Uttar Pradesh.

# C) Civil Society Organisations

Under the supervision of the District Collector of several districts, Wetland Brief Documentation Committees have been formed consisting of the citizenry (members) from the local community. In another district, Wetland Conservation and Development Authority has put forward the idea of appointing citizens as lake wardens and becoming a partner in conservation and management efforts by playing a watchdog and outreach role. The approach has however been revised by the MoEFCC and is incorporated as one of the pillars of the wetland rejuvenation programme. Other than this, a number of Non-profit organisations are engaged in developmental and conservation activities around the wetlands including the World Wildlife Fund (WWF) – India, which is making an effort to restore the ecological health of the Ganga in Hastinapur and trying to develop it into a model for aquatic biodiversity conservation. Another organisation is The Turtle Survival Alliance, which is presently undertaking a survey of turtle species in the Terai region of Uttar Pradesh.

# **Ownership aspects**

Of the 93 wetlands surveyed in the landscape, a majority (44 %) were fully controlled by the Gram Panchayats. Another 15% wetlands were partially owned by Gram Panchayats. Line departments viz. the Forests, the Revenue and Land Records, Railways and the Irrigation and Water Resources Development owned 31 % of the wetlands within the landscape. The wetlands present within protected areas (23.7%) are owned and managed by Uttar Pradesh Forest Department. Haiderpur and Isshakwala wetlands in Muzzafarnagar are examples of such wetlands. Individuals owned 4 % of the wetlands.

Few wetlands were also found to have no clear ownership with respondents citing a lack of clarity in knowledge on holders of land. Such wetlands constituted around 4.3% of total surveyed wetlands. Jalpur in Bijnor and Mansurpur Jheel in Muzzafarnagar District are examples of such wetlands. Digitization of land records and their ready availability will serve to resolve conflicts arising due to ambiguity in land ownership (Figure 21).



Figure 21: Graph showing the distribution of wetland ownership in Above Ram Ganga Confluence sub basin

# **Rights and privileges**

Communities exercise certain traditional and customary privileges and rights associated with the wetlands. These range from right to access, harvesting of resources, transit to practice of rituals and religious ceremonies. Survey indicated that privileges of cattle grazing and bathing / wallowing existed in 88.1% and 83.8% of wetlands respectively. Also, 30% of wetlands are traditionally used for harvesting plant material used as fodder, fuel, fibre, food, medicine, or decorative item. This was mostly an unregulated activity with little restrictions in in terms of quality or quantity resource harvested.

Fishing is done in 31% of wetlands, mostly by inhabitants of shoreline villages. 15% of wetlands are leased out for culture fisheries and inaccessible to public and are used exclusively by lessee. 11% of wetlands are also leased out seasonally for cultivation of edible aquatic plants like water chestnut. Plying of boats is mostly undertaken for fishing and transportation during monsoons in 21% of the wetlands. Gangabas wetland in Aligarh and Karanwas in Bulandshahr district are amongst wetlands that witness boat plying exclusively during monsoon months.

Customary religious and cultural rights are enjoyed by communities in 42% of the wetlands. They are used for conducting religious ceremonies including immersion of idols. Many annual fairs are also organized around wetlands. Rights and privileges were found to be restricted in wetland sites that are privately owned or are located within protected areas (Figure 22).

Although harvesting of plant material for fodder, fuel, fibre, medicines is largely an unregulated activity, with exception of fodder collection, it has witnessed a sharp decline, majorly due to changes in choices, degraded condition, and a decline in the availability of wetland resources.





Presence of such rights and privileges were also found to be a cause of degradation of wetlands, as witnessed especially in wetlands located within the agricultural landscape due to encroachment and deterioration of soil characteristics owing to excessive use of chemicals. Kulpur jheel in Hapur and Kalewala wetland in Muzzafarnagar are wetlands that are getting converted for agricultural activities, mostly due to community ownership. It is imperative that dependent communities are sensitized on importance and wise use of wetland resources to bring about a change in behaviour. Restriction on access and use to wise use thresholds and formulation of community-based resource management and allocation plans are some of the steps that will help reduce the degradational pressures.

# **Evaluation of existing institutional arrangements**

Enabling institutional conditions and	Status of current institutional arrangements	Key gaps			
implications for wetland					
management					
Defined user and resource boundaries					
Presence of well-defined	The wetlands have been entered in to	Ground demarcation of wetland			
boundaries around	land use records.	boundary is yet to be undertaken			
Ganga floodplain	Wetland maps prepared using satellite	for a majority of wetlands.			
wetlands is required to	data are available with the UPSWA	Maps available are not of			
ensure that management	Of the surveyed wetlands 44 % of	required scale to permit site			
zones and actions are	wetlands were owned by the Gram	level management and			
defined in spatial terms	Panchayats, 23.7 % were present	regulation			
and linked with user	within protected areas, Government	or 4.3 % of wetlands the			
access rights, adverse	departments owned 31% of the	ownership is not clear			
land and water use	wetlands.	For additional 32 % of wetlands,			
change is prevented, and		multiple ownership leads to lack			
communities have					

Table 11: Identifying key gaps in the status of the different components of existing institutional arrangements

Enabling institutional	Status of current institutional	Key gaps			
conditions and	arrangements				
implications for wetland	5				
management					
incentives for protecting		of congruence in management			
the wetland		arrangements			
		Balancing of preexisting rights			
		and privileges with conservation			
		outcomes is a challenge			
Congruence		outcomes is a challenge			
Rules for management of	The River Ganga (Rejuvenation,	Rules for conservation at			
Ganga floodplain	Protection and Management)	floodplain level are clearly			
wetlands conform to the	Authorities Order, 2016 sets the	outlined but their harmonization			
functioning of biophysical	overarching regulation and	with site level wetlands			
and social systems. The	management framework for the	conservation is a challenge.			
rules also balance the	Ganga River System, including	There is limited clarity on			
cost of enforcement of	tributaries, floodplains and connected	activities which are prohibited,			
management with the	surface and groundwater regimes.	regulated and permitted within			
benefit derived from	The order defines floodplains as	the wetland and its zone of			
wetland ecosystem	'areas of River Ganga or its tributaries	influence.			
services and biodiversity.	which comes under water on either	One third of the wetlands were			
,	side of it due to floods corresponding	found to have verv bad health			
	to its greatest flow or with a flood of	scores and another 18 % had			
	frequency once in hundred years'. Rule	worst wetland health scores			
	4 (ix) provide that the entire floodplain	suggesting deteriorating health			
	zone to be construction free zone to	status. This shows there is a			
	reduce pollution sources, pressures	lack of implementation of			
	and to maintain its natural ground	regulation and/or systematic			
	water recharge functions.	monitoring of water quality			
	Rule 4 of wetland conservation and	along the River Ganges and its			
	management rules apply to all	floodplains.			
	wetlands above 2.5 ha.	Over abstraction of water that			
	Wetlands within PAs are regulated	led to increased sedimentation			
	under the purview of Wildlife	and reduced flushing, decreased			
	Protection Act. 1972 and the Ramsar	groundwater recharge and			
	convention.	increased pollution			
	The Water (Prevention and Control of	concentration was reported			
	Pollution) Act, 1974 defines stream as	from several wetlands.			
	a river; water course (whether flowing	Supply side management of			
	or for the time being dry); inland water	water resources, water			
	(whether natural or artificial); sub-	diversions in the absence of			
	terranean waters; sea or tidal waters.	adequate knowledge base on			
	Section 24 of the Act prohibits any	Gangetic floodplain ecology and			
	person from person from knowingly	ascertaining the ecological flows			
	cause or permit any poisonous,	requirements of the River has			
	noxious or polluting matter	increased the risk of water			
	determined in accordance with the	pollution and adversely			
	standards laid down by the State	impacted biodiversity habitats,			
	Board to enter (whether directly or	fisheries and wetland based			
	indirectly) into any stream or well or	livelihoods.			
	sewer or on land				
	Northern India Canal and Drainage Act				
	No 8 of 1873 guides the management				
	of irrigation canals and engineering				
	structures in the states of Uttar				
Enabling institutional	Key gaps				
------------------------------	--	----------------------------------			
conditions and	arrangements				
implications for wetland					
management					
	Pradesh and the territories which				
	immediately before 1st Nov 1956				
	wore comprised in the states of				
	Punjah and Dolhi and applies to all				
	landa whathar parmanantly or				
	tomporarily acttled or free from				
	Environmental electronece under the				
	Elivitori mental clearances under the				
	for electronic of new prejects and				
	for clearance of new projects and				
	expansion and modernisation of				
	existing projects within the Ganga				
	River basin.				
Conflict resolution mechan	ism				
Low cost and effective	Several cases of conflicts were	Existing ambiguities in wetland			
conflict resolution	reported.	ownership in land records yet to			
mechanism are available	Between the Forest and Irrigation	be settled.			
for supporting the	department - Haiderpur wetlands	Gram Panchayats (and other			
implementation of	Forest department and the Gram	wetland owners) do not resolve			
wetland management.	Panchayat. Sikri village located in	wetland use related conflicts in			
	Muzzafarnagar District communities	a timely manner.			
	living within PA boundaries are not	District Wetland Committees			
	able to use the wetlands for fishing	should take measures to resolve			
	Agriculturists and fishers - Expansion	conflicts at the earliest			
	and intensification of agriculture is at	Wetland management needs to			
	the cost of fragmentation of wetland	be co-adopted by concerned			
	regimes and habitats	sectors.			
	Conflict resolution mechanism in the	Stakeholder views as yet are not			
	form of appeal to the relevant bench	getting incorporated in			
	of National Green Tribunal is provided	management planning			
	within the Wetland (Conservation and				
	Management) Rules, 2017.				
Minimal recognition of right	ts to organize				
Rights of communities to	Communities enjoy traditional rights	Checks and balances to be			
define management	and privileges to access wetland	placed to regulate community			
objectives for Ganga	resources.	rights and privileges in			
floodplain wetlands are	Data suggests over extraction of	accessing wetland resources			
not counter to existing	wetland resources (water and biota in	subject to the threshold levels			
government rules and	particular) that is adversely impacting	and to ensure equitable sharing			
regulations	the ecological character of wetlands	of benefits and maintaining			
		wetlands ecological character			
		There is no prescribed			
		monitoring and regulatory tool			
		to guide wetlands wise use and			
		ensure adherence			
		Lack of community level interest			
		and capacity for stewardship of			
		wetlands particularly in case of			

Enabling institutional	Status of current institutional	Key gaps		
conditions and	arrangements			
implications for wetland				
management				
		the Gram Panchayat owned		
		wetlands.		
Nested enterprises	L	I		
Institutional	Multitier institutional arrangements	Aligning departmental		
arrangements for	are in place to support basin to site	programmes and priorities that		
management of Ganga	level conservation efforts for River	traditionally have a sectoral		
floodplain wetlands are	Ganga and its floodplains with the	focus and are antithetical to		
linked with wider	District Ganga Committees	wetlands conservation is a		
developmental planning	constituted in 26 districts abutting	challenge specifically those		
within the Ganga River	Ganga and its tributaries in Littar	related to water management		
Basin	Prodesh under the superintendence	and agriculture development		
Dasin.	and control of the State Congo			
	Committee	vot to be tapped in to		
	The existing District Wotlands	There is a lack of institutional		
	Committees constituted by Col ID in			
	2000 is now guided by the Congo	integrated management of		
	2009 IS now guided by the Ganga			
	districts. The Divisional Forest Officer	bightighted for all wetlands		
	is the Convener of the District Conce	during workshapp on desired		
	Is the Convener of the District Ganga	during workshops on desired		
	Committee. The District Wetlands	management actions across the		
	Committee engages with a multi-			
	stakeholder forum through the District	I here exists weak coordination		
		across sectors and amongst		
	There is an opportunity to integrate	stakeholders was observed		
	wetland conservation actions within	Though UPSWA has the		
	the District Ganga Committee action	mandate to manage the Ganga		
	plans.	floodplain wetlands, policy		
	There are more funds available that	impetus for harmonized		
	can be deployed for wetland	planning in the basin does not		
	conservation through the NMCG.	exist. As of now there is a		
	Now there is greater scope for scaling	greater focus on need based		
	up wetland conservation actions and	short term actions. Consultative		
	adoption of integrated river basin level	mechanisms and cohesion		
	approach to wetland management.	amongst administrative units		
	The NMCG structure favours greater	will help to align the objective of		
	collaboration and capacities	integrated management		
	enhancement of different	planning of the Ganga floodplain		
	stakeholders (Government and Non-	wetlands and its systematic		
	government bodies) including the	monitoring, review and		
	nodal officers designated by District	adaptation with the priorities of		
	Ganga Committees.	the District Ganga Committees.		

# Proposed arrangements for managing Ganga floodplain wetlands

## Wetland management categories

The Ganga floodplain wetlands can be classified in to different categories based on the landscape setting, wetland use and whether the wetlands are situated within protected Area or outside (Table 12). Wetland ownership is heterogenous but ownership can be attached to each class based on the dominant institution.

• Wetlands within Protected Areas (PAs) - A number of wetlands are managed as protected areas. The management rests with the state Department of Environment and Forests. Haiderpur wetland is a Ramsar site situated within the Hastinapur Wildlife Sanctuary. The protected area status allows securing biodiversity habitats by limiting outside human disturbances supported by dedicated conservation funding from the department.

Outside of PAs, wetlands can be grouped in to different categories based on their landscape setting i.e., Rural or Urban.

- Ponds The wetlands less than 5 ha are classified as ponds. Mostly these wetlands fall within the jurisdiction of a Gram Panchayat. Funds are earmarked as part of village development plans for the development of wetland and water resources.
- Urban/Peri-urban wetlands The wetlands within urban limits are mostly managed by municipalities unless privately owned.

Another classifier is the wetland use and rights and privileges that communities enjoy in these wetlands. Mostly wetlands are used for agriculture.

• Agricultural floodplains - Agricultural floodplains are occupy peripheral areas around villages, rivers, roads. Located away from human settlements, many serve as buffer zones and as connectors and migration corridors between national parks, wildlife sanctuaries and reserved and protected forests.

A description of the four categories of wetlands which emerge on the basis of clubbing hydrogeomorphic classes and institutional arrangements in presented in Table 13

Table	12:	Distribution	of	the	three	different	wetland	types	according	to	their	management
catego	ories											

Wetland types	Features of	Protected Area	Wetland Use
N=93	surrounding	and Non-Protected	(Agriculture/Urban)/Ponds
	landscape	Area	
Within River	Rural – 15.1 %	Non-PA – 8.6 %	Agriculture – 1.1
Channel 16.1 %			
			Ponds – 7.5 %
		PA - 6.5 %	
	Urban - 0.0 %		
Along Irrigation canal - 17.3%	Rural - 15.1 %	Non-PA – 14 %	Agriculture – 6.5 %
			Ponds – 4.3 %
		PA – 4.3 %	

	Urban – 2.2 %		Agriculture – 1.1 %
			Ponds – 1.1 %
Isolated - 66.6 %	Rural - 61.3%	Non-PA – 49.5 %	Agriculture - 8.6%
			Ponds – 40.8 %
		PA – 11.8 %	
	Urban - 5.3 %		Agriculture – 2.1 %
			Ponds -2.1 %
		PA – 1.1%	

#### Proposed institutional arrangements

Mission Sahbhagita launched in 2022 to commemorate 75 years of independence, is a Government of India initiative for conservation and wise use of wetlands of national and international importance. The Mission prescribes a multitier institutional arrangement for the management of wetlands that is relevant and can be suitably adopted in the given context. The following institutional arrangement is proposed for management for the management of Ganga floodplain wetlands.

- At Site level: A cadre of ground volunteers such as the Wetland Prabhari assisted by a network of Wetland Mitra/Ganga Praharis coordinating site management, line government departments and agencies, knowledge partners, civil society organisations and corporate sectors.
- At District level: District Wetland Committees ensuring that convergence is built with district-level conservation and development plans and programmes.
- At State level: The Uttar Pradesh State Wetland Authority reviewing and approving site management plans and providing access to funds for implementing management from central and state-level public sector schemes, as well as corporate sector partnerships.

#### **Roles and Responsibilities**

#### Wetland Prabharis

The Wetland Prabharis may be responsible for the following activities:

- Install signages displaying information on wetland site's uniqueness, conservation significance, cultural significance and management arrangements
- Nurture a network of 'Wetland Mitra' for stakeholder engagement in wetland management actions
- Coordinate development of action plan for conservation and sustainable management

- Identify 'cultural icon(s)' and run community campaigns relating the icon to wetlands conservation and sustainable management
- Organize events linked to local legends/cultural values of the wetland.
- Design and implement citizen science programme such as Asian Water bird Census' to engage citizens in wetlands monitoring and management
- Coordinate targeted stakeholder education, awareness and behaviour change campaign to incentive affirmative actions for wetlands conservation and sustainable management through existing or refurbished wetland interpretation centres
- Commission baseline wetland inventories through the support of knowledge partners, corporate and civil society partners
- Connect with Panchayats and Municipalities in the vicinity; connect with local schools and teachers for awareness-raising among children and youth
- Coordinate implementation of the wetland action plan through funds from ongoing development plans and programmes, including through engagement with corporates
- Coordinate periodic wetlands monitoring and management effectiveness review to assess whether mid-course correction in wetland management implementation is required

## District Wetland Committees

The primary responsibilities of the District Wetland Committee include:

- Review wetland management plans, in consultation with all relevant departments and sectors
- Integrate wetland management actions in district level environment plans, disaster risk reduction plans, district development plans and others
- Build convergence of wetland management plan with district level development plans
- Periodic review of management plan implementation and monitoring outcomes

The Uttar Pradesh State Wetland Authority

The State Wetland Authorities will have the following key roles:

- Mapping of each wetland site with District Wetland Committees, Knowledge Partners, Corporate Sector and CSO Partners
- Designate a Wetland Prabhari for each wetland with a mandate to deliver roles and responsibilities as prescribed
- Review and approve management plans
- Ensure access to funds for implementing management plan actions by building convergence with conservation and development sector schemes
- Provide platform for business engagement in wetlands management
- Review wetlands monitoring information, and undertake mid-term course correction as may be required
- Notify wetland sites under Wetlands (Conservation and Management) Rules, 2017 and other extant regulation

Table 13: Detailed description of wetlands under the different ma	anagement categories
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Management	Area and other	Ecosystem services	Threats predominance	Ownership	Rights & privileges
categories	morphological features	predominance			
Wetlands within	Mostly large wetlands	The regulatory services	Despite their protected	Half of the	The rights and privileges
Protected Areas	(54% of the wetlands	of the wetlands are	status the wetlands	wetlands are fully	availed are to meet the basic
	have areas > 5 ha).	important as the large	face numerous and	owned by the	subsistence needs of PA
	Haiderpur (5206 ha),	wetlands play a	high levels of threats.	village	dwelling communities and not
	Purkazi (281 ha) and	significant role in		Panchayats. 32 %	for income generation.
	Ishaqwala (120 ha),	buffering floods.	Water abstractions for	wetlands were	Agriculture and commercial
	Samana (175 ha)	Besides the wetlands	irrigation emerges as	owned by the	fishing under lease not allowed
	wetlands are larger than	support groundwater	key threat. Discharge of	Forest	(only 4.5%).
	100 ha. Majorly the	recharge and direct	nutrient rich runoff from	Department.	Sustenance fishing and
	wetlands are natural	provisioning of water.	adjoining agricultural		aquatic plants extraction and
	oxbows /lakes. The		fields is threat		water withdrawal for
	wetlands are connected.	The wetlands also	associated with it.		agriculture was allowed in 23
	77 % have inlets and 64	perform significant			% of the wetlands (23%).
	% have outlets that	supporting functions.	Since the wetlands are		Grazing is permitted in most of
	connects to a river or	Hydrological	connected, they also		the wetlands (86%).
	adjoining wetland at least	connectivity creates	get affected by the		Use of wetlands for religious
	during monsoons and	conducive environment	alteration in natural		practices was low (13.6%).
	have water that is	for habitat	water inflows reducing		Withdrawal of water for
	flowing. Shoreline	heterogeneity and high	flushing. Deforestation		domestic use and plying of
	vegetation is present in	species diversity. The	and agriculture in		boats was not observed.
	most cases.	wetlands serve as	catchment increase the		
		migratory corridors.	sedimentation risk.		
Village pond	Small wetlands, 60 % are	Regulatory services is	Face numerous threats	Majority wetlands	Religious ceremonies
	less than 2.5 ha of which	high considering the	but the threat intensity	are under village	practiced around wetlands
	23% are smaller than 1	water security benefits	is low because of low	Panchayats (72%)	(59%).
	ha. The wetlands are	provided by the	population density in	and another 15 %	Withdrawal of water for
	naturally formed in flats	wetlands.	villages.	is owned by line	domestic use was observed in
	or depressions. Majority	Village ponds have high		departments	one fourth wetlands.
	wetlands (82%) are	cultural values as many	Threats are local.		Fishing and harvesting of
	isolated. Half have	religious ceremonies	Prominent is the	Panchayats are	aquatic plants is high and
	multiple inlets but very	are performed around	discharge of household	able to regulate	practiced in half of the
	few have outlets. The	waterbodies.	toilet sewage in wetland	and manage	

Management	Area and other	Ecosystem services	Threats predominance	Ownership	Rights & privileges
categories	morphological features	predominance			
	inlets drain sewage from	The wetlands do not	and discharge of	wetlands to some	wetlands (28% without lease
	the village in to the	provide any significant	untreated sewage.	extent as seen in	and 23 % under lease)
	wetlands. All the ponds	supporting service.		awarding the	Agriculture or horticulture
	are surrounded by roads	The provisioning		fishing leases.	within wetland was allowed in
	and settlements. Only 27	services of wetlands		Village ponds	one fifth of the wetlands.
	% have depths greater	are at par with		rank second in	Water withdrawal for
	than 1m. Majority (65 %)	agricultural wetlands		terms of health	agriculture of fishing in 36%
	remain only seasonally	and both are lower than		after the PA	wetlands
	inundated.	production system		wetlands.	Unlike the PAs boat plying was
		wetlands or urban			observed in 21% wetlands.
		wetlands.			
Urban and peri	71 % of wetlands < 3 ha.	The provisioning and	Wetlands have worse	57% are owned by	Community fishing and aquatic
urban wetlands	29 % > 5 ha. Mostly	regulatory services of	health scores. Close	local	plant harvest without lease
	wetlands are natural	wetland are high.	proximity to populous	governments.	was in 43 % wetlands pointing
	ponds. A few large		settlements subjects	29% by line	to largely an absence of
	wetlands about 100 ha		the wetlands to high	departments.	regulation and management.
	are marshes. The		intensity of threats as	Individuals own	Grazing allowed in all
	wetlands are surrounded		pollution.	14%.	wetlands.
	by built up as roads,				Lease given in 29 % wetlands
	settlements, railway.		Groundwater extraction	The wetlands are	for fishing. Boat plying was an
	Majority are isolated,		around the wetland is	more exposed to	associated activity I these
	have multiple inlets that		high.	degradation and	number of wetlands.
	carry household sewage			exploitation due	Agriculture and withdrawal of
	and no or a few outlets.			to institutional	water for irrigation allowed in
	Only 30 % are connected			neglect and lack	29 % wetlands.
	with wetland or rivers. 57			of maintenance	
	% wetlands dry up and				
	are seasonal.				
Floodplain	Moderate size wetlands	High regulatory and	The wetlands face	The wetlands are	Agriculture within wetland and
agriculture	with 63 % wetlands larger	supporting services of	threat of structural	situated along	water withdrawal for irrigation
wetlands	than 5 ha. 32 % wetlands	wetlands owing to their	modification through	canals and roads	is highest amongst all
	are 50 -100 ha in size.	groundwater recharge,	conversions to	and are majorly	wetlands (32%).
	They occur on flats. All	flood buffering	agricultural/	owned by the	Community use these
	are natural ponds or	functions and rural	horticultural uses and		wetlands (32 %) for capture

Management	Area and other	Ecosystem services	Threats predominance	Ownership	Rights & privileges
categories	morphological features	predominance			
	natural oxbows. More than half of wetlands are hydrologically connected at least during monsoons, majority have (63 %) depth less than 2 m. Half remain permanently inundated and rest are seasonal. Shoreline has vegetation in many wetlands.	landscape setting supports several ecotone species.	also discharge of nutrient rich runoff from agriculture	respective line departments (42%). 26% are owned by Panchayats and some have joint ownership (16%)	fisheries and harvest of aquatic plants. Boat plying quite high in about 42 %. This is probably linked with agriculture activities for ferrying farm workers and harvesting crops. Since the wetlands are located away from settlements, they are not used for religious practices. Regulated lease fisheries is and harvest of plants is even lower (10% and 5% respectively).
Production systems	Small wetlands 1 to 2 ha in size. A few are as large as 92 ha. Are natural ponds located on flats sometimes depressions. Are surrounded by major settlements. Majority are isolated. Half have inlets but majority wetlands do not have outlets. These have static water. 75 % are seasonal.	Wetlands have high provisioning services.	Wetlands have poor health. Leaching of animal and human waste is high besides many faces threat from discharge of household toilet sewage in wetland	75% owned by Line Dept. and 25 % under private ownership	Fishing/ wetland product harvest is unregulated and without any lease in half of the wetlands. No lease rights are being availed in the sampled wetlands. Rights to religious practices assumes importance (50%) Agriculture or horticulture within wetland in half the wetlands points to seasonal drying of wetlands. Withdrawal of water for agriculture was observed in half of the wetlands Boat plying in only one fourth wetlands

## 5. Management Framework

Management of floodplain wetlands of River Ganga needs to be based on the recognition of their full range of ecosystem services and biodiversity values, their relationships with ecosystem health, and mainstreaming into conservation development plans and programmes at all levels. The effectiveness of management will be reflected in the ability to sustain the multiple values of wetlands based on the traditional knowledge of communities that have evolved over time, without undermining the key ecological and social processes that underpin the functioning of these wetlands as socioecological systems. Wise use of floodplain wetlands of River Ganga will be realised when the capability of these wetlands to provide diverse ecosystem services and sustain rich diversity is maintained now as well as in the future, on pathways that are aligned with ecosystem principles and guided by sustainable development. The sustainable development framework, as adopted in 2015 calls for addressing five elements – People, Planet, Partnerships, Peace, and Prosperity.

The current chapter sets out the management planning framework including the management goal and purpose, management strategy, objectives, targets and indicators, and likely risks and risk-mitigation options pertaining to the implementation of the management.

#### **Management Goal and Purpose**

The overarching goal of managing the floodplain wetlands of River Ganga is "conservation and wise use of wetland ecosystems so as to sustain their full range of ecosystem services and biodiversity values including their contribution to River Ganga ecosystem health".

The purpose is to: a) enhance river ecosystem health, b) enhance water security in the Upper-Ganga basin, c) reduce water-related disaster risks to communities living in and around the wetlands, d) provide livelihood opportunities to local communities based on sustainable use of wetland resources and e) sustain habitats and migration corridors of wetland-dependent species.

#### **Management Strategy**

The ecological and hydrological connectivity of the floodplain wetlands with River Ganga provides the physical template in which these wetlands evolve and function. At the same time, the wetlands are also conditioned by the land use in the surrounding areas, traditional uses of the wetland, the cultural and relational linkages that communities have with wetland ecosystems, and the overarching regional developmental planning for different development sectors. Management of these floodplain wetlands is thereby proposed at two levels: a) the interventions at the sub-basin level which are aimed at ensuring that wetlands are embedded in the institutional and governance framework for water, land, and biodiversity management and b) interventions at wetland sites which address the direct drivers of adverse change.

#### Strategies for integrating wetlands within sub-basin level plans and programmes

As land and water resources development plans and programmes at the sub-basin level have a bearing on the functioning of floodplain wetlands, the set of strategies at the sub-basin level will be aimed at ensuring consideration of the full range of wetland ecosystem services and biodiversity values in the sub-basin level plans and programmes. The following strategies are proposed:

- Including wetlands conservation within the mandate of the District Ganga Committee. The committees would maintain an overview of the ecosystem health of wetlands within their jurisdiction, review implications of sectoral plans and programmes, commission specific research to address the knowledge gaps and approve the implementation of interventions at specific sites.
- Inventory assessment and monitoring of sub-basin scale processes that influence wetlands. These include weather patterns, geology and geomorphology, water regimes (surface and groundwater), land use and land cover change, and other parameters.
- Ensures the convergence of wetlands conservation action within the district-level plans for the environment, disaster risk reduction, agriculture, fisheries, and other sectors.
- Commissioning strategic impact assessment of major infrastructural development projects in terms of their likely impacts on wetlands and identify necessary impact-mitigation and abatement measures and ensure the implementation through appropriate institutional arrangements including the District Ganga Committee.
- Enhances public awareness of wetlands ecosystem services and biodiversity values through coordinated district-level campaigns.
- Develops the capacity of wetland managers in determining water regime requirements for wetland ecosystem health and communicating and engaging with concerned government departments to ensure their implementation.

#### Strategies for addressing drivers of adverse change within wetland sites

Based on the detailed inventory carried out, each of the floodplain wetlands and wetland complexes can be placed under one of the four categories: a) wetlands located within protected areas, b) floodplain agricultural wetlands, c) urban and peri-urban wetlands, and d) ponds within the jurisdiction of village panchayats (Map 23).

#### Wetlands located within Protected Area Network

Management of such wetlands is essentially targeted toward the protection and conservation of endangered wildlife species and their unique habitats. Thus, management is often supplemented with the Protected Area Plan or the Forestry Working Plan. The provisions of the Wildlife Protection Act 1972, and the Forest Conservation Act 1980 provide the basis for the regular monitoring and

management of such wetland. The focus should be on increasing the effectiveness of existing management arrangements for wildlife habitat conservation and restoration while reducing conflicts amongst stakeholders.

The strategy involves:

- Consolidation and demarcation of boundaries.
- Management zoning with the introduction of core and buffer zones.
- High biodiversity areas under private ownership can be recognized as 'Community Reserves' to strengthen the protected area network.
- Stricter enforcement of legal provisions and surveillance arrangements.
- Encourage long-term research by engaging local academic institutes and NGOs.
- Promoting livelihood options for local communities through sustainable ecotourism.

## Wetlands within the jurisdiction of Village Panchayat

Ponds (interchangeably used with the phrase 'wetlands within the jurisdiction of village panchayats') provide decentralized storage and local water security benefits to village communities. Water conservation activities by promoting the management of ponds is also a priority mission of the Jal Shakti Ministry, to be achieved through the application of participatory and integrated approaches to water management. Watershed treatment and water conservation activities are listed as Panchayat subjects. Wetland conservation will benefit from the strengthening of Panchayat's capacities to appreciate the benefits of wetland conservation and undertake the required conservation actions.

The strategy involves:

- Systematic and regular capacity development for PRI members.
- Increased participation and contribution of communities to decisionmaking by providing representation to PRIs in the District Wetlands Committee.
- Development of SOPs for wetlands conservation and sustainable use to guide village development planning.
- Mapping and building consensus on desired wetland conservation actions through Gram Panchayat Development Planning.
- Implementation of actions through Gram Sabha and convergence funds.
- Capacity development and involvement of village communities in monitoring and assessments activities.

## Floodplain agriculture wetlands

Gangetic floodplains are extensively used for agricultural practices. Promotion of sustainable agricultural practices which economizes water use and enhances productivity should form the core strategy. This should also include regulating the cropping pattern within the core inundation area in line with fluctuating hydrological regimes, by reducing the cropping cycle, allowing for lands to be left fallow during

monsoons for natural soil enrichment, and reducing area under water-intensive perennial crops. There is over-dependence on the use of groundwater for irrigation. This has a deleterious impact on the river ecosystem health and needs to be reduced.

The strategy involves:

- Awareness generation and incentivization to promote technology options such as the System of Rice Intensification (SRI) which are known to reduce water use by 40-50% and enhance productivity by 20-30%.
- Reducing the intensity of chemical fertilizer and pesticide use through promotion of organic cultivation and establishment of centers for the supply of quality agricultural inputs.
- Formation of SHG/farmers groups in villages to encourage adoption of alternate income generation programmes with technical support of Krishi Vigyan Kendras (KVKs) on Mushroom cultivation, Animal husbandry, and Poultry and dairy activities.
- Incentives in the form of farming equipment, training, and soft loans to be provided to farmer groups for the adoption of sustainable agricultural techniques.
- Sensitization of farmers on reducing groundwater use in agriculture and on the role of wetlands in providing local water security and irrigation benefits
- Monitoring and research activities pertaining to changes in land use and land cover within the wetland complex and basin, Overall water use pattern within the basin, Surface runoff, and trends in nutrient enrichment.

#### Urban and Peri-urban wetlands

Wetlands in urban and peri-urban settings serve multiple functions like that a water treatment plant, flood buffer, carbon sink, groundwater recharge, sediment trap, fish farms, habitats for urban biodiversity, etc. They form an important part of our natural wealth and liquid assets. The conservation of wetlands will immensely support achieving the Government's goal of 'Nal Se Jal' in each household. Under the Wetlands (Conservation and Management) Rules, 2017; construction of any permanent nature, solid waste dumping, and discharge of untreated waste and effluents from industries, cities, towns, and villages into the wetlands have been listed as prohibited activities. Hence conservation of urban wetlands should be aligned with master plans forming an integral part of the city and urban planning.

The strategy involves:

- Mapping of present and historical wetland regimes including landscape connectivity and preparation of a wetland restoration plan for all urban centres in consultation with water managers and all stakeholders.
- Revival of urban/peri-urban wetlands through various restoration measures (Such as boundary notification, removal of encroachment, restoration of inlets and outlets through selective dredging and desilting, cleaning, water treatment measures, catchment conservation measures) by embedding the restoration plan within AMRUT and Smart Cities mission.

- Creation of infrastructure for the interception, diversion, and treatment of point sources of pollution to manage the water issues (sanitation and availability of safe drinking water) of the city.
- Establishment of a systematic, monitoring and evaluation system involving various stakeholders to gauge the effectiveness of the implementation of wetland restoration actions and their benefits.
- Augment aesthetics of the wetlands for recreational benefits while preserving the ecological character of wetlands and their catchments.
- Plan for species conservation, habitat improvement, and maintenance of migratory routes should be developed as a core part of environmental protection.
- Capacity building, communications and outreach should be made an integral part of wetlands management.



Map 23: Distribution of wetlands in the ARC Sub-basin in accordance to their management category

# Management Objectives and Performance indicators

Table 14: Management objectives, performance indicators and desired outcomes in the study wetlands at the sub-basin and site levels

Level	Objectives	Performance	Desired outcomes
		indicators	
Sub-basin lev	el		
	Integration of multiple	The number of sectoral	Plans for water resources
	values of wetlands in	plans and programmes	development, irrigation, land
	sectoral development	wherein convergence	resources management,
	plans is enhanced	with wetlands	fisheries, and tourism do not
		conservation has been	lead to adverse impacts on
		achieved	wetlands
	A systematic wetland	Availability of long-term	A hierarchical wetland
	inventory assessment	monitoring records on	monitoring and assessment
	and monitoring system is	wetlands features	system is functional
	used to inform	Use of monitoring data	Monitoring reports are
	management decisions	and information to	produced periodically
	and assess	amend existing	
	effectiveness.	management	
		framework	
	Compliance with existing	Number of natural	All provisions of the Wetlands
	rules and regulations is	wetlands notified under	(Conservation and
	maintained	the Wetlands	Management) Rules, 2017 and
		(Conservation and	other extant rules and
		Management) Rules,	regulations are fully complied
		2017	with
		Number of violations	
		recorded of extant rules	
		and regulations	
Site-level			
Wetlands	Maintain hydrological	Duration of flood pulse	Inundation regimes (minimum
within PAs	connectivity with	and connectivity of river	and maximum) achieved in the
	catchments	channels with wetlands	past 30 years is maintained
	Maintain water quality to	DO levels	4mg/l or more
	support ecosystem		
	processes and services		
	Limit anthropogenically	Sedimentation guantity	Natural profiles of inlets and
	induced sedimentation	and location	outlets are maintained
	Maintain the naturalness	The extent of the	No concretization of the
	of shorelines	wetland shoreline	shoreline
		devoid of any built-up	Maintenance of at least 50 m
		area	buffer around the wetland
	Maintain and improve	Habitat diversity	No species extirpation
	habitat quality to support	,	Migration corridors for fish and
	the diversity of wetland-		large mammals (Swamp Deer,
	dependent species		Otters) are maintained
	. '		Sighting of key species is
			maintained in the range of 20%
			deviation from the average of
			the last five years
			Counts of migratory waterbirds
			are maintained in the range of

Level	Objectives	Performance indicators	Desired outcomes
			20% deviation from the average of the last five years
	Maintain and enhance populations of species of high conservation significance	Species diversity, richness, and populations trends	Species diversity, richness, and populations trends remain stable or show an increasing trend
	Enhance awareness of wetlands biodiversity and ecosystem services amongst stakeholders	The number of affirmative actions by stakeholders for wetlands conservation and wise use	Increase in affirmative actions
	Species invasion threats are reduced	Area of wetland under invasive species	Habitat is conserved Species that are native, ecologically sensitive, and of conservation importance are protected
	Preserve the recreational and touristic value of wetlands	Tourist footfall and ecologically sensitive behaviour of tourists	Visitors are informed and aware Number of tourists increases
Floodplain agricultural wetlands	Maintain hydrological connectivity with the wetland catchment	Duration of flood pulse and connectivity of river channels with wetlands.	Inundation regimes (minimum and maximum) achieved in the past 30 years are maintained
	Promote good agricultural practices aligned with wise use of wetlands	Cropping practices that do not modify water regimes or deteriorate water quality or introduce exotic species	No structural modification of wetland No introduction of chemicals, fertilizers, and pesticides No introduction of exotic species. No intensive water abstraction
	Maintain the naturalness of shorelines	The extent of the wetland shoreline, devoid of any built-up area	No concretization of the shoreline Maintenance of at least 50 m buffer around the wetland
	Maintain and improve habitat quality to support the diversity of wetland- dependent species	Habitat diversity	No species extirpation Migration corridors for fish and large mammals (Nilgai) are maintained Sighting of key species is maintained in the range of 20% deviation from the average of last five years Counts of migratory waterbirds is maintained in the range of 20% deviation from the average of last five years
	Enhance awareness of wetlands biodiversity and ecosystem services amongst stakeholders	affirmative actions by stakeholders for wetlands conservation and wise use	Increase in affirmative actions

Level	Objectives	Performance	Desired outcomes
		indicators	
	Promote local	Representation of local	Communities' views rights and
	stakeholder participation	stakeholders in wetland	capacities are reflected in
	in wetlands management	management	wetland management
		structures	decisions.
			Pro-active engagement of
			women, youth, and children in
			wetland management.
Urban and	Maintain the naturalness	The extent of the	No concretization of the
peri-urban	of shorelines	wetland shoreline,	shoreline
wetlands		devoid of any built-up	Maintenance of at least 50 m
ļ		area	buffer around the wetland
	Maintain hydrological	Duration of flood pulse	Inundation regimes (minimum
	connectivity with the	and connectivity of river	and maximum) achieved in the
	wetland catchment	channels with wetlands	past 30 years is maintained
	Maintain water quality to	DO levels, heavy metal	4mg/l or more
	support ecosystem	concentrations	Heavy metal conc. in sewage
ļ	processes and services		brought to permissible levels
	Limit anthropogenically	Sedimentation quantity	Natural profiles of inlets and
	induced sedimentation	and location	outlets are maintained
Γ	Maintain and improve	Habitat diversity	No species extirpation
	habitat quality to support		Migration corridors for fish and
	the diversity of wetland-		large mammals (Nilgai) are
	dependent species		maintained
			Sighting of key species is
			maintained in the range of 20%
			deviation from the average of
			the last five years
			Counts of migratory waterbirds
			are maintained in the range of
			20% deviation from the average
			of the last five years
	Preserve the scenic and	Absence of built-up	Preserved naturalness of the
	aesthetic beauty of	areas	landscape
	wetlands	Landscape naturalness	
	Preserve the recreational	Tourist footfall and	Registering higher revenues
	and touristic value of	ecologically sensitive	through tourism.
	wetlands.	behaviour of tourists.	
	Enhance awareness of	The number of	Increase in affirmative actions
	wetlands biodiversity and	affirmative actions by	
	ecosystem services	stakeholders for	
	amongst stakeholders	wetlands conservation	
		and wise use	
	Promote local	Representation of local	Communities
	stakeholder participation	stakeholders in wetland	views rights and
	in wetlands management	management	capacities are
		structures	reflected in
			wetland
			management
			decisions.
			Pro-active
			engagement of
			women, youth,
			and children in

Level	Objectives	Performance	Desired outcomes
		indicators	
			wetland
			management.
Ponds	Maintain the naturalness	The extent of the	No concretization of the
	of shorelines.	wetland shoreline,	shoreline.
		devoid of any built-up	Maintenance of a 50 m buffer
		area.	around the pond.
	Maintain water quality to	DO levels	4mg/l or more
	support ecosystem		
	processes and services		
	Maintain non-declining	Fish harvest (size,	No individuals of below
	harvest of fish and	quantity, and diversity)	minimum harvestable size in
	wetland plants for	Plant harvest	fish catch
	economic use	(abundance and type)	No use of illegal mesh size and
			gear in wetland fisheries.
			No harvest beyond regenerative
			capacity
	Preserve cultural and	Celebration of traditions	Continuation and perpetuation
	spiritual values and	and practices aligned	of wise use aligned with
	traditional and	with the wise use of	traditional and customary
	customary practices	wetlands	practices
	aligned with the wise use		
	of wetlands		
	Enhance awareness of	The number of	Increase in affirmative actions
	wetlands biodiversity and	affirmative actions by	
	ecosystem services	stakeholders for	
	amongst stakeholders	wetlands conservation	
		and wise use	
	Promote local	Representation of local	Communities' views rights and
	stakeholder participation	stakeholders in wetland	capacities are reflected in
	in wetlands management	management	wetland management decisions
		structures	Pro-active engagement of
			women, youth, and children in
			wetland management

#### Phasing

A functional score (FS) was derived for key functions of the wetland like groundwater recharge potential, flood buffering and water purification using the hydro-geomorphic approach wherein the wetlands were ranked as per the significance of functional attributes like geomorphology, water source, water permanence, hydrodynamics, soil type and vegetation. The score was then aggregated with the ecosystem service index (ESI) derived from the ecosystem services assessment using the RAWES tool for the surveyed wetlands. The aggregate score was the plotted in a quadrant chart against the threat score for the individual wetlands. Wetlands exhibiting High FS+ESI Score and High Threat Score were given High Priority for conservation and management. Wetlands having High FS+ESI Score and Low Threat Score and, Low FS+ESI Score and High Threat Score were given Moderate Priority for conservation and management Figure 23 and Map 24). The plotted graph (Figure 24 and Table 15 for all surveyed wetlands summarises the wetlands prioritised and categorized into three phases based on their significance for management interventions in the sub basin. Thus, Phase 1 corresponds to high priority, 2 to moderate priority and 3 to low priority wetlands respectively.



Figure 23: Phasing justification diagram based on cumulative aggregate of ecosystem services index, functional scores and threat scores



Figure 24: Categorising wetlands in the basis of their threat scores, ecosystem services index and phasing



Map 24: Surveyed wetlands under different categories of Priority in the 10 Km buffer zone on either side of the river Ganga in the sub-basin Above Ramganga Confluence in Uttar Pradesh

Wetland Type	Phase 1	Phase 2	Phase 3
Village Ponds	Palpur, Piprol Pukhta, Dhurra Khas urf Premnagar, Khai Khera, Chaurawala, Amilpur, Karanpur Datt, Kuthila jheel, Kharagpur khandauli, Soron, and Balawali	Bhavanipur Khalli, Rasulpur Bhawanr Ahatmali, Ashikpur, Deepanagla, Panihara, Gesupur, Kapsaipur, Karanwas, Bharatpur, Islamganj, Rajepur Raipur, Wazirabad, Hodalpur, Sadikpur Talaab, Rajarampur, Chahadwala, and Deepanagla 3.	Tikaikham, Mukarampur Mustakam, Shareefpur Sumali, Jaithal, Paratpur, Narupura, Raipur khas, Ajwaindher, Mohammadpur, Khadar, Niwadi khadar, Noorpur Tarsoura, Bahbalpur, Nakara Wetland, Johri, Gajrola achpal, Manshahpur 2, Mandawar.
Urban and peri- urban wetlands	Khairpur Khaerati, Kamalganj, and Rampur Dhafarpur	Gajraula, and Amartahl urf Unchagaon	
Floodplain agricultural wetlands	Sisai, Sikri, Hakimpur, Kalewala Jheel, Sikandarpur khurd, Ram Chittonni, and Khanpur Khadar	Gangabas, Bani Nagla- I, Kulpur Jheel, Kalyanpur Jheel, Bastoli Brahmapur, Deosi husenpur and Deepanagla 2	Naraura Barrage, Abhepur Bahlolpur, Kumrauwa, Sikandarpur, Sikandarpur 2, and Naugawan Jheel
Wetlands within PAs	Tigri, Mansurpur Jheel, Mahmoodpur, Ishhakwala, Raharwa Jadid, Lalpur, and Shahpur	Sujamna, Jalalpur Johra, Rustampur Bhikund, Sarai Khadar, Bhuwapur, Samana, Kothla Jheel (Khadar), Saidpura Urf Naipura, Badshahpur, Manshahpur-1, and Jalpur	Behsuma Talaab, Purkazi Rural, Haiderpur, and Ravannaguljar bag

Table 15: Category of wetlands in the ARC Sub-basin based on their phase and management category

## **Risks and risk-mitigation measures**

The management plan design is based on certain assumptions. Table 16 below identifies the risk associated with these assumptions in the management plan and possible risk-management measures.

Risk Risk-management measures		
At Goal Level		
District Ganga Committees have insufficient capacity to integrate wetlands in sectoral plans.	Formulate integrated management plans for conservation and sustainable use of prioritized wetlands. Build management and professional skills of sectoral authority members and staff to mainstream wetlands conservation in sectoral programmes and policies <i>inter alia</i> water resources development, rural development, agriculture, and urban development to ensure complementarity of the sectoral programmes with wetlands ecosystem services.	
Wetland conservation actions are restricted to a few large wetlands and not taken at a landscape scale.	Regulate and control all activities detrimental to the maintenance of biodiversity and other ecological components, processes, and services of the wetlands Ensure compliance with the existing national and state-level regulatory frameworks related to wetlands conservation SWA to approach the state government for enactment of any regulation for achieving conservation and sustainable management of wetlands in the state.	
Sectoral pursuits (such as agricultural intensification and large-scale afforestation programmes and urbanization) lead to wetland conversion.	Coordinate and facilitate implementation of the following activities (within the ambit of the site management plans) by different departments, organizations, institutions, and local agencies or communities: a) restoration of hydrological regimes, including improvement of water quality, b) control of silt load from catchments, c) management of plant and animal invasives, d) ecological restoration and habitat improvement, e) sustainable development of capture and culture fisheries, f) livelihood improvement and disaster risk reduction with communities living in and around wetlands, g) community-managed eco-tourism development. Ensure resolution of trans-catchment and multi-stakeholder conflicts.	

Table 16: Proposed risk management measures at the goal and objective levels

Risk	Risk-management measures
Ownership of wetlands is not clear with multiple departments and agencies staking their claim.	SWA to advise the state government, government and non-government agencies, and local authorities on matters pertaining to the conservation and management of wetlands. SWA to act as a nodal agency for clearing all technical matters related to wetlands conservation and management. Formulate policy guidelines for conservation and sustainable management of the wetlands of the state.
Wetland monitoring systems are not established and there is no effort for monitoring the effectiveness of management.	Based on scientific guidelines, a wetlands inventory, assessment, and monitoring system are to be developed and maintained to assess and respond to changes in the wetlands components, processes, and services. Environmental Impact Assessments (EIA) for developmental projects likely to create detrimental impacts on wetlands ecosystem services and biodiversity values are to be commissioned. Collate and disseminate periodic reports on the status of wetlands in the state.
At Objective Level	
Wetland management actions are not included within the approved PA management plans.	Management plans of protected areas must focus on the conservation of the forest ecosystem as one functional unit building management interlinkages between terrestrial and freshwater entities. Develop landscape-level approaches to ensure wetlands functioning and delivery of ecosystem services.
Sufficient human capacity is not allocated for implementing wetland management.	Conduct capacity needs assessments and identify priority training areas. Devise capacity development programmes for wetlands management.
Urban development projects lead to the concretization of wetland margins and an unsustainable concentration of infrastructural investment.	Recognize wetlands areas as ecologically sensitive within infrastructure development projects or plans.
Tourism is promoted without any connection to ecological sensitivity.	Develop awareness and outreach material for tourists.

Risk	Risk-management measures
	Conduct a capacity assessment to determine the level of tourism that can be supported at the site. Prepare do's and don'ts for activities permitted and prohibited in ecologically sensitive areas. Restrict tourist movement in ecologically sensitive areas.
Pollution abatement measures are energy-intensive and do not integrate the opportunity to use wetland-mediated solutions.	Promote nature-based solutions, such as wetlands management to ensure hydrological connectivity of the entire system. Restrict waste disposal activities that can alter wetlands water quality.
Livelihood concerns related to the adoption of good agricultural practices are not addressed.	Leverage compensatory schemes or provide alternative livelihoods such as through engagement in wetland-based tourism activities. Promote participatory management.
Conservation of ponds is not linked with Gram-Panchayat Development Plans.	The orientation of Gram-Panchayat towards the importance of wetlands and their management. Integrating wetlands functioning in Gram- Panchayat Development Plans. Promote participatory management.
Investment in behaviour change communication is insufficient and does not lead to awareness generation on wetland values and functions.	Consideration of stakeholder issues and feedback in management implementation.
Financing of wetland values and conservation is episodic and in project mode and not linked with systematic budget allocations.	Identify sectoral priorities and align them with the management of wetlands. For different wetlands management activities, an analysis of complementarity with ongoing development or conservation sector schemes may be done to assess the extent of funding that can be generated through convergence with these schemes. Opportunities for private sector participation should be identified and encouraged.

# 6. Monitoring Plan

Wetland management is an exercise in decision-making— choosing actions that are expected to best achieve the management objectives. Monitoring plays a central role in wetlands management because these ecosystems are dynamic and variable, and often do not align with the desired results of intended decisions and actions. There are several sources of uncertainty that affect natural resource decisions. Primarily, environmental variation in space and time often drives natural systems in ways that may or may not be consistent with management prescriptions. Secondly, many system variables are not measured directly (i.e., partial system observability), and thirdly, outcomes of management actions often deviate in degree and spatial extent from management prescriptions. Thus, by integrating monitoring into decision-making, adaptive management explicitly addresses these sources of uncertainty and allows decision-makers to simultaneously achieve management objectives and generate new knowledge about how the system responds to management.

Management of floodplain wetlands in the ARC is primarily focused on meeting the objectives of achieving 'wise use'. Having a system to monitor, detect and describe changes in ecological character is therefore critical to support decision-making for wise use of wetlands. Equally important is ability to assess the effectiveness of management in terms of the capacity to develop and implement integrated planning, management, and evaluation systems to secure wise use of the wetland.

This chapter describes a monitoring framework for the ARC sub-basin at the scale of both sub-basin and individual wetland sites to support integrated management for wetlands wise use. It essentially delineates monitoring objectives, strategy and associated resource requirements.

#### **Monitoring Objectives**

Developing a monitoring plan for the ARC sub-basin requires addressing the interrelated requirements of wetland inventory (which is the collection and/ or collation of basic information for wetland management) and wetland assessment (identification of status of, and threats to wetlands which provides a basis for wetlands monitoring. It is imperative therefore to put in place an integrated Wetland Inventory, Assessment and Monitoring System (WIAMS) to address the overall information needs for wetland management, and to provide a robust decision support system for the same. Following are the specific objectives for establishing WIAMS for ARC Sub-basin:

- Developing up-to-date and scientifically valid information on the status and trends of wetland features and influencing factors.
- Establishing a baseline for measuring the change in ecosystem components, processes, and services.
- Informing decision-makers and stakeholders on the status and trends in biodiversity, ecological functioning, and ecosystem services of the wetland

- Supporting compliance with national and state specific legal requirements and regulatory regimes.
- Determining the impacts of developmental projects on ecosystem components, processes, and services.
- Identifying risks to the ecological character and supporting the development of response strategies.
- Assessing the effectiveness of wetland management.

#### **Monitoring Strategy**

Monitoring is proposed to be undertaken at following two levels:

- Sub-basin level to explain status and trends in key hydrological and ecological processes that influence wetland functioning (Table 17).
- At specific sites that explain status and trends in wetland ecological character in response to natural and anthropogenic stresses (Table 18).

The monitoring parameters have been selected on the basis of their ability to reflect the degree to which management objectives are met.

Given the large number of wetlands in the floodplain zone, it is recommended that a few representative sites are taken up for monitoring purposes. These are as follows:

**Wetlands within Protected Areas (PA):** Tigri (Amroha); Badshahpur, Manshahpur (Bijnor); Ravannaguljar Bagh (Farrukhabad); Kothla Jheel (Hapur), Rustampur Bhikund (Meerut); Haiderpur, Ishhakwala (Muzaffarnagar).

**Ponds**: Ajwaindher, Sikri (Aligarh); Mukarampur Mustakam, Rasulpur Bhawanr Ahatmali (Amroha); Balawali, Gajraula Achpal, Manshahpur-2 (Bijnore); Piprol Pukhta (Badaun).

Floodplain Agricultural wetlands: Gangabas (Aligarh); Jaithal, Shareefpur (Amroha); Tikai Kham (Budaun); Karanwas, Hakimpur (Bulandshahr); Kuthila Jheel, Bahbalpur (Farrukhabad); Kulpur Jheel (Hapur); Kalewala Jheel (Muzzafarnagar), Narupura (Sambhal); Naugawan Jheel (Shahjahanpur).

**Urban and peri-urban wetlands:** Abhepur Bahlolpur (Aligarh); Gajraula (Amroha); Khairpur Khaerati (Budaun); Amartahl urf Unchagaon (Bulandshahr); Rampur Dhafarpur Kamalganj (Farrukhabad); Sadikpur Talaab (Kasganj).

The information needed for inventory are derived from the core datasets required to establish a baseline on ecological character for the sub-basin and contains all essential ecosystem components, processes, and services, as well as management related parameters that characterize the site. Within the aquatic environment, information needs pertain to inflow, quality, and ecosystem services such as provisioning, regulating, culture and supporting. At the level of wetland, information needs to pertain to land-use and land cover change, and threats such as over household effluent discharge. At the basin scale, the information required is related

to geo-morphological and climatological setup, as well as basin-wide management arrangements, particularly those related to land, water resources and urban planning. At all levels, information on institutional arrangements and management practices is included so as to enable the creation of a database on sectoral programmes, and the linked stakeholders, which are likely / have an impact on the wetland state. While not explicitly mentioned, strategic environmental assessments can be commissioned for any developmental project that has/is likely to have a negative impact on the wetlands.

Information needs for monitoring the ARC sub-basin have been derived from the assessment of ecological character carried out for the development of the management plan. Four clusters of needs have been identified: a) land use and land cover change, to assess the dynamics of land use within the catchment; b) hydrological regimes, to assess the flux of water, sediments, and nutrients; c) ecological components and processes, to assess the biodiversity, habitat quality and resource productivity; and d) socioeconomics and livelihoods to assess the trends in ecosystem services – livelihoods interlinkages. This monitoring information adequately addresses the needs of the ARC sub-basin under the Wetlands (Conservation and Management) Act, 2017, and the NPCA Guidelines, 2019.

The monitoring and assessment needs are envisaged to be addressed by a dedicated monitoring programme and specific research and assessment projects. Inventory, being based on collated information on identified wetland features and management practices, will be developed based on the monitoring and assessment information, as well as secondary sources. Inventory, assessment, and monitoring form an integral part of wetland management, and thereby the core activity of UPSWA. The management plan proposes to establish a dedicated wetland monitoring unit with adequate infrastructure support to effectively deliver this function.

Linkages also need to be developed so that data from the existing monitoring networks of different agencies (for example, inundation and flooding information from Central Water Commission and Department of Water Resources; groundwater quality and quantity from Central Ground Water Board; select surface water quality parameters from Uttar Pradesh Pollution Control Board; and fish production from Fisheries Department) can be accessed and shared. Similarly, provision for participation of NGOs and civil society in a monitoring programme has also been built, especially for socioeconomics and livelihoods aspects and biodiversity monitoring (for example, the waterbird census being implemented by NGOs under the aegis of the Asian Waterbird Census). Thematic management needs-based research can be taken up by specialized agencies such as ZSI, BSI, and CIFRI, to complement the monitoring programme. Table 17: Monitoring Parameters and corresponding indicators at the sub-basin level.

	Monitoring	Monitoring Indicator	Monitoring Method	Frequency	Location	1
	parameter					ĺ
Sub-	Ecological	Conservation Sector Plans	Number of wetlands conservation &	Review	Once in 10	
basin	Changes		management activities proposed		years	
			Collaboration between various	Review	Once every	
			stakeholders		year	
			Funds available through various Central	Review	Once every	
			and State Government schemes		year	
	Landscape	Development Sectoral Plans	Number of wetlands conservation &	Review	Once in 5	
	Changes		management activities proposed		years	
			Collaboration between various	Review	Once every	
			stakeholders		year	
			Funds available through various Central	Review	Once every	
			and State Government schemes		year	
	Institutional	Effective implementation of WIAMS (Wetlands	Availability of WIAMS	Review	Once every	
	Gaps	Inventory, Assessment and Monitoring Systems)			year	l

Table 18: Monitoring Parameters and corresponding indicators at the wetland site level

	Monitoring parameter	Monitoring Indicator	Monitoring Method	Frequency	Location
	Ecological boundary &	Wetland extent defined by	Remote Sensing & GIS	Once in 2 years	All Wetlands
	area	inundation & hydrophytic			
		vegetation			
me	Boundary defined by	PA boundary as per the respective	Literature review	Once in 5 years	Selected
fegi	Law & regulation	notification / Wetland boundary			Wetlands
al		as per the notification			
/sic	LULC within the	% Cover of various LULC classes	Remote Sensing & GIS	Once in 10 years	Selected
h	wetland	within the wetland boundary			Wetlands
ica		Inundation (Minimum, Maximum,	Remote Sensing & GIS	Once in 2 years	All Wetlands
e log		Interannual variability)			
gin		Inflows (Number,	Physical survey	Once every year	Selected
Le Hy		Seasonality/Extent of choking)			Wetlands

	Monitoring parameter	Monitoring Indicator	Monitoring Method	Frequency	Location
		Outflows (Number, Seasonality/Extent of choking)	Physical survey	Once every year	Selected Wetlands
		Water use (Volume and Purpose)	Physical survey (Bathymetric profile)	Once in 2 years	Selected Wetlands
	Water regimes	Water balance (Monthly)	Monitoring gauging station	Once every year	Selected Wetlands
		Water chemistry (DO, BOD, COD, pH, Nutrients, Heavy metals)	Physical survey (Standard protocols of CPCB to be followed)	Biannual (Winter & Summer)	Selected Wetlands
		Sediment flux (Inflow, Outflow & Balance)	Physical survey (Monitoring gauging station)	Once in 2 years	Selected Wetlands
	Sedimentary regime	Soil texture	Physical survey (Standard protocols of CPCB to be followed)	Once in 2 years	Selected Wetlands
		Soil pH	Physical survey (Standard protocols of CPCB to be followed)	Once in 2 years	Selected Wetlands
		Soil organic carbon	Physical survey (Standard protocols of CPCB to be followed)	Once in 2 years	Selected Wetlands
		Bathymetry	Physical survey (Bathymetric profile)	Once in 2 years	Selected Wetlands
	Connectivity	Extent of flood pulse (spatial and temporal)	Remote Sensing & GIS	Once every year	Selected Wetlands
		Active channels between river and wetlands and within wetlands	Remote Sensing & GIS	Once every year	Selected Wetlands
		Migratory pattern of key groups (Fish, Reptile, Mammals, Birds)	Physical survey	Once every year	Selected Wetlands
	Catchment boundary and area	Catchment area	Remote Sensing & GIS	Once in 5 years	All Wetlands
	LULC	% Cover of various LULC classes within the catchment	Remote Sensing & GIS	Once in 10 years	All Wetlands
Catchments	Degree of fragmentation	Location and Length of linear structures on wetlands inflow & outflow	Remote Sensing & GIS and Physical survey	Once in 10 years	All Wetlands

	Monitoring parameter	Monitoring Indicator	Monitoring Method	Frequency	Location
	Different forms of flora & fauna	Richness & Abundance List of Flora & Fauna	Physical survey	Once in 2 Years	Selected Wetlands
		Species distribution	Literature review and Physical survey	Once in 2 Years	Selected Wetlands
		Conservation status	Literature review	Once in 10 years	Selected Wetlands
		Relative abundance	Physical survey	Once in 2 Years	Selected Wetlands
		Keystone	Literature review and physical survey	Once in 2 Years	Selected Wetlands
		Economic importance of flora	Literature review and Physical survey	Once in 5 Years	Selected Wetlands
	Habitat	Туре	Physical survey and Remote Sensing & GIS	Once in 2 Years	Selected Wetlands
		Area	Physical survey and Remote Sensing & GIS	Once in 2 Years	Selected Wetlands
		Associated flora & fauna	Physical survey	Once in 2 Years	Selected Wetlands
		Biological importance	Literature review and Physical survey	Once in 2 Years	Selected Wetlands
	Vegetation cover	Туре	Physical survey and Remote Sensing & GIS	Once in 2 Years	Selected Wetlands
		Area	Remote Sensing & GIS	Once in 2 Years	Selected Wetlands
ats		Density	Physical survey and Remote Sensing & GIS	Once in 2 Years	Selected Wetlands
		Composition	Physical survey and Remote Sensing & GIS	Once in 2 Years	Selected Wetlands
& Habit		IVI (Importance value index)	Physical survey and Remote Sensing & GIS	Once in 2 Years	Selected Wetlands
Species	Migratory species	Population Counts	Physical survey	Once each year	Selected Wetlands

	Monitoring parameter	Monitoring Indicator	Monitoring Method	Frequency	Location
		Concentration areas	Physical survey and	Once each year	Selected
			Literature review		Wetlands
		Migration period	Physical survey	Seasonal	Selected
				(Winter Migrant;	Wetlands
				Summer Migrant)	
		Conservation status	Literature review	Once in 10 Years	Selected
					Wetlands
	Invasive species	Species list (Presence/Absence)	Physical survey and	Once in 2 Years	Selected
			Literature review		Wetlands
		Proliferation rate of invasive	Physical survey	Once in 2 Years	Selected
		macrophytes			Wetlands
		Proliferation rate of invasive fish	Physical survey	Once in 2 Years	Selected
		species			Wetlands
		Area occupied	Physical survey	Once in 2 Years	Selected
					Wetlands
	Species mortality	Incidental, Mass	Physical survey	Once in 2 Years	Selected
					Wetlands
	Type of ecosystem	Provisioning (Presence/Absence)	Field survey	Once in 5 Years	Selected
	service				Wetlands
		Regulatory (Presence/Absence)	Field survey	Once in 5 Years	Selected
					Wetlands
		Supporting (Presence/Absence)	Field survey	Once in 5 Years	Selected
spo					Wetlands
, ei		Cultural (Presence/Absence)	Field survey and Literature review	Once in 5 Years	Selected
vel					Wetlands
	Availability of the	Seasonal variation in ecosystem	Field survey	Once in every	Selected
se	ecosystem services	services		season	Wetlands
vice	Beneficiaries of the	List of stakeholders dependent on	Field survey	Once in 2 Years	Selected
Ser	ecosystem services	wetland services			Wetlands
E	Demography around	Population	Field survey	Once in 2 Years	Selected
ste	the wetland				Wetlands
so		Occupation profile	Field survey	Once in 2 Years	Selected
О Ш					Wetlands

	Monitoring parameter	Monitoring Indicator	Monitoring Method	Frequency	Location
		Duration of dependency on the	Field survey	Once in 2 Years	Selected
		wetland,			Wetlands
		Income profile	Field survey	Once in 2 Years	Selected
					Wetlands
a	Stakeholder mapping	List of formal & informal	Field survey; Workshops and	Once in 5 Years	Selected
		institutions and networks related	Literature review		Wetlands
rna		to wetlands management, their			
ove		mandates, roles & responsibilities			
Ğ		and decision-making process			
] St	Laws & Regulation	Policy, Legal and Regulatory	Literature review	Once in 5 Years	Selected
titution		Framework			Wetlands
	Resource availability	State, Central or CSR funds	Literature review	Once every year	Selected
su	(Finance & Human)	available			Wetlands
-		•	•		

## **Assessing Management Effectiveness**

Wetlands in the Above Ramganga Confluence sub-basin are dynamic ecosystems and so are their management needs. Management plans, which are developed based on assumptions known to managers, need to be periodically assessed to make sure that the set goals and objectives are being achieved.

The effectiveness of management towards achieving the overarching objective of maintenance of ecological character can be greatly enhanced if the following questions are periodically reflected upon:

- What is the current status of the wetlands in the landscape?
- Is the management achieving the goal of maintenance of ecological character?
- What are the current and future threats?
- Are adequate resources available for implementing management, and if not, how can they be accessed?
- Are management processes adequate, effective, and efficient?
- What other steps can be taken to improve management?

The Contracting Parties to the Ramsar Convention adopted R-METT (Ramsar Site Management Effectiveness Tracking Tool) to assist Ramsar site managers in assessing the effectiveness of management in achieving wetland wise use outcomes. The assessment looks into the following aspects:

- **Context** of management (wetland ecological character, threats, and risks of adverse change).
- **Management planning** defines how the management goals and objectives have been defined.
- **Inputs** including human, technical and financial resources applied to implement management actions.
- **Process** of management plan implementation.
- **Outputs** (tangible and intangible) that result from the implementation of management actions.
- Outcomes concerning the objectives defined by the management plan

It is proposed that management effectiveness assessments for ARC wetlands be done at least once in five years so that management action plans are revised and updated to reflect the real time condition of wetlands as well as the ability of management to prevent adverse changes in ecological character. A baseline assessment is proposed to be done at the inception of the management plan.

#### **Infrastructure and Human Resources Requirements**

Implementing the monitoring strategy as outlined in the previous sections requires the following physical and human infrastructure support:

• Remote Sensing and GIS unit with advanced capabilities of remote sensing image processing, preparation of maps and development and maintenance of spatial datasets.

- Ecological monitoring laboratory with capabilities for analysis of chemical, physical and biological properties of water and soil.
- Mobile-based citizen reporting system for recording and reporting illegal encroachments.
- Database management system for storing and retrieving monitoring and assessment data. The monitoring data would be stored along with metadata, as per the quality control procedures suggested in the following sections.
- Network of hydro-meteorological and water quality stations for real time monitoring of weather, hydrological -biological variables.

Deployment of the aforementioned resources can be done cost-effectively by applying the lessons and expertise of the existing infrastructure created by the state government for the management of floodplain wetlands. Need-based training programmes can also be conducted to upgrade the skills of the concerned state government departments and agencies.

## Reporting

Reporting constitutes an important element of the wetland monitoring programme. The intended user group, format, style and peer review requirements need to be set in the initial phases of set up of the monitoring programme. Periodic reports, for example as a part of the annual report of the UPSWA should aim to provide a summary overview of the outcomes of monitoring.

Special publications, for example, wetland atlases constituting thematic maps on various parameters are intended to inform stakeholders on wetland status and trends. Outcomes of specific assessments, for example, ecological character status and trends, economic valuation, environmental flows etc. could be made available in the form of technical report series, with an extended summary for a general readership. As the monitoring programs get sophisticated over a period of time, real-time monitoring options through the use of satellite-based data communication techniques can be explored.

## **Quality control**

Monitoring systems are required to ensure the scientific validity of sampling, laboratory analysis, data analysis and reporting. They also play a critical role in preventing the introduction of random and systematic errors in data collection, analysis and reporting. It is recommended that a Quality Management and Assurance Plan is developed for the monitoring programme. The plan should, *inter alia* specify the following:

- **Data quality objectives:** Maximum amount of uncertainty that can be tolerated to ensure that the data is fit for the intended use.
- **Sampling programme design:** Statistical robustness of sampling frame; Means to ensure that samples are representative of the environment; Sample recording; Procedures for minimizing environmental impact.
- Documentation: Procedures for field sample record-keeping and methods documentation.
- Sample processing validity (especially for water quality and biological components).
- **Data quality control methods:** Processes for quality control samples, duplicates and replicates; Performance audit procedures including data and systems audit.

## **Review and Adaptation**

A periodic review of the monitoring programme is required to determine the extent to which the objectives of wise use are met, support to management is achieved, and the monitoring system remains relevant for maintaining the wetland state (particularly in the light of new and emerging threats). The review process should also aim at increasing the sophistication of the monitoring system to be able to assess complex landscape scale processes affecting the ecological character of wetland and related management. The review process should include documentation on the way wetland inventory, assessment and monitoring information is being used to support management planning and policy goals. The review should also include identification of appropriate mechanisms to ensure that wetland monitoring is continued in the event of a funding shortfall.

# 7. Action Plan

Actions to meet the management goal, purpose and objectives (as outlined in chapter 5) are proposed at two levels, namely the sub-basin level to be coordinated by the UPSWA and site level to be coordinated by wetland managers working under the ambit of District Ganga Committees.

## Sub basin level action plan

#### Institutional Set-up

#### Notification of wetlands under Wetland Rules

It is proposed to notify the Ganga Floodplain wetlands under the Wetlands (Conservation and Management) Rules, 2017 to enable application of regulatory provisions. The Rules specifically prohibit conversion of wetlands for non-wetlands usages, direct discharge of untreated sewage from any source, dumping of solid waste, poaching, and any construction of permanent nature within 50 meters of the mean high flood level recorded in the last decade. The rules also require specification of a zone of influence, developmental activities within which are likely to adversely influence ecological character of the site. Finally, the State Wetland Authority, notified as per provisions of the Rules has also been entrusted with the task of putting in place an integrated management plan, clearly specifying activities which are to be regulated and permitted within the site, with corresponding thresholds and mechanisms for enforcement of the rules.

Following activities are to be taken:

- Seeking formal consent of the General Body of the UPSWA, to notify Ganga floodplain wetlands under the wetland rules
- Preparation of brief document for notification of the wetlands, containing:
  - Map of wetland boundary
  - Map of zone of influence
  - Ecological character description (information available in Chapter 3)
  - o Account of pre-existing rights and privileges
  - List of activities to be permitted within the Ganga Floodplain wetlands and their zone of influence
  - List of activities to be regulated within the Ganga Floodplain wetlands and their zone of influence
  - Modalities for enforcement of regulation (agency responsible for regulation, the mechanism through with regulation shall be done and penal provisions)
- Presentation of the brief documents and draft notification formulated as per the provisions of the Wetlands (Conservation and Management) Rules, 2017 for the approval of the UPSWA,
- Publication of draft notification on website of UPSWA and the Government of Uttar Pradesh for the notice of general public
- Revision of the draft notification, incorporating comments and objections received
- Seeking final approval of the draft notification from the State Wetlands Authority
- Publication of final notification in the State Gazette (to be completed within 240 days from the day on which the approval of State Wetlands Authority to notify the site is obtained)
• Publication of communication material in English and in Hindi for dissemination of information to stakeholders, particularly local communities

# Notification/Reorganization of District Wetland Committees

It is proposed to constitute/reform existing district level wetland committees for recommending what activities need to be regulated or permitted within the wetlands in each district, establishing thresholds, and regulation and imposition of penal provisions. The committees have to have representation from departments of fisheries, irrigation and flood control, urban development, revenue, agriculture, tourism, environment and wildlife. The committee may have representation from lakeshore fisher and farming communities to ensure that the regulations are arrived at by consensus and have support at various levels and of stakeholders.

In Uttar Pradesh, the District Wetlands Committee (DWC) were constituted in 2009 with an objective of inventorization of all wetlands in the state and their integration in land use records and were brought under the ambit of the State Wetlands Authority (SWA). The District Wetland Committees need to be reorganized and/or notified with a results oriented institutional structure. Specific activities to be undertaken in this regard include

- Finalization of Memorandum of Association and governance structure by the UPSWA, with government line departments, Panchayati Raj and Municipalities and other stakeholders
- Notification of the DWCs
- Staffing and work allocation as per the structure suggested.
- Conducting business as per the set Terms of Reference

# Infrastructure development-human resources

A reorganised for DWC is proposed to include following units:

- Planning and Design unit: Responsible for strategic planning for conservation and wise use, including assessing adherence to the various policy mandates and regulatory provisions.
- Wetland monitoring unit: Responsible for systematic wetland inventory, assessment with the state wetland monitoring and research center acting as the functional node. The unit shall also be responsible for assessing progress in implementation of various components by line departments and agencies.
- Engineering unit: Responsible for carrying out minor engineering and construction works.
- Watershed management unit: Responsible for monitoring catchment conservation works within the direct basin of wetland complex.
- Community engagement unit: Responsible for liaison with community and civil society organisations, and ensuring integration of community concerns within management actions.
- Communication and outreach unit: Responsible for external communications, based on a communications plan.

#### Integrated wetland inventory, assessment and monitoring system

An integrated wetland inventory, assessment and monitoring system is proposed to be set up to address the overall information needs of wetland management and to provide robust decision support system for the same. Specific objectives and a detailed framework have been outlined in Chapter 6 of the management plan. The following activities are proposed:

#### Establishment of wetland monitoring and research centre

A state-of-the-art wetland monitoring and centre is proposed to be operationalized for monitoring the ecological, hydrological and socio-economic features of the Ganga floodplain wetlands.

#### Development of database management system

A database system for storing, retrieving and analysing the WIAMS is proposed to be set up in a GIS environment. This will include:

- Development of data quality management and assurance plan including specification of data collection objectives, data quality objectives, sampling programme design, data and metadata documentation procedure, data quality control methods and performance audit procedures;
- Development of GIS based database management system

#### Wetland monitoring and evaluation

Wetland monitoring and inventory protocols for land use and land cover, hydrological regimes, ecosystem processes and biodiversity and socio-economics and livelihoods as proposed in Chapter 6 will be implemented.

#### Ecosystem Health Report Card

It is proposed to develop an Ecosystem Health Report Card, and publish biannually to assess and communicate wetland monitoring information to decision-makers and stakeholders. The health report card summarizes indicators along major indices (water quality, catchment status, biodiversity status) which represent various ecosystem features of the wetlands, and are reported against respective thresholds set in line with management goals. Such a report card will be biennially published in English and Hindi.

#### **Research Studies**

Following specific research studies are proposed to be commissioned to address the knowledge gaps in assessing status and trends in ecological character:

- Climate Risk Assessment Climate risk and vulnerability to assess perception of climate risks based on sensitivity and adaptive capacity of critical ecological character elements; climate scenarios with respect to ecological character; and risk management options.
- Hydrological connectivity assessment -
- Wetlands biodiversity assessments Study of floral and faunal abundance and community richness, population trends, conservation status, habitat suitability of wetland

dependent species and waterbirds, mapping of migratory corridors of swamp deer, otters and hog deer and breeding and spawning ground of fish

- Socio-cultural inventory of wetlands Identification and mapping of socio-cultural and religious values and customs associated with wetlands, historical linkages and heritage values of the floodplain wetlands
- Multiple wetland values assessment Demographic and socio-economic profiling of wetland dependent communities, resource use and wetland dependency, assessment and valuation of provisioning, supporting, regulating and cultural services

# Capacity development

Systematic capacity development of wetland managers, concerned line departments of state government, civil society and other stakeholders is proposed.

Following activities are to be carried out:

- Training needs assessment of the UPSWA, concerned state government agencies and departments and civil society. The assessment should be taken at two levels (at macro level – aligned with strategic goals of wetland conservation at the state level and the needs of integrated management, and at meso level – assess whether training is the solution, analyse performance and characteristics of the trainees). The assessment should identify: a) areas of training, b) who needs the specific training, c) mode of training and d) interventions required for maintaining built capacity.
- Development of a training plan for a five years period, and specify baseline for evaluation
- Implement capacity development activities as specified in the training plan (training workshops, exposure visits, on-job training etc)
- Use of the wetland webpage as a platform for wetland managers for the exchange of experiences and best practices
- Conduct effectiveness assessment and revise programme, as per need

# Communication and outreach

Stakeholder engagement in wetland management will be promoted through creating awareness on biodiversity and ecosystem services values, management strategies adopted and opportunities for participation. The ultimate objective is to incentivise affirmative behavioural change for conservation and wise use of wetlands at various levels of planning, programming and decision making. The sub basin level activities will complement the site level communication and outreach interventions and will be largely targeted at levels higher than district. Specific activities to be undertaken include:

# State wide wetland campaign

A wetland campaign is envisaged to be implemented at state level to promote higher awareness on the significance of wetlands and to promote citizen engagement in conservation and wise use of wetlands. Following activities are proposed

- Hiring of an expert agency to design the wetland campaign including key messages, target audience and communication objective, dissemination action (print media, electronic media, direct media and key performance indicators.
- Implementing the campaign by reaching out to the target audience with specific messages

• Monitoring effectiveness of campaign through the key performance indicators

#### Webpage

A dedicated webpage on wetlands of Uttar Pradesh is proposed to be developed and periodically updated with information, datasets and communication products. It is envisaged that the website would become an important interface of UPSWA and Government of Uttar Pradesh on issues related to conservation of wetlands.

#### Resource material

Brochures, fact sheets and awareness materials on Ganga Floodplain wetlands are proposed to be published in English and Hindi for public distribution. A coffee table book is also proposed to be published for serious nature lovers.

#### Newsletter

A biannual newsletter highlighting progress made in management plan implementation and key emerging issues related to Ganga Floodplain wetlands is proposed to be published annually in English and Hindi, and disseminated to all stakeholders.

#### Workshops and public events

Public events are proposed to be organized on the eve of World Wetlands Day (Feb 2), World Environment Day (June 5) and International Day for Biological Diversity (May 22) as a means of reaching out to public on the issues of wetland conservation and wise use. Public events on specific issues, as pollution abatement, sustainable fisheries, waterbird conservation and water management are also proposed to be organized as a means of engaging with stakeholders.

#### Management implementation and review

A mid-term and end-term review of management plan implementation is proposed to assess the extent to which stipulated objectives have been achieved with a high degree of resource efficiency and in participation with stakeholders. Wetlands International South Asia shall carry out the evaluation, specifically looking at the following elements:

- Degree to which wetland ecological character is being maintained as a result of management being applied
- Implementation quality, timeliness and resourcing of activities
- Quality and comprehensiveness of wetlands monitoring
- Effectiveness of management being applied, in terms of design, activities, outcomes and impacts
- Quality of stakeholder engagement in implementation of various activities and discharging wetland management functions
- Changes in external environment, requiring adaptation in management plan

# Site level action plan

Actions specific to four management categories are given below. The actions are guided by the wetland strategies outlined in chapter 5. While many actions others cater to category specific management needs, some of these activities apply to all categories. These are

# Agriculture floodplains

Activities to meet the objectives of the agriculture floodplains wetlands management category are proposed under different management interventions namely; institutional set-up, wetlands delineation and demarcation, enhancing hydrological regimes, pollution abatement, species and habitat conservation, resource development and livelihoods and monitoring and review. (Table 19)

#### Institutional set-up

- Formation of a multi-stakeholder forum as a *wetlands-mitra network* is proposed as an effective arrangement for cross-sectoral coordination and multi-stakeholder engagement in wetlands management. Specifically, the network shall:
  - Support implementation of various management activities on ground.
  - Promote awareness on wetland values and functions within community stakeholders.
  - Articulate community views and suggestions on various management interventions.
  - Support adoption of alternative and new knowledges/skills/technologies aimed at reducing livelihood vulnerabilities and advancing wise use of wetlands.
- Systematic wetlands inventory, assessment and monitoring system is proposed to be established to address the overall information needs of wetland management and support decision making and management.
- To support integrated management of wetlands capacity building of stakeholders needs to be enhanced through professional training workshops on:
  - Integrated wetlands management
  - Wetlands inventory assessment and monitoring
  - Land use planning for multiple wetlands use
  - Wetlands and climate change mitigation and adaptation
  - Integrating wetlands wise use in developmental planning
- The site-management plan is to be prepared by the concerned Divisional Forest Officer. After being endorsed by the PCCF-Wildlife (Principal Chief Conservator of Forests-Wildlife), it is subsequently approved by the SWA.
- Signage indicating the wetland as a Ramsar Site, an Important Bird Area or a Biodiversity Hotspot is proposed to be placed at all major entry points of the wetlands complex.
- Workshops and public events are proposed to be organized on the eve of World Wetlands Day (Feb 2), World Environment Day (June 5) and International Day for Biological Diversity (May 22) as a means of reaching out to public on the issues of wetland conservation and wise use.
- Public events on specific issues, as pollution control or water management are also proposed to be organized as a means of engaging with stakeholders.
- Development of resource material on the wetland including posters, brochures, pamphlets, films and education kits and Publication of newsletter.

#### Wetlands delineation and demarcation

#### Wetlands demarcation

It is proposed to demarcate wetland boundary by placing geo-tagged pillars all along the wetland periphery. Demarcation will be done using geo-tagged boundary pillars. Pillars will be placed at an interval of approximately 100 m or as the case may be. Approval of the demarcated boundary of the wetland will be obtained from the State Wetlands Authority. Activities to be carried out are as follows:

- Completion of field reconnaissance survey. Wherein detailed mapping of wetland extent using Remote Sensing and GIS and ground truthing will be undertaken.
- Removal of encroachments. The issue has to be addressed at the administrative level and removed following due legal processes.
- Placement of geo-tagged pillars. These will be concrete cemented pillars.

#### Enhancing hydrological regimes

Clearing of inlets and outlets

• Identification and cleaning and maintenance of inlets and outlets to identify flow impediments.

#### Pollution abatement

Constructed wetlands involving horizontal subsurface flow through large gravel and sandfilled channels that is planted with aquatic vegetation is proposed in prioritized wetlands as a pollution abatement measure. The location of constructed wetlands and design may be finalized in the first year of management plan implementation, and the wetland development work taken up in the second and third year of the management plan.

#### Species and habitat conservation

Creation and maintenance of People's Biodiversity Registers

- With support from the State Biodiversity Board (SBB), People's Biodiversity Registers are created at the local level under the guidance of the Biodiversity Management Committee (BMC).
- For creating the Peoples' Biodiversity Register, training by experts should be conducted to prepare document which contains comprehensive information on the landscape, demography of the village and locally available bio-resources. To prepare species inventories training by wildlife experts should be conducted on habitat mapping and identification of local flora and fauna.
- Training on Asian Waterbird Census (AWC) must be conducted annually during winter season. This is a must for wetlands that are known to be frequented by migratory waterbirds of the central Asian flyway.

Habitat mapping and surveillance

• Exposed to riverine flood pulses the floodplains serve as breeding and spawning grounds for fishes, migratory corridors for wildlife, and as habitats for ecotone species such as

Sarus Cranes. Actions include mapping of key habitat and breeding areas followed by regular monitoring and surveillance through community groups.

• Community sensitization and formation of bird protection committees to monitor waterbird habitats and to control any human disturbance. Incentives in the form of recognition and training as bird guides could be provided to the committee members.

Management of invasive species

- Growth of invasive macrophytes to be managed by either manual or mechanical removal of thick stands of emergent vegetation like *Phragmites karka, Ipomoea aquatica, Eichhornia crassipes* etc. to improve hydrological connectivity, check eutrophication and increase fish breeding areas.
- Control of invasive macrophytes such as Water Hyacinth can also be done through meshing of inlets.

# Resource development and livelihoods

Sustainable fisheries development

- Formation of user groups or fisher cooperatives as key community institutions managing fishery operations in the wetland complex. Revisiting institutional structure to ensure genuine co-operative character owned by their members, governed by their elected representatives and managed professionally. Wherever required, bye laws for management of society operations may be facilitated.
- Microcredit support provided through linkages with Fisheries Department and NABARD.
- Training on sustainable fisheries development through workshops on: sustainable fish culture practices, management of fish hatchery, integrated fish farming and policy and regulatory requirements for fish culture.
- Regulating use of banned fishing gears like use of mosquito nets for harvesting of fish.
- Controlling harvesting of fingerlings.
- Controlling introduction of exotic species by measures such as selective netting.
- Gears of mesh size 4cm or above ought to be promoted. This must be enforced on an urgent basis as panchayat owned ponds that forms a common property resource frequently witness such kind of activities.
- Construction and upgradation of jetties.

# Promoting sustainable agriculture practices

Krishi Vigyan Kendras function as knowledge centres on agricultural technology and should be involved in developing farmers capacities on sustainable wetland agriculture practices. Related activities are:

- Organising district level workshops for farmers and others stakeholders to promote and adoption of natural farming in wetland catchment zones. Wetlands like Bhavanipur khalli in Badaun, Deepanangla in Sambhal and Sikri in Aligarh districts having more than 85% of catchment area under agriculture should be prioritized for such activities.
- Capacity development of farmers on various aspects like soil aeration, intercropping, vermicomposting, soil conservation techniques, use of climate resilient and less water intensive crop varieties, water conservation techniques like drip irrigation, micro-irrigation etc. bio-manures, multiple cropping and adoption of eco-friendly practices should be facilitated in a zone/ district wise manner in collaboration with Krishi Vigyan Kendras

• Facilitate availing of farm loans on Kisan Credit Cards for marginal farmers and credit under NABARD refinancing schemes.

# Monitoring and review

A mid-term review of management plan implementation is proposed to assess the extent to which stipulated objectives have been achieved with a high degree of resource efficiency and in participation with stakeholders. An external committee on wetlands is proposed to be formed by the SWA to carry out the evaluation, specifically looking at the following elements:

- Degree to which wetland ecological character is being maintained as a result of management being applied
- Implementation quality, timeliness and resourcing of activities
- Quality and comprehensiveness of wetlands monitoring
- Effectiveness of management being applied, in terms of design, activities, outcomes and impacts
- Quality of stakeholder engagement in implementation of various activities and discharging wetland management functions
- Changes in external environment requiring adaptation in management plan.

nagement category - Floodp	lain Agricultural wetlands				-																								
Wetlands		Sambhal	Naraura Barrage	Deepanagla 2	Aligarh	Abhepur	Sisai	Sikri	Gangabas	Kumrauwa	Sikandarpur	Bulandshahar	Bani Nagla-I	Hakimpur	Shahjahanpur	Naugawan Jheel	Muzzafarnagar	Kalewala Jheel	Farrukhabad	Deosi husenpur	Hapur	Kulpur Jheel	Kalyanpur Jheel	Kasganj	Sikandarpur khurd	Sikandarpur 2	Ram Chittonni	Bastoli Brahmapur	Bijnor Khanniir Khadar
I Institutional Set-up																													
	Constitution of wetland mitra network		✓	✓		✓	✓	1	1	1	1		✓	✓		✓		✓		✓		✓	✓		✓	✓	✓	✓	V
	Training and orientation on wetland management		~	~		~	~	~	~	~	~		✓	~		~		~		~		~	~		~	~	~	~	•
	Issue-specific training		✓	✓		✓	✓	√	1	1	✓		✓	✓		✓		✓		✓		✓	✓		✓	✓	✓	✓	v
	Finalisation and endorsement of site- management plan		~	~		~	~	~	~	~	1		~	~		~		~		~		~	~		~	~	~	~	v
	Signage		✓	✓		✓	✓	√	1	1	✓		✓	✓		✓		✓		✓		✓	✓		✓	✓	✓	✓	¥
	Outreach programmes		✓	✓		✓	✓	1	1	•	1		✓	✓		✓		✓		✓		✓	✓		✓	1	✓	✓	v
2 Wetlands delineation & d	emarcation																												
2.1 Wetland demarcation			_																	_								_	_
	Placement of geo-tagged boundary pillars		•	~		~	~	•	1	~	1		~	~		•		✓		~		~	~		~	~	~	✓	۲
	Removal of encroachments																												
3 Enhancing hydrological re	egimes																												
3.1 Clearing inlets and outlets			_	✓									✓							✓					✓		✓	✓	v
4 Pollution abatement																													
	Constructed wetlands			✓			✓		✓	✓	✓		✓			✓				✓					✓	✓	✓	✓	V
5 Species and habitat conse	ervation																												
5.1 People's Biodiversity Register	f rs																												
	Training		✓	✓		✓	✓	✓	✓	✓	✓		~	✓		✓		✓		✓		✓	✓		✓	✓	✓	✓	v

# Table 19: Proposed phase-wise activities under the management category – Ponds category

Mana	gement category - Floodplain A	Agricultural wetlands																													
	Wetlands		Sambhal	Naraura Barrage	Deepanagla 2	Aligarh	Abhepur	Sisai	Sikri	Gangabas	Kumrauwa	Sikandarpur	Bulandshahar	Bani Nagla-I	Hakimpur	Shahjahanpur	Naugawan Jheel	Muzzafarnagar	Kalewala Jheel	Farrukhabad	Deosi husenpur	Hapur	Kulpur Jheel	Kalyanpur Jheel	Kasganj	Sikandarpur khurd	Sikandarpur 2	Ram Chittonni	Bastoli Brahmapur	Bijnor	Khanpur Khadar
		Creation of People's Biodiversity Registers		4	~		~	~	~	~	~	1		~	~		4		~		4		~	~		~	1	~	~		~
5.2	Habitat mapping and surveillance			✓	✓		√	1	✓	1	1	1		✓	✓		✓		✓		✓		✓	✓		✓	1	✓	✓		✓
		Mapping of key habitat areas																													
		Mapping of fish breeding and spawning grounds																													
		Formation of community groups to monitor habitats																													
		Community sensitization																													
5.3	Mangement of invasive species																														
		Removal of water hyacinth and other invasive macrophytes		•	~			•	•	•	~	~		~			~		~		~		•	1		~	~	~	~		1
6	Resource development and live	elihoods																													
6.1	Sustainable fisheries development																														
		Formation of user groups and setting up rules and regulations		~	~			~						~	✓				~		~					~		~	~		1
		Microcredit support																													
		Training on sustainable fisheries development																													
		Assistance for craft and gear																													
		Construction and upgradation of jetties																													
6.2	Promoting sustainable agriculture practices			4				1	~	•					✓		4		1							~	1	~	~		~
		Training through KVKs on sustainable wetland agriculture practices																													
		Microcredit support to farmers															_		_												

Mana	gement category - Floodplain A	gricultural wetlands																											
	Wetlands		Sambhal	Naraura Barrage	Deepanagla 2	Aligarh	Abhepur	Sisai	Sikri	Gangabas	Kumrauwa	Sikandarpur	Bulandshahar	Bani Nagla-I	Hakimpur	Shahjahanpur	Maugawan Jheel	Kalewala Iheel	Farrukhabad	Deosi husenpur	Hapur	Kulpur Jheel	Kalyanpur Jheel	Kasganj	Sikandarpur khurd	Sikandarpur 2	Ram Chittonni Ractoli Rrahmaniir	Bijnor	Khanpur Khadar
		Wetland agro-product based																											
		microenterprise																											
7	Monitoring and review																												
		Monitoring		✓	✓		✓	✓	✓	✓	✓	✓		✓	✓		✓	√	'	✓		✓	✓			✓			
		Monitoring (Representative Sites)		✓	1		✓	1	✓	✓	✓	✓		✓	✓		✓	-	•	✓		✓	✓			✓			
		Management plan mid-term review (External)		~	~		~	~	~	~	~	~		~	✓		~	~	•	~		•	~			~			

# Ponds

Activities to meet the objectives of the pond management category are proposed under different management interventions namely; institutional set-up, wetlands delineation and demarcation, enhancing hydrological regimes, species and habitat conservation, resource development and livelihoods and monitoring and review (Table 20).

#### Institutional set-up

- Formation of a multi-stakeholder forum as a *wetlands-mitra network* is proposed as an effective arrangement for cross-sectoral coordination and multi-stakeholder engagement in wetlands management. Specifically, the network shall:
  - Support implementation of various management activities on ground
  - Promote awareness on wetland values and functions within community stakeholders
  - Articulate community views and suggestions on various management interventions
  - Support adoption of alternative and new knowledges/skills/technologies aimed at reducing livelihood vulnerabilities and advancing wise use of wetlands
- Systematic wetland inventory, assessment and monitoring system is proposed to be established to address the overall information needs of wetland management and support decision making and management.
- To support integrated management of wetlands capacity building of stakeholders needs to be enhanced through professional training workshops on:
  - o Integrated wetlands management
  - Wetlands inventory assessment and monitoring
  - Land use planning for multiple wetlands use
  - Wetlands and climate change mitigation and adaptation
  - Integrating wetlands wise use in developmental planning
- The site-management plan is to be prepared by the concerned Divisional Forest Officer. After being endorsed by the PCCF-Wildlife (Principal Chief Conservator of Forests-Wildlife), it is subsequently approved by the SWA.
- Signage indicating the wetland as a Ramsar Site, an Important Bird Area or a Biodiversity Hotspot is proposed to be placed at all major entry points of the wetlands complex.
- Workshops and public events are proposed to be organized on the eve of World Wetlands Day (Feb 2), World Environment Day (June 5) and International Day for Biological Diversity (May 22) as a means of reaching out to public on the issues of wetland conservation and wise use.
- Public events on specific issues, as pollution control or water management are also proposed to be organized as a means of engaging with stakeholders.
- Development of resource material on the wetland including posters, brochures, pamphlets, films and education kits and Publication of newsletter.

# Wetlands delineation and demarcation

# Wetlands demarcation

It is proposed to demarcate wetland boundary by placing geo-tagged pillars all along the wetland periphery. Demarcation will be done using geo-tagged boundary pillars. Pillars will be placed at an

interval of approximately 100 m or as the case may be. Approval of the demarcated boundary of the wetland will be obtained from the State Wetlands Authority. Activities to be carried out are as follows:

- Completion of field reconnaissance survey. Wherein detailed mapping of wetland extent using Remote Sensing and GIS and ground truthing will be undertaken.
- Removal of encroachments.
- Placement of geo-tagged pillars. These will be concrete cemented pillars.

#### Creation of vegetative buffers

Afforestation activities to be promoted to arrest soil erosion. Indigenous soil binding plant species to be planted in consultation with local communities through PRA exercise. For raising plantations and maintenance following activities are proposed:

- Nursery raising through community organizations.
- Preparatory works, including deweeding and making pits for plantation.
- Plantation of saplings into the prepared pits.
- Protection measures (including watch and ward) from fire, cattle etc.
- The plantation shall be maintained for three years after creation, and handed over to the respective village committee for operation as per the approved Forest Working Plan.

#### Enhancing hydrological regimes

Clearing inlets and outlets

• Identification and cleaning and maintenance of inlets and outlets to identify flow impediments.

# Selective desilting

• Selective desilting of highly silted up wetlands areas to enhance their water holding capacity and overall wetland water regime stability.

# Pollution abatement

Village ponds are the ultimate recipients of untreated sewage and sewerage from the settlements which dot its periphery. Also, intensification of agriculture in adjoining areas has led to increased use of fertilizers and pesticides. Coupled with changes in circulation and mixing pattern, excessive loading of nutrients has promoted growth of macrophytic vegetation. Activities for pollution abatement are as follows:

- Survey of wastewater nallahs that are clogging the channels and increasing waterlogging.
- Manual scouring of scum and other waste material. The waste-collectors will form an integral part of the solid waste management system.
- Applying of in-situ inflowing nallah treatment for efficient control of sewage quantity and quality received within the wetland.
- Relocation of dumping sites. The wetlands may be designated a zero-waste zone. A management framework for this purpose, including components on regulation and behaviour change may be drawn up, in consultation with stakeholders. Screens/mesh are proposed to be placed at all inlets to prevent transport of solid-wate/plastic in the canal system of the wetland.

Species and habitat conservation

Creation and maintenance of People's Biodiversity Registers

- With support from the State Biodiversity Board (SBB), People's Biodiversity Registers are created at the local level under the guidance of the Biodiversity Management Committee (BMC).
- For creating the Peoples' Biodiversity Register, training by experts should be conducted to prepare document which contains comprehensive information on the landscape, demography of the village and locally available bio-resources. To prepare species inventories training by wildlife experts should be conducted on habitat mapping and identification of local flora and fauna.
- Training on Asian Waterbird Census (AWC) must be conducted annually during winter season. This is a must for wetlands that are known to be frequented by migratory waterbirds of the central Asian flyway.

Habitat mapping and surveillance

- Identification of potential areas for restoration and improvement as waterbird habitats.
- Maintenance of different forms of waterbird habitats based on inventorisation and habitat mapping:
  - Open water areas as feeding areas for diving species, such as pochards, grebes and coots, and as open roosting areas for other flocking waterbird species.
  - Reed beds and channels for migratory ducks and geese.
  - Reed beds and open marsh vegetation for nesting species.
  - Trees along wetland edge for tree nesting species.
  - Patches of wet grasslands and open grounds for grazing ducks, geese and shorebirds.
- Community sensitization and formation of bird protection committees to monitor waterbird habitats and to control any human disturbance. Incentives in the form of recognition and training as bird guides could be provided to the committee members.
- In areas important for reed nesting bird species, grazing and harvesting of macrophytes need to be completely banned during breeding season.
- For areas of tree nesting bird species, cutting of trees and tall bushes along the periphery of the wetland to be banned.

Management of invasive species

- Growth of invasive macrophytes to be managed by either manual or mechanical removal of thick stands of emergent vegetation like *Phragmites karka, Ipomoea aquatica, Eichhornia crassipes* etc. to improve hydrological connectivity, check eutrophication and increase fish breeding areas.
- Control of invasive macrophytes such as Water Hyacinth can also be done through meshing of inlets.

# Resource development and livelihoods

Sustainable fisheries development

• Regulating use of banned fishing gears like use of mosquito nets for harvesting of fish. Gears of mesh size 4cm or above ought to be promoted. This must be enforced on an urgent basis as panchayat owned ponds that forms a common property resource frequently witness such kind of activities.

- Controlling harvesting of fingerlings.
- Controlling introduction of exotic species by measures such as selective netting.

#### Water Hyacinth-based enterprise

Promoting alternate/additional livelihood options based on value addition to existing resources e.g., develop a community led handicrafts enterprise based on macrophytic vegetation such as Water Hyacinth. Other micro-enterprises to reduce pressure on wetland resources such as apiculture may also be promoted.

#### Multi-purpose shelter

Strengthening community managed disaster risk reduction capability in the villages through promoting contingency planning and community risk reduction interventions such as construction of flood shelters, fuel bank and grain bank.

Construction of approach roads as a comprehensive coverage of facilities to the villages. Other incentives particularly focussing on marginalised communities (fisher) include provisioning of safe drinking water supply, sanitation and health facilities, and community toilets.

#### Monitoring and review

A mid-term review of management plan implementation is proposed to assess the extent to which stipulated objectives have been achieved with a high degree of resource efficiency and in participation with stakeholders. An external committee on wetlands is proposed to be formed by the SWA to carry out the evaluation, specifically looking at the following elements:

- Degree to which wetland ecological character is being maintained as a result of management being applied
- Implementation quality, timeliness and resourcing of activities
- Quality and comprehensiveness of wetlands monitoring
- Effectiveness of management being applied, in terms of design, activities, outcomes and impacts
- Quality of stakeholder engagement in implementation of various activities and discharging wetland management functions
- Changes in external environment requiring adaptation in management plan.

# Table 20: Proposed phase-wise activities under the management category – Ponds category Management Category - Ponds

Fianagement Category - Tolius																																									
Wetlands		<b>Badaun</b> Bhavanipur Khalli	Palpur	Piprol Pukhta Tikaikham	Amroha	Mukarampur Mustakam Rasulpur Bhawanr Ahatmali	Ashikpur	Shareefpur Sumali laithal	Sambhal	Deepanagla I Paratpur	Narupura	Deepanagla 3	Aligarn Dhurra Khas	Panihara	Raipur Kha Aiwaindher	Bulandshahr	Gesupur Mohammadnur Khadar	Kapsaipur	Karanwas	Niwadi khadar Nandar Talaah	Shahjahanpur	Bharatpur	Islamganj Rajepur Raipur	Noorpur Tarsoura	Muzzafarnagar	vyazirabau Khai Khera	Chaurawala	Farrukhabad Amilbur	Karanpur Datt	Kuthila Jheel	banbaipur Kharagpur Khandauli	Kasganj	Nakara Wetland	Jonri Soron	Hodalpur n	Sadikpur Talaab <b>Bijnor</b>	Balawali	Rajarampur	Chahadwala Gairola Achpal	Manshahpur 2	Mandawar
I Institutional Set-up																-					-			-			-			<u> </u>			<u> </u>	<u> </u>	H		H	<u> </u>	<u> </u>	H	
	Constitution of wetland mitra network	1	1	<	·	11	· •	<b>1</b>	•	<b>√</b> √	1	✓	1	· 🖌	<b>√ √</b>	·	¥ 1	1 1	· 🖌	<b>/</b> ,	1	1	1 1	1		1 1	1	٧	<ul> <li>I</li> </ul>	<ul> <li>✓</li> </ul>	< <	<i>,</i>	<b>1</b>	1 1	1	✓	1	✓	<b>v</b> v	11	1
	Training and orientation on wetland management	-	1	• •	•	• •	•	• •	•	• •	• •	~	~	•	• •	•	<b>~</b> .	/ /	•	•	1	•	• •	1			-	•	•	<b>√</b> .	• •	-	•	• •	1	~	1	•	• •		1
	Issue-specific training	1	1	1 1	•	1 1	1	1 1		< <	1	✓	1	•	1 1	·	۷ ،	1 1	•	<b>،</b>	1	1	1 1	1		1 1	1	v	1	<b>イ</b> ・	1 1	1	<ul> <li>✓</li> </ul>	1 1	1	-	1	1	<b>√</b>	11	1
	Signage	<ul> <li>✓</li> </ul>	1	< <	·	11	· •	<b>1</b>	•	√ √	1	✓	1	1	11	1	1	1 1	· 🖌	<b>/</b> ·	1	✓	1 1	1		/ /	1	٧	1	<b>/</b> ·	< </td <td>·</td> <td><ul> <li>✓</li> </ul></td> <td>1 1</td> <td>1</td> <td>✓</td> <td>1</td> <td>✓</td> <td>√ √</td> <td>11</td> <td>1</td>	·	<ul> <li>✓</li> </ul>	1 1	1	✓	1	✓	√ √	11	1
	Outreach programmes	1	1	< <		<ul> <li>Image: A start</li> </ul>	•	<b>1</b>	•	< <	· •	1	1	•	<b>√ √</b>	·	<b>ا</b>	/ /	· 🖌	•	/	1	1 1	1		1 1	1	۷	<ul> <li>Image: Image: Ima</li></ul>	1	</td <td>1</td> <td><b>√</b> ·</td> <td>1 1</td> <td>1</td> <td>✓</td> <td>1</td> <td>1</td> <td>√ √</td> <td>1 1</td> <td>1</td>	1	<b>√</b> ·	1 1	1	✓	1	1	√ √	1 1	1
2 Wetlands delineation & dema	rcation																																								
2.1 Wetland demarcation								_										_		_						_							_								-
	Placement of geo-tagged boundary pillars	1	1	• •	,	1 1	•	• •		• •	• •	1	1	•	• •	•	1	/ /	•	•	1	1		1			1	•	•	•		•	•	1 1	1	1	1	1		′ イ	1
	Removal of encroachments			_						_								_		_																					
2.2 Creation of vegetative buffers																				_													_						_	_	
	Plantation of native species					* *		_		_	_						*	_		_		$\vdash$				1	1				_		_				¥		<b>v v</b>		×
	Maintenance			_		* *		_		_							*	_		_		$\vdash$				*	V				_		-				-		* *		-
3 Enhancing hydrological regime	es																																								
3.1 Clearing inlets and outlets				1	·						1						¥ 1	1 1	· 🖌		1							v	1	~			<b>1</b>	<b>-</b>	1	✓					
3.2 Selective desilting		1	1	1 1	-	11	• •	< <		<ul> <li></li> </ul>	• •	1					v ,	14	•	<b>,</b>	1	1	1 1	1		11	1	v	• •	¥ .	1 1	<i>i</i> 1	1	11	1	~	1	1	<b>v</b> v	11	-
4 Pollution abatement																																									
	Survey of wastewater nallahs	1											1	•			<b>/</b> 1	1 1	· 🖌	<b>/</b> ·	1	1	1	1		1 1	1		1	1	1	·					1	1	✓	1	1
	Manual scouring of scum and other	1											1					/ /			/	~		1			1		1	1		,					1	1	~	1	1
	waste materials												_								_	_											_					_			-
	In-situ inflowing nallah treatment	<ul> <li>✓</li> </ul>		_				_		_			-	· •			1	/ <b>/</b>	· •	•	<b>/</b>	✓ 	✓	1	-	/ / /	1		1	-	1		-				-		-	-	-
	Relocation of dumping sites	~		_				_					-	•			•	-	•	-		~				<b>*</b>							-					-	+		-
5 Species and habitat conservat	ion																																								_
Creation and Maintenance of																																									_
5.1 People's Biodiversity Registers																																									
	Training	1	1	11	•	11	1	1 1	·	1 1	1	1	1	1	11	·	1	1 1	1	<b>·</b> .	1	1	1 1	1		1 1	1		1	<b>√</b> .	1 1	•	1	11	1	✓	1	1	<b>1</b> 1	11	1
	Creation of People's Biodiversity Registers	1	1	• •	·	• •	•	• •	·		• •	1	1	•	• •	•		/ /	•	•	1	~	• •	1		1 1	1	•	•	<b>√</b> .	• •	•	•	• •	1	1	1	1	• •	11	~
5.2 Habitat mapping and surveillance																																									
	Mapping of key habitat areas	1	1	1 1	•	1 1	•	1 1		1 1	1	1	1	•	1 1	•	1	1 1	•	1	1	1	1 1	1		11	1	v	1	¥ .	1 1	,	1	1 1	1	-	1	1	<b>v</b> v	11	1

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Management Category - Ponds	
Metrampur Khalli Badaun Bhavambur Khalli Palpur Photol Pukha Theol Pukha Theol Pukha Theikham Antona	Johri Soron Hodalpur Sadkpur Tabab <b>Bijnor</b> Bakwali Rajarampur Gajrob Achpal Gajrob Achpal Mandavbur 2 Mandavbur 2
Formation of community groups to monitor habitats	• • • • • • • • • • •
Community sensitization 4 4 4 4 4 4 4 4 4 4 4 4 4 4 4 4 4 4 4	
Surveillance and reporting <b>Y Y Y Y Y Y Y Y Y Y</b>	• • • • • • • • • • •
5.3 Mangement of invasive species	
Removal of water hyacinch and other invasive macrophytes	· · · · · · · · ·
6 Resource development and livelihoods	
Sustainable fisheries development 🖌 🖌	1 1 1 1 1
Water hyscinth-based enterprise         I <thi< th="">         I         <thi< th="">         I         <thi< th=""><th>1 1 1 1 1 1 1</th></thi<></thi<></thi<>	1 1 1 1 1 1 1
Multi-purpose shelter 4 4 4 4 4 4 4 4 4 4 4 4 4 4 4 4 4 4 4	1 1 1 1 1 1 1 1 1 1 1
Construction of approach roads v v v v v v v v v v v v v v v v v v v	
7 Monitoring and review	
Monitoring 4 4 4 4 4 4 4 4 4 4 4 4 4 4 4 4 4 4 4	1 1 1 1 <del>1</del> 1 1 1 1 1 1
Monitoring (Representative Sites)	✓                   ✓
Management plan mid-term review (External)	* * * * * * * * * *

#### Urban and Peri-Urban Wetlands

Activities to meet the objectives of the urban and peri-urban wetlands management category are proposed under different management interventions namely; institutional set-up, wetlands delineation and demarcation, enhancing hydrological regimes, pollution abatement, species and habitat conservation and wetlands education and interpretation (Table 21).

#### Institutional set-up

- Formation of a multi-stakeholder forum as a *wetlands-mitra network* is proposed as an effective arrangement for cross-sectoral coordination and multi-stakeholder engagement in wetlands management. Specifically, the network shall:
  - Support implementation of various management activities on ground.
  - Promote awareness on wetland values and functions within community stakeholders.
  - Articulate community views and suggestions on various management interventions.
  - Support adoption of alternative and new knowledges/skills/technologies aimed at reducing livelihood vulnerabilities and advancing wise use of wetlands.
- Systematic wetlands inventory, assessment and monitoring system is proposed to be established to address the overall information needs of wetland management and support decision making and management.
- To support integrated management of wetlands capacity building of stakeholders needs to be enhanced through professional training workshops on:
  - o Integrated wetlands management
  - Wetlands inventory assessment and monitoring
  - Land use planning for multiple wetlands use
  - Wetlands and climate change mitigation and adaptation
  - Integrating wetlands wise use in developmental planning
- The site-management plan is to be prepared by the concerned Divisional Forest Officer. After being endorsed by the PCCF-Wildlife (Principal Chief Conservator of Forests-Wildlife), it is subsequently approved by the SWA.
- Signage indicating the wetland as a Ramsar Site, an Important Bird Area or a Biodiversity Hotspot is proposed to be placed at all major entry points of the wetlands complex.
- Workshops and public events are proposed to be organized on the eve of World Wetlands Day (Feb 2), World Environment Day (June 5) and International Day for Biological Diversity (May 22) as a means of reaching out to public on the issues of wetland conservation and wise use.
- Public events on specific issues, as pollution control or water management are also proposed to be organized as a means of engaging with stakeholders.
- Development of resource material on the wetland including posters, brochures, pamphlets, films and education kits and Publication of newsletter.

# Wetlands delineation and demarcation

# Wetlands demarcation

It is proposed to demarcate wetland boundary by placing geo-tagged pillars all along the wetland periphery. Demarcation will be done using geo-tagged boundary pillars. Pillars will be placed at an

interval of approximately 100 m or as the case may be. Approval of the demarcated boundary of the wetland will be obtained from the State Wetlands Authority. Activities to be carried out are as follows:

- Completion of field reconnaissance survey. Wherein detailed mapping of wetland extent using Remote Sensing and GIS and ground truthing will be undertaken.
- Removal of encroachments.
- Placement of geo-tagged pillars. These will be concrete cemented pillars.

#### Creation of vegetative buffers

Afforestation activities to be promoted to arrest soil erosion. Indigenous soil binding plant species to be planted in consultation with local communities through PRA exercise. For raising plantations and maintenance following activities are proposed:

- Nursery raising through community organizations.
- Preparatory works, including deweeding and making pits for plantation.
- Plantation of saplings into the prepared pits.
- Protection measures (including watch and ward) from fire, cattle etc.
- The plantation shall be maintained for three years after creation, and handed over to the respective village committee for operation as per the approved Forest Working Plan.

#### Enhancing hydrological regimes

Clearing of inlets and outlets

• Identification and cleaning and maintenance of inlets and outlets to identify flow impediments.

Selective desilting

• Selective desilting of highly silted up wetlands areas to enhance their water holding capacity and overall wetland water regime stability.

# Pollution abatement

Village ponds are the ultimate recipients of untreated sewage and sewerage from the settlements which dot its periphery. Also, intensification of agriculture in adjoining areas has led to increased use of fertilizers and pesticides. Coupled with changes in circulation and mixing pattern, excessive loading of nutrients has promoted growth of macrophytic vegetation. Activities for pollution abatement are as follows:

- Survey of wastewater nallahs that are clogging the channels and increasing waterlogging.
- Manual scouring of scum and other waste material. The waste-collectors will form an integral part of the solid waste management system.
- Applying of in-situ inflowing nallah treatment for efficient control of sewage quantity and quality received within the wetland.
- Construction of sand gravel-beds for inflow filtration.
- Establishment of floating treatment wetlands.
- Relocation of dumping sites. The wetlands may be designated a zero-waste zone. A management framework for this purpose, including components on regulation and behaviour change may be drawn up, in consultation with stakeholders. Screens/mesh are

proposed to be placed at all inlets to prevent transport of solid-wate/plastic in the canal system of the wetland.

Species and habitat conservation

Creation and maintenance of People's Biodiversity Registers

- With support from the State Biodiversity Board (SBB), People's Biodiversity Registers are created at the local level under the guidance of the Biodiversity Management Committee (BMC).
- For creating the Peoples' Biodiversity Register, training by experts should be conducted to prepare document which contains comprehensive information on the landscape, demography of the village and locally available bio-resources. To prepare species inventories training by wildlife experts should be conducted on habitat mapping and identification of local flora and fauna.
- Training on Asian Waterbird Census (AWC) must be conducted annually during winter season. This is a must for wetlands that are known to be frequented by migratory waterbirds of the central Asian flyway.

Habitat mapping and surveillance

- Identification of potential areas for restoration and improvement as waterbird habitats.
- Maintenance of different forms of waterbird habitats based on inventorisation and habitat mapping:
  - Open water areas as feeding areas for diving species, such as pochards, grebes and coots, and as open roosting areas for other flocking waterbird species.
  - Reed beds and channels for migratory ducks and geese.
  - Reed beds and open marsh vegetation for nesting species.
  - Trees along wetland edge for tree nesting species.
  - Patches of wet grasslands and open grounds for grazing ducks, geese and shorebirds.
- Community sensitization and formation of bird protection committees to monitor waterbird habitats and to control any human disturbance. Incentives in the form of recognition and training as bird guides could be provided to the committee members.
- In areas important for reed nesting bird species, grazing and harvesting of macrophytes need to be completely banned during breeding season.
- For areas of tree nesting bird species, cutting of trees and tall bushes along the periphery of the wetland to be banned.

Management of invasive species

- Growth of invasive macrophytes to be managed by either manual or mechanical removal of thick stands of emergent vegetation like *Phragmites karka, Ipomoea aquatica, Eichhornia crassipes* etc. to improve hydrological connectivity, check eutrophication and increase fish breeding areas.
- Control of invasive macrophytes such as Water Hyacinth can also be done through meshing of inlets.

#### Wetlands education and interpretation

#### Interpretation infrastructure

A wetlands interpretation centre is proposed to be constructed. Following facilities are proposed to be developed in the interpretation complex: Exhibits including posters, models, flying patterns hanging from ceiling, wetland birds interactive panel and ecosystem food chain, viewing gallery comprising panels highlighting the ecological, socioeconomic and cultural aspects. Desks fitted with adequate displays, bird identifications books. Children's Play area consisting of open dioramas and floorings with underwater paintings should be developed as a special section to cater to the young visitors. The area should have several innovative environment-oriented games and interactive food chain, fish trap games, jigsaw puzzles etc. Auditorium having audio-visual facilities for screening documentaries and arranging talks/workshops/meetings. Children's Play area consisting of open dioramas and floorings with underwater paintings with underwater paintings should be developed as a special section to cater to the young visitors. The area should have several innovative environment-oriented games area consisting of open dioramas and floorings with underwater paintings should be developed as a special section to cater to the young visitors. The area should have several innovative environment-oriented games and floorings with underwater paintings should be developed as a special section to cater to the young visitors. The area should have several innovative environment-oriented games and interactive food chain, fish trap games, jigsaw puzzles.

#### Construction of watch towers

Watchtowers may be constructed at vantage points. They should be equipped with binocular and telescope facilities for better viewing.

#### Establishment of walking trails

Walking trails around the wetlands should be established to enable visitors to have a better view of the landscape.

#### Monitoring and review

A mid-term review of management plan implementation is proposed to assess the extent to which stipulated objectives have been achieved with a high degree of resource efficiency and in participation with stakeholders. An external committee on wetlands is proposed to be formed by the SWA to carry out the evaluation, specifically looking at the following elements:

- Degree to which wetland ecological character is being maintained as a result of management being applied
- Implementation quality, timeliness and resourcing of activities
- Quality and comprehensiveness of wetlands monitoring
- Effectiveness of management being applied, in terms of design, activities, outcomes and impacts
- Quality of stakeholder engagement in implementation of various activities and discharging wetland management functions
- Changes in external environment requiring adaptation in management plan.

Table 21: Proposed phase-wise activities under the management category – Urban and Peri-Urban wetlands category

<b>.</b>	ent Category - Urban and Peri-	Urban wetlands		_				_	_	_	-
	Wetlands		Badaun	Khairpur Khaerati	Amroha	Gajraula	Bulandshahar	Amartahl urf Unchagaon	Farrukhabad	Kamalganj	Rampur Dhafarapur
I.	Institutional Set-up										
		Constitution of wetland mitra network		√		√		✓		✓	1
		Training and orientation on wetland		1		1		1		1	1
		management						·			
		Issue-specific training		✓		√		✓		✓	1
		Finalisation and endorsement of site-		✓		✓		√		∢	1
		management plan				1					
		Signage		✓ ✓		<b>√</b>		¥ /		¥ /	<b>v</b>
		Outreach programmes		*		v		*		*	v
2	Wetlands delineation & demar	cation									
21	Wetland demarcation										
		Placement of geo-tagged boundary pillars		1		~		1		1	1
		Removal of encroachments									
2.2	Creation of vegetative buffers										
		Plantation of native species		✓							V
		Maintenance		✓							V
3	Enhancing hydrological regime	S									
3.1	Clearing of inlets and outlets			✓ ✓		✓ ✓		✓ ✓		✓ ✓	1
3.2	Selective desilting			✓		✓		✓		✓	1
4	Pollution abatement										
		Survey of wastewater nallahs		√				4			1
		Manual scouring of scum and other									
		waste materials		•				•			
		Installation of waste sieves at inlets		✓				1			V
		Construction of sand gravel-beds for		1		1		1		1	
		inflow filtration									
		Establishment of floating treatment				✓		√		✓	-
		Relevation of dumping sites				1		1			
		Relocation of dumping sites				¥		*			
5	Species and habitat conservati	00									
5.1	Creation and Maintenance of Peop	le's Biodiversity Registers									
		Training		✓		✓		✓		✓	v
		Creation of People's Biodiversity Register	s	✓		✓		✓		✓	v
		Asian Waterbird Census		✓		✓		✓		✓	¥
5.2	Mangement of invasive species										
		Removal of water hyacinth and other		7		7		7		7	
		invasive macrophytes		Y		۲		۲		*	ľ
6	Wetland education and interpr	retation									
		Interpreptation Infrastructure		1		1		1		1	¥
		Watch Towers						✓		✓	V
											i
		Walking Trails						~		✓	۷

#### Wetlands within Protected Area

Activities to meet the objectives of the wetlands within protected area management category are proposed under different management interventions namely; institutional set-up, enhancing of hydrological regimes, species and habitat conservation, sustainable tourism development and monitoring and review (Table 22).

#### Institutional set-up

- Formation of a multi-stakeholder forum as a *wetlands-mitra network* is proposed as an effective arrangement for cross-sectoral coordination and multi-stakeholder engagement in wetlands management. Specifically, the network shall:
  - o Support implementation of various management activities on ground
  - Promote awareness on wetland values and functions within community stakeholders
  - Articulate community views and suggestions on various management interventions
  - Support adoption of alternative and new knowledges/skills/technologies aimed at reducing livelihood vulnerabilities and advancing wise use of wetlands
- Systematic wetland inventory, assessment and monitoring system is proposed to be established to address the overall information needs of wetland management and support decision making and management.
- To support integrated management of wetlands capacity building of stakeholders needs to be enhanced through professional training workshops on:
  - o Integrated wetlands management
  - Wetlands inventory assessment and monitoring
  - Land use planning for multiple wetlands use
  - Wetlands and climate change mitigation and adaptation
  - Integrating wetlands wise use in developmental planning
- The site-management plan is to be prepared by the concerned Divisional Forest Officer. After being endorsed by the PCCF-Wildlife (Principal Chief Conservator of Forests-Wildlife), it is subsequently approved by the SWA.
- Signage indicating the wetland as a Ramsar Site, an Important Bird Area or a Biodiversity Hotspot is proposed to be placed at all major entry points of the wetlands complex.
- Workshops and public events are proposed to be organized on the eve of World Wetlands Day (Feb 2), World Environment Day (June 5) and International Day for Biological Diversity (May 22) as a means of reaching out to public on the issues of wetland conservation and wise use.
- Public events on specific issues, as pollution control or water management are also proposed to be organized as a means of engaging with stakeholders.
- Development of resource material on the wetland including posters, brochures, pamphlets, films and education kits and Publication of newsletter.

#### Enhancing hydrological regimes

Clearing and maintenance of inlets and outlets

• Identification and cleaning and maintenance of inlets and outlets to identify flow impediments.

Selective desilting

• Selective desilting of highly silted up wetlands areas to enhance their water holding capacity and overall wetland water regime stability.

#### Species and habitat conservation

Species inventory and population count

- Training by wildlife experts on habitat mapping and inventorisation of wetland species along with an assessment of preferred habitat zones of key wetland species.
- Augmenting surveillance infrastructure including construction of watch towers, procurement of equipment for bird watching and mobile vans and boats for patrolling.
- Training on Asian Waterbird Census (AWC) must be conducted annually during winter season. This is a must for wetlands that are known to be frequented by migratory waterbirds of the central Asian flyway.
- Knowledge of the health of resident and migratory species that inhabit the wetlands is critical to understanding the risk and potential of transmission of avian diseases to other birds and animals, domestic poultry and people. Specific studies need to be undertaken to establish a baseline of the common and potentially harmful zoonotic diseases.

Management of invasive species

- Growth of invasive macrophytes to be managed by either manual or mechanical removal of thick stands of emergent vegetation like *Phragmites karka, Ipomoea aquatica, Eichhornia crassipes* etc. to improve hydrological connectivity, check eutrophication and increase fish breeding areas.
- Control of invasive macrophytes such as Water Hyacinth can also be done through meshing of inlets.

Sustainable tourism development

• A wetlands interpretation centre is proposed to be constructed. Following facilities are proposed to be developed in the interpretation complex: Exhibits including posters, models, flying patterns hanging from ceiling, wetland birds interactive panel and ecosystem food chain, viewing gallery comprising panels highlighting the ecological, socioeconomic and cultural aspects. Desks fitted with adequate displays, bird identifications books. Children's Play area consisting of open dioramas and floorings with underwater paintings should be developed as a special section to cater to the young visitors. The area should have several innovative environment-oriented games and interactive food chain, fish trap games, jigsaw puzzles etc. Auditorium having audio-visual facilities for screening documentaries and arranging talks/workshops/meetings. Children's Play area consisting of open dioramas and floorings with underwater paintings should be developed as a special section to cater to the young visitor section to cater to the young area consisting of open dioramas and floorings. The area should have several innovative environment-oriented games and interactive food chain, fish trap games, jigsaw and floorings with underwater paintings should be developed as a special section to cater to the young visitors. The area should have several innovative environment-oriented games and floorings with underwater paintings should be developed as a special section to cater to the young visitors. The area should have several innovative environment-oriented games and interactive food chain, fish trap games, jigsaw puzzles.

- To enable visitors to have a better view of the landscape boardwalks around the wetlands should be constructed. Wooden benches may also be established to provide sitting/resting facilities.
- Watchtowers may be constructed at vantage points. They should be equipped with binocular and telescope facilities for better viewing.

#### Monitoring and review

A mid-term review of management plan implementation is proposed to assess the extent to which stipulated objectives have been achieved with a high degree of resource efficiency and in participation with stakeholders. An external committee on wetlands is proposed to be formed by the SWA to carry out the evaluation, specifically looking at the following elements:

- Degree to which wetland ecological character is being maintained as a result of management being applied
- Implementation quality, timeliness and resourcing of activities
- Quality and comprehensiveness of wetlands monitoring
- Effectiveness of management being applied, in terms of design, activities, outcomes and impacts
- Quality of stakeholder engagement in implementation of various activities and discharging wetland management functions
- Changes in external environment requiring adaptation in management plan.

Table 22: Proposed phase-wise activities under the management category – Wetlands within Protected Area	category
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Manag	ement Category - Wetlands with	nin Protected Areas																												-
	Wetlands		Amroha	Sujamna	Tigri	Meerut	Behsuma Talaab	Jalalpur Johra	Rustampur Bhikund	Sarai Khadar	Muzzafarnagar	Mansurpur Jheel	Mahmoodpur	Bhuwapur	Ishhakwala	Samana	Raharwa Jadid	Lalpur	Shahpur	Purkazi Rural	Haiderpur	Farrukhabad	Ravannaguljar bag	Hapur	Kothla Jheel (Khadar)	Bijnor	Saidpura Urf Naipura	Badshahpur	Manshahpur-I	Jalpur
- 1	Institutional Set-up											-																		
		Workshops for constitution of wetland mitra network		√	1		√	~	✓	~		✓	~	~	~	✓	~	~	✓	1	✓		✓		✓		✓	✓	~	1
		Training and orientation workshop on wetland management		~	~		~	~	~	~		1	~	~	~	1	~	~	~	~	✓		~		~		~	~	~	1
		Issue-specific training workshops		√	1	•	✓	1	√	✓		✓	✓	✓	√	✓	✓	✓	✓	✓	✓		✓		√		✓	✓	✓	✓
		Finalisation and endorsement of site- management plan		1	1		1	~	1	~		~	~	~	~	~	~	~	~	~	✓		~		1		~	~	~	~
		Signages (Publication and Installation)		∢	1	•	✓	1	∢	✓		✓	✓	✓	✓	✓	✓	✓	✓	✓	✓		✓		✓		✓	✓	✓	✓
		Outreach programmes (Publication of field/event brochures)		1	1		1	~	✓	~		~	1	~	✓	1	~	~	~	1	✓		~		1		✓	✓	~	~
2	Enhancing hydrological regimes																													
2.1	Clearing and maintenance of inlets and outlets			~	~				~							1		~	✓	1			✓				✓			
2.2	Selective desilting			✓	~	•	✓	✓	✓	1		✓	✓	✓	✓	✓	✓	✓	✓	•	✓		✓		✓		✓	✓	✓	✓
3	Species and habitat conservatio	n N																												
3.1	Species inventory and population count																													
		Training		1	1		✓	1	✓	1		✓	✓	✓	✓	✓	✓	✓	✓	✓	✓		✓		✓		✓	✓	✓	✓
		Periodic updation		√	1		√	✓	✓	✓		✓	✓	✓	✓	✓	✓	✓	✓	✓	✓		✓		✓		✓	✓	✓	✓
		Conduct species survey - Asian Waterbird Census		~	1		4	~	1	~		~	~	~	~	~	~	~	~	~	~		✓		1		~	~	~	~

Manage	ement Category - Wetlands with	nin Protected Areas																												
	Wetlands		Amroha	Sujamna	Tigri	Meerut	Behsuma Talaab	Jalalpur Johra	Rustampur Bhikund	Sarai Khadar	Muzzafarnagar	Mansurpur Jheel	Mahmoodpur	Bhuwapur	Ishhakwala	Samana	Raharwa Jadid	Lalpur	Shahpur	Purkazi Rural	Haiderpur	Farrukhabad	Ravannaguljar bag	Hapur	Kothla Jheel (Khadar)	Bijnor	Saidpura Urf Naipura	badshanpur	Manshahpur-I	Jalpur
		Zoonotic disease surveillance		✓	1	1	✓	✓	✓	✓		✓	✓	✓	✓	✓	✓	✓	✓	✓	✓		✓		✓		<ul> <li>✓</li> </ul>	✓	✓	✓
3.2	Management of invasive species																													
		Removal of water hyacinth and other invasive macrophytes		1	1	•	~	~	~	~		4	~	1	~	~	~	1	~	~	1		~		~		<b>√</b>	~	~	~
4	Sustainable tourism developme	nt																												
		Interpreptation Infrastructure		√	1	1	✓	1	✓	1		✓	✓	✓	✓	✓	✓	✓	✓	✓	✓		√		✓		<ul> <li>✓</li> </ul>	✓	✓	✓
		Boardwalks		√	1	1	✓	✓	✓	1		✓	1	✓	✓	✓	✓	✓	✓	✓	✓		✓		✓		<ul> <li>✓</li> </ul>	✓	✓	✓
		Watch Towers		✓	1	1	✓	1	✓	1		✓	✓	✓	✓	✓	✓	✓	✓	✓	✓		√		✓		✓	✓	✓	✓
5	Monitoring and review																													
		Management plan mid-term review (External)		~	1	·	~	~	~	~		~	~	~	~	~	~	1	~	~	~		~		~		✓ ·	~	~	~

# 8. Budget and Financing

# **Budget**

Management plan implementation will entail a budget of  $\mathfrak{F}$  61.1 crores. Of this, the budget allocated for the sub-basin level actions is  $\mathfrak{F}$  16.7 crores (27.3 %) and that for the site level actions is about  $\mathfrak{F}$  44.4 crores (72.7 %). Out of the total budget, the activities proposed under phase 1 will require  $\mathfrak{F}$  29.6 crores (48.4%), phase 2 will require about  $\mathfrak{F}$  14 crores(22.9%), and phase 3 will require  $\mathfrak{F}$  16.8 crores (27.5 %) (Table 23).

Table 23: Summarized budget for management plan implementation at the sub-basin and site levels

	Number of Wetlands	Total Amount	Phase 1	Phase 2	Phase 3
Sub-basin level actions		167,000,000	167,000,000		
Wetland level actions					
Wetlands within Protected areas	22	208,286,960	28,820,850	55,490,160	126,563,450
Urban and Peri-urban wetlands	5	21,537,447	12,904,247	8,633,200	
Floodplain agricultural wetlands	20	79,182,823	39,684,363	13,488,390	16,559,870
Ponds	46	134,997,850	47,609,150	62,456,925	24,931,775
	93	61,10,05,081	29,60,18,611	14,00,68,675	16,80,55,095

Detailed activity wise budget plan for the sub-basin level Table 24) and site level indicating all four management categories viz., wetlands within protected areas (Table 25), urban and peri-urban wetlands (Table 26), floodplain agricultural wetlands (Table 27) and ponds (Table 28) are as follows:

#### Table 24: Detailed activity wise budget for sub-basin level activities

	Wetlands	Rate	Unit	Physical	Amount		Year I		Year 2		Year 3		Year 4		Year 5
						Physical	Financial	Physical	Financial	Physical	Financial	Physical	Financial	Physical	Financial
1	Institutional Set-up				18000000		3600000		3600000		3600000		3600000		3600000
	Notification of wetlands under	To be done													
1.1	Wetland Rules	departmentallly													
1.2	Notification of district wetland committees	To be done departmentallly													
1.3	Infrastructure development-human resources	75,000	Per person per month	20		4	3,600,000	4	3,600,000	4	3,600,000	4	3,600,000	4	3,600,000
2	Integrated wetland inventory				108,900,000		52,500,000		51,600,000		1,600,000		1,600,000		1,600,000
2.1	Establishment of wetland monitoring						50,000,000		50,000,000						
2.2	Development of database						1 000 000		100.000		100.000		100.000		100.000
2.2	management system						1,000,000		100,000		100,000		100,000		100,000
2.3	Wetland monitoring						1,000,000		1,000,000		1,000,000		1,000,000		1,000,000
2.4	Ecosystem health report						500,000		500,000		500,000		500,000		500,000
3	Research Studies				25.000.000		6.000.000		13,000,000		6.000.000		-		-
3.1	Climate Risk Assessment						3,000,000		2,000,000						
3.2	Hydrological connectivity assessment						3,000,000		2,000,000						
	Inventorization of wetlands								2 000 000						
3.2	biodiversity								3,000,000		2,000,000				
3.3	Socio-cultural inventory of wetlands								3,000,000		2,000,000				
3.4	Multiple wetland values assessment								3,000,000		2,000,000				
	Consider development				( 200,000		2 000 000		000.000		1 200 000		000.000		1 200 000
41	Training needs assessment				0,200,000		1 500,000		800,000		1,300,000		000,000		1,300,000
4.2	Development of training plan						500,000								
4.3	Capacity development workshops	500.000	Per workshop	4			200,000	1	500.000	1	500.000	1	500.000	1	500.000
4.4	Post-training handholding support	,							300,000		300,000		300,000		300,000
4.5	Effectiveness assessment										500,000				500,000
5	Communication and outreach				6,900,000		2,000,000		1,100,000		1,600,000		1,100,000		1,100,000
5.1	Webpage				1,800,000		1,000,000		200,000		200,000		200,000		200,000
5.2	Resource material	250,000	Per publication	4	I ,000,000	2	500,000			2	500,000				
5.3	Newsletter	100,000	Per issue	5	500,000	1	100,000	I	100,000	1	100,000	1	100,000	I	100,000
5.4	Workshop and public events	400,000	Per event	9	3,600,000	1	400,000	2	800,000	2	800,000	2	800,000	2	800,000
6	agement implementation and rev	iew			2 000 000						1 000 000				1 000 000
6.1	Mid-term review				2,000,000						1,000.000				.,,
6.2	Annual learning events										-				1,000,000
					₹ 167,000,000.00		₹ 66,100,000.00		₹ 70,100,000.00		₹ 15,100,000.00		₹ 7,100,000.00		₹ 8,600,000.00

Table 25: Detailed activit	v wise budget for wetland level	activities in wetlands within	protected areas

	Wetlands		Rate	Unit	Physical	Phase 1 Physical	Phase 1 Amount	Phase 2 Physical	Phase 2 Amount	Phase 3 Physica	Phase 3 Amount	Total Amount
_	1 Institutional Cat up						11 100 000 00		21 100 000 00		C7 200 000 00	00 500 000 00
-		Workshops for constitution of wetland mitra	100000	Der Werkshen	50.00	10.00	1,100,000.00	31.00	21,100,000.00	28.00	3,900,000,00	59,500,000.00
		notwork Training and orientation workshop on wetland	100000	Per workshop	59.00	10.00	1,000,000.00	21.00	2,100,000.00	28.00	2,800,000.00	5,900,000.00
		management	100000	Per Workshop	55.00	13.00	1,300,000.00	22.00	2,200,000.00	20.00	2,000,000.00	5,500,000.00
		Issue-specific training workshops	100000	Per Workshop	93.00	27.00	2,700,000.00	43.00	4,300,000.00	23.00	2,300,000.00	9,300,000.00
		Finalisation and endorsement of site-management plan	Lumpsum	Per Wetland			1,200,000.00		3,000,000.00		51,400,000.00	55,600,000.00
		Signages (Publication and Installation)	Lumpsum	Per Wetland			900,000.00		2,000,000.00		1,800,000.00	4,700,000.00
		Outreach programmes (Publication of field/event brochures)	Lumpsum	Per Wetland			4,000,000.00		7,500,000.00		7,000,000.00	18,500,000.00
1	2 Enhancing hydrological regimes						333350		1640160		27525950	29499460
2.:	Clearing and maintenance of inlets and outlets		25	Person days per inlet/outlet @ Rs 204 per person day	325.00	125.00	25,500.00	125.00	25,500.00	75.00	15,300.00	66,300.00
2.2	2 Selective desilting		50	Per m3	29,433,160.00		307,850.00		1,614,660.00		27,510,650.00	29,433,160.00
1	3 Species and habitat conservation						4,000,000.00		8,000,000.00		5,000,000.00	17,000,000.00
3.:	1 Species inventory and population count		Lumpsum	Per Wetland			4,000,000.00		8,000,000.00		5,000,000.00	17,000,000.00
		Training	Lumpsum	Per Wetland								
		Periodic updation	Lumpsum	Per Wetland								
		Conduct species survey - Asian Waterbird Census	Lumpsum	Per Wetland								
		Zoonotic disease surveillance	Lumpsum	Per Wetland								
2 '	Management of invasive species											
3.4	wanagement of myasive species	Removal of water hyacinth and other invasive macrophytes										
	3 Sustainable tourism development						12,750,000.00		23,250,000.00		25,500,000.00	61,500,000.00
-		Interpreptation Infrastructure	Lumpsum	Per Wetland			8,500,000.00		15,500,000.00		17,000,000.00	41,000,000.00
		Boardwalks	Lumpsum	Per wetland			2,125,000.00		3,8/5,000.00		4,250,000.00	10,250,000.00
		watch rowers	Lumpsum	Per wetiand			2,125,000.00		3,8/5,000.00		4,250,000.00	10,250,000.00
	4 Monitoring and review						637 500 00		1 500 000 00		1,237,500,00	787 500 00
		Management plan mid-term review (External)	Lumpsum	Per Wetland			637 500.00		1.500.000.00		1,237,500.00	787,500.00
							₹ 28,820,850.00		₹ 55,490,160.00		₹ 126,563,450.00	₹ 208,286,960.00

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	Wetlands		Rate	Unit	Physical	Phase I Physical	Phase I Amount	Phase 2 Physical	Phase 2 Amount	Phase 3 Physical	Phase 3 Amount	Amount
1	Institutional Set-up						2,850,000		1,900,000			4,750,000
		Constitution of wetland mitra network	100,000	Per wetland	5	3	300,000	2	200,000			500,000
		Training and orientation on wetland management	50,000	Per wetland	5	3	150,000	2	100,000			250,000
		Issue-specific training	50,000	Per wetland	5	3	150,000	2	100,000			250,000
		Finalisation and endorsement of site-management	50,000	Per wetland	5	3	150,000	2	100,000			250,000
		Signage	200,000	Per wetland	5	3	600,000	2	400,000			I ,000,000
		Outreach programmes	500,000	Per wetland	5	3	1,500,000	2	1,000,000			2,500,000
2	Wetlands delineation &						₹ 577,507.27		₹ 112,000.00			₹ 689,507.27
2.1	Wetland demarcation											
		Placement of geo-tagged boundary pillars	8,000	Per pillar	58	44	352,000	14	112,000			464,000
		Removal of encroachments	To be done at administrative level									
2.2	Creation of vegetative buffers						-	0	-			
		Plantation of native species	100,000	Per ha	1.879227219	1.879227219	187,923	0	-			187,923
		Maintenance	20,000	Per ha	1.879227219	1.879227219	37,585	0	-			37,585
3	Enhancing hydrological regimes						289,700		124.800			414,500
31	Clearing of inlets and outlets		25	Person days per	150	75	15 300	75	15 300			30,600
5				inlet/outlet @			. 5,500		10,000			50,000
3.2	Selective desilting		50	Per m3	7678	5488	274,400	2190	109,500			383,900
4	Pollution abatement			Por impacted			1,880,000		2,065,000			3,945,000
		Survey of wastewater nallahs	20,000	wetland	3	2	40,000	I	20,000			60,000
		Manual scouring of scum and other waste materials	75,000	Per impacted wetland	3	2	150,000	I.	75,000			225,000
		Installation of waste sieves at inlets	250,000	Per impacted wetland	3	2	500,000	I	250,000			750,000
		Construction of sand gravel-beds for inflow filtration	700,000	Per MLD	1.1	0.7	490,000	0.4	280,000			770,000
		Establishment of floating treatment wetlands	10,000	Per Rafter	114	70	700,000	44	440,000			1,140,000
		Relocation of dumping sites	500,000	Per impacted wetland	2	0	-	2	1,000,000			1,000,000
5	Species and habitat conservation						1,407,040		831,400			2,238,440
5.1	Creation and Maintenance of People's Biodiversity Registers											

	Wetlands		Rate	Unit	Physical	Phase I Physical	Phase I Amount	Phase 2 Physical	Phase 2 Amount	Phase 3 Physical	Phase 3 Amount	Amount
4	Pollution abatement						1,880,000		2,065,000			3,945,000
		Survey of wastewater nallahs	20,000	Per impacted wetland	3	2	40,000	I	20,000			60,000
		Manual scouring of scum and other waste materials	75,000	Per impacted wetland	3	2	150,000	I	75,000			225,000
		Installation of waste sieves at inlets	250,000	Per impacted wetland	3	2	500,000	I	250,000			750,000
		Construction of sand gravel-beds for inflow filtration	700,000	Per MLD	1.1	0.7	490,000	0.4	280,000			770,000
		Establishment of floating treatment wetlands	10,000	Per Rafter	114	70	700,000	44	440,000			1,140,000
		Relocation of dumping sites	500,000	Per impacted wetland	2	0	-	2	1,000,000			1,000,000
5	Species and habitat conservation						1,407,040		831,400			2,238,440
5.1	Creation and Maintenance of People's Biodiversity Registers											
		Training	50,000	Per wetland	5	3	150,000	2	100,000			250,000
		Creation of People's Biodiversity Registers	100,000	Per wetland	5	3	300,000	2	200,000			500,000
		Asian Waterbird Census	200,000	Per wetland	5	3	600,000	2	400,000			I ,000,000
5.3	Mangement of invasive species							0	-			
		Removal of water hyacinth and other invasive macrophytes	50,000	per ha per impacted wetland	9.7688	7.1408	357,040	2.628	131,400			488,440
6	'etland education and interpretati	on					3,500,000		2,000,000			5,500,000
		Interpreptation Infrastructure	500,000	Per wetland	5	3	1,500,000	2	1,000,000			2,500,000
		Watch Towers	500,000	Per tower	3	2	1,000,000	1	500,000			1,500,000
_		Walking trails	500,000	Per wetland	3	2	1,000,000	I	500,000			1,500,000
'	Monitoring and review	Monitoring	250.000	Por wotland	5	3	2,400,000	2	1,600,000			4,000,000
		rionitoring	250,000	i er weuarid	5	3	750,000	2	500,000			1,250,000
		Monitoring (Representative Sites)	500,000	Selected wetland	5	3	1,500,000	2	1,000,000			2,500,000
		Management plan mid-term review (External)	50,000	Per wetland	5	3	150,000	2	100,000			250,000
							12,904,247		8,633,200			21,537,447

Table 27 <sup>.</sup> Detailed activity	wise budget for wetland	level activities in flo	odplain agricultural wetlands
Table 27. Detailed dottill	inoc budget for metiana		

	Wetlands		Rate	Unit	Physical	Phase I Physical	Phase I Amount	Phase 2 Physical	Phase 2 Amount	Phase 3 Physical	Phase 3 Amount	Amount
1	Institutional Set-up						3795000		2210000		2260000	9,815,000
		Constitution of wetland mitra network	100,000	Per network	31	12	1200000	7	700000	7	700000	3,100,000
		Training and orientation on wetland management	50,000	Per network	31	12	600000	7	350000	7	350000	1,550,000
		Issue-specific training	50,000	Per network	31	12	600000	7	350000	7	350000	1,550,000
		Finalisation and endorsement of site-management plan	50,000	Per wetland	20	7	350000	5	250000	5	250000	1,000,000
		Signage	15,000	Per signage	61	23	345000	14	210000	14	210000	915,000
		Outreach programmes	50,000	Per programme per 50 ha	34	14	700000	7	350000	8	400000	1,700,000
2	Wetlands delineation &						5,024,000		2,152,000		3,648,000	12,720,000
2.1	Wetland demarcation											
		Placement of geo-tagged boundary pillars	8,000	Per pillar	1590	628	5024000	269	2152000	456	3648000	12,720,000
		Removal of encroachments	To be done at administrative level	IDIACED EVELY								
3	Enhancing hydrological regimes						10,200		15,300		-	35,700
3.1	Clearing inlets and outlets		25	Person days per inlet/outlet @	7	2	10200	3	15300	-	0	35,700
4	Pollution abatement						1,000,000		1,000,000		1,500,000	5,000,000
		Constructed wetlands	500,000	Per impacted wetland with identified inflows	10	2	1000000	2	1000000	3	1500000	5,000,000
5	Species and habitat conservation						7,155,163		2,811,090		3,251,870	14,712,123
5.1	Creation and Maintenance of People's Biodiversity Registers											
		Training	50,000	Per Gram Panchayat	32	13	650000	7	350000	7	350000	1,600,000
		Creation of People's Biodiversity Registers	100,000	Per Gram Panchavat	32	13	1300000	7	700000	7	700000	3,200,000
5.2	Habitat mapping and surveillance	. , , ,	Lump sum	Tanchayac			4,050,000		625,000		925,000	5,600,000
		Mapping of key habitat areas										
		Mapping of fish breeding and spawning grounds										
		Formation of community groups to monitor habitats										
L		Community sensitization										
5.3	Mangement of invasive species	Removal of water hyacinth and other invasive macrophytes	10,000	Per ha	431	116	1155163.318	114	1136090	128	1276870	4,312,123

	Wetlands		Rate	Unit	Physical	Phase I Physical	Phase I Amount	Phase 2 Physical	Phase 2 Amount	Phase 3 Physical	Phase 3 Amount	Amount
6	source development and livelihoo	ds					I 1,400,000		2,500,000		1,700,000	17,600,000
6.1	Sustainable fisheries development		Lump sum				3,900,000		I ,000,000		200,000	7,100,000
	For	mation of user groups and setting up rules and regula	tions									
		Microcredit support										
		Training on sustainable fisheries development										
		Assistance for craft and gear										
		Construction and upgradation of jetties										
6.3	Promoting sustainable agriculture practices		Lump sum				7,500,000		1,500,000		1,500,000	10,500,000
		Training through KVKs on sustainable wetland										
		agriculture practices										
		Microcredit support to farmers										
		Wetland agro-product based microenterprise										
7	Monitoring and review		Lump sum				11,300,000		2,800,000		4,200,000	19,300,000
		Monitoring	250,000	Per wetland	20							5,000,000
		Monitoring (Representative Sites)	500,000	Selected wetland	20							10,000,000
		Management plan mid-term review (External)	50,000	Per wetland	20							1,000,000
							₹ 39,684,363.32		₹ 13,488,390.00		₹ 16,559,870.00	₹ 79,182,823.32

#### Table 28: Detailed activity wise budget for wetland level activities in ponds

	Wetlands		Rate	Unit	Physical	Phase I Physical	Phase I Amount	Phase 2 Physical	Phase 2 Amount	Phase 3 Physical	Phase 3 Amount	Amount
1	Institutional Set-up				36,800,000		11,200,000		14,400,000		11,200,000	36,800,000
		Constitution of wetland mitra network	100,000	Per wetland	46	14	I,400,000	18	I ,800,000	14	1,400,000	4,600,000
		Training and orientation on wetland management	50,000	Per wetland	46	14	700,000	18	900,000	14	700,000	2,300,000
		lssue-specific training	50,000	Per wetland	46	14	700,000	18	900,000	14	700,000	2,300,000
		rinalisation and endorsement or site-management	50,000	Per wetland	46	14	700,000	18	900,000	14	700,000	2,300,000
		Signage	50,000	Per wetland	46	14	700,000	18	900,000	14	700,000	2,300,000
		Outreach programmes	500,000	Per wetland	46	14	7,000,000	18	9,000,000	14	7,000,000	23,000,000
2	Wetlands delineation &						1,220,000		1,548,000		1,412,000	4,180,000
2.1	Wetland demarcation											
		Placement of geo-tagged boundary pillars	8,000	Per pillar	425	133	I,064,000	159	1,272,000	133	1,064,000	3,400,000
		Removal of encroachments	To be done at the administrative level	IDIACED EVERY								
2.2	Creation of vegetative buffers											
		Plantation of native species	100,000	Per ha	6.5	1.3	130,000	2.3	230,000	2.9	290,000	650,000
		Maintenance	20,000	Per ha	6.5	1.3	26,000	2.3	46,000	2.9	58,000	130,000
							7 170 (00		0.000.005		(15 330 035)	122 (00
3	Ennancing nydrological regimes			Person days per			7,179,600	,	8,282,925	,	(15,329,925)	132,600
3.1	Clearing inlets and outlets		25	inlet/outlet @	650	150	30,600	225	45,900	275	56,100	132,600
3.2	Selective desilting		50	Per m3		142980	7,149,000	164740.5	8,237,025	-307720.5	(15,386,025)	-
							2 (50 000		5 740 000		1 45 000	0 535 000
4	Pollution abatement			Per impacted			3,650,000		5,740,000		145,000	9,535,000
		Survey of wastewater nallahs	20,000	wetland	23	10	200,000	12	240,000	I	20,000	460,000
		Manual scouring of scum and other waste materials	75,000	Per impacted wetland	23	10	750,000	12	900,000	I	75,000	1,725,000
		In-situ inflowing nallah treatment	250,000	Per impacted wetland	23	10	2,500,000	12	3,000,000	I	250,000	5,750,000
		Relocation of dumping sites	200,000	Per impacted wetland	8	I	200,000	8	1,600,000	-1	(200,000)	1,600,000
5	Species and habitat conservation						2,900,000		4,100,000		3,900,000	10,900,000
5.1	Creation and Maintenance of People's Biodiversity Registers											
		Training	50,000	Per wetland	46	14	700,000	18	900,000	14	700,000	2,300,000

	Wetlands		Rate	Unit	Physical	Phase I Physical	Phase I Amount	Phase 2 Physical	Phase 2 Amount	Phase 3 Physical	Phase 3 Amount	Amount
		Creation of People's Biodiversity Registers	100,000	Per wetland	46	14	1,400,000	18	1,800,000	14	I,400,000	4,600,000
5.2	Habitat mapping and surveillance											
		Mapping of key habitat areas										
		Formation of community groups to monitor habitats										
		Community sensitization										
		Surveillance and reporting										
5.3	Mangement of invasive species											
		Removal of water hyacinth and other invasive macrophytes	200,000	Per impacted wetland	20	4	800,000	7	1,400,000	9	1,800,000	4,000,000
	the second se								21.007.000			
6	source development and livelino	ods					16,759,550		21,986,000		18,904,700	57,650,250
6	source development and livelino	ods Sustainable fisheries development	50,000	per ha per impacted wetland	33.005	15.191	759,550	9.72	486,000	8.094	<b>18,904,700</b> 404,700	57,650,250 1,650,250
6	source development and livelino	ds Sustainable fisheries development Water hyacinth-based enterprise	50,000	per ha per impacted wetland I group per wetland	33.005 <b>20</b>	15.191 4	2,000,000	9.72 7	486,000	8.094	18,904,700 404,700 4,500,000	1,650,250 1,650,250
6	source development and livelino	ds Sustainable fisheries development Water hyacinth-based enterprise Multi-purpose shelter	50,000 500,000 500,000	per ha per impacted wetland I group per wetland Per wetland	33.005 20 46	15.191 4 14	2,000,000 7,000,000	9.72 7 18	486,000 3,500,000 9,000,000	8.094 9 14	18,904,700 404,700 4,500,000 7,000,000	57,650,250 1,650,250 10,000,000 23,000,000
6	source development and livelino	ds Sustainable fisheries development Water hyacinth-based enterprise Multi-purpose shelter Construction of approach roads	50,000 500,000 500,000 500,000	per ha per impacted wetland I group per wetland Per wetland Per wetland	33.005 20 46 46	15.191 4 14 14	2,000,000 7,000,000 7,000,000	9.72 7 18 18	486,000 3,500,000 9,000,000 9,000,000	8.094 9 14 14	404,700 4,500,000 7,000,000 7,000,000	57,650,250 1,650,250 10,000,000 23,000,000 23,000,000
6	source development and livelino	ds Sustainable fisheries development Water hyacinth-based enterprise Multi-purpose shelter Construction of approach roads	50,000 500,000 500,000 500,000	per ha per impacted wetland I group per wetland Per wetland Per wetland	33.005 20 46 46	15.191 4 14 14	759,550 2,000,000 7,000,000 7,000,000	9.72 7 18 18	486,000 3,500,000 9,000,000 9,000,000	8.094 9 14 14	18,904,700 404,700 4,500,000 7,000,000 7,000,000	57,650,250 1,650,250 10,000,000 23,000,000 23,000,000
6	Source development and livelino	Sustainable fisheries development Sustainable fisheries development Water hyacinth-based enterprise Multi-purpose shelter Construction of approach roads	50,000 500,000 500,000 500,000	per ha per impacted wetland I group per wetland Per wetland Per wetland	33.005 20 46 46	15.191 4 14 14	759,550 2,000,000 7,000,000 7,000,000	9.72 7 18 18	486,000 3,500,000 9,000,000 9,000,000	8.094 9 14 14	18,904,700 404,700 4,500,000 7,000,000 7,000,000	57,650,250 1,650,250 10,000,000 23,000,000 23,000,000
	Source development and livelino	Sustainable fisheries development Water hyacinth-based enterprise Multi-purpose shelter Construction of approach roads	50,000 500,000 500,000 500,000	per ha per impacted wetland I group per wetland Per wetland Per wetland	33.005 20 46 46	15.191 4 14 14	16,759,550 759,550 2,000,000 7,000,000 4,700,000	9.72	486,000 3,500,000 9,000,000 9,000,000 6,400,000	8.094 9 14 14	404,700 404,700 4,500,000 7,000,000 4,700,000	57,650,250 1,650,250 10,000,000 23,000,000 23,000,000 15,800,000
	Source development and livelino	ds Sustainable fisheries development Water hyacinth-based enterprise Multi-purpose shelter Construction of approach roads Monitoring	50,000 500,000 500,000 500,000 250,000	per ha per impacted wetland I group per wetland Per wetland Per wetland	33.005 20 46 46 46	15.191 4 14 14 14	16,759,550 759,550 2,000,000 7,000,000 7,000,000 4,700,000 3,500,000	9.72 7 18 18 18	486,000 3,500,000 9,000,000 9,000,000 <b>6,400,000</b> 4,500,000	8.094 9 14 14 14	404,700 404,700 7,000,000 7,000,000 4,700,000 3,500,000	57,650,250 1,650,250 10,000,000 23,000,000 23,000,000 15,800,000 11,500,000
	Source development and livelino	Sustainable fisheries development Sustainable fisheries development Water hyacinth-based enterprise Multi-purpose shelter Construction of approach roads Monitoring Monitoring Monitoring (Representative Sites)	50,000 500,000 500,000 2500,000 250,000 500,000	per ha per impacted wedand I group per wetand Per wetand Per wetand Selected wetand	33.005 20 46 46 46 46 46	15.191 4 14 14 14 14 14 1	16,759,550 759,550 2,000,000 7,000,000 7,000,000 4,700,000 3,500,000 500,000	9.72 7 18 18 18 18 18 2	486,000 3,500,000 9,000,000 9,000,000 6,400,000 4,500,000 1,000,000	8.094 9 14 14 14 14 14	404,700 404,700 7,000,000 7,000,000 4,700,000 3,500,000 500,000	57,650,250 1,650,250 10,000,000 23,000,000 23,000,000 15,800,000 11,500,000 2,000,000
	Source development and livelino	Sustainable fisheries development Sustainable fisheries development Water hyacinth-based enterprise Multi-purpose shelter Construction of approach roads Monitoring Monitoring Monitoring (Representative Sites) Management plan mid-term review (External)	50,000 500,000 500,000 250,000 250,000 500,000	per ha per impacted wetland I group per wetland Per wetland Per wetland Selected wetland Per wetland	33.005 20 46 46 46 46 4 46	15.191 4 14 14 14 14 14 1 14	16,759,550 759,550 2,000,000 7,000,000 7,000,000 4,700,000 3,500,000 500,000	9.72 7 18 18 18 18 2 18	486,000 3,500,000 9,000,000 9,000,000 6,400,000 4,500,000 1,000,000 900,000	8.094 9 14 14 14 14 1 1	18,904,700 404,700 4,500,000 7,000,000 7,000,000 4,700,000 3,500,000 500,000 700,000	57,650,250 1,650,250 10,000,000 23,000,000 23,000,000 11,500,000 2,000,000 2,300,000
	Source development and livelino	Sustainable fisheries development Sustainable fisheries development Water hyacinth-based enterprise Multi-purpose shelter Construction of approach roads Monitoring Monitoring Monitoring (Representative Sites) Management plan mid-term review (External)	50,000 500,000 500,000 250,000 500,000 500,000	per ha per impacted wetland I group per wetland Per wetland Per wetland Selected wetland Per wetland	33.005 20 46 46 46 46 4 46	15.191 4 14 14 14 14 14 14	4,700,000 3,500,000 4,700,000 3,500,000 500,000	9.72 7 18 18 18 18 2 18 2 18	486,000 3,500,000 9,000,000 9,000,000 6,400,000 1,000,000 900,000	8.094 9 14 14 14 14 1 1 14	18,904,700 404,700 4,500,000 7,000,000 7,000,000 3,500,000 500,000 700,000	57,650,250 1,650,250 10,000,000 23,000,000 23,000,000 15,800,000 1,500,000 2,000,000 2,300,000
# Financing

The management plan may be financed under the National Mission of Clean Ganga (NMCG) under the relevant scheme guidelines.

Conservation of village ponds may be financed under Amrut Sarovar Scheme. For wetlands within the protected area network, it is recommended that the management interventions and actions are linked with protected area plan implementation. Additional sources of funds may be sourced from National Plan for Conservation of Aquatic systems (wherein 40% State funds will have to be provided as State share).

# 9. Reference

- Brinson, M.M. 1993. A hydrogeomorphic classification for wetlands, Technical Report WRP-DE-4, U.S. Army Corps of Engineers Engineer Waterways Experiment Station, Vicksburg, MS. http://el.erdc.usace.army.mil/wetlands/pdfs/wrpde4.p
- Butchart, H. M. et. al. (+ 44 authors). (2010). Global Biodiversity: Indicators of Recent Declines. Science. Vol 328, Issue 5982. Pp. 1164-1168.
- Central Pollution Control Board. (2013). Pollution Assessment: River Ganga, 206. <u>http://cpcb.nic.in/upload/NewItems/NewItem\_203\_Ganga\_report.pdf</u>. Accessed 1 Apr 2019.
- Finlayson, C Max, Nick Davidson, Dave Pritchard, G Randy Milton, and Heather Mackay. 2011. "The Ramsar Convention and Ecosystem-Based Approaches to the Wise Use and Sustainable Development of Wetlands." Journal of International Wildlife Law & Policy 14 (3–4): 176–98.
- Finlayson, C Max. 2012. "Forty Years of Wetland Conservation and Wise Use: EDITORIAL." Aquatic Conservation: Marine and Freshwater Ecosystems 22 (2): 139–43. https://doi.org/10.1002/aqc.2233
- Kanaujia, A and Kumar, A. (2013). Amphibians of Uttar Pradesh and their ecological importance. *In* Water & Biodiversity. Souvenir (2013) published by the Uttar Pradesh State Biodiversity Board.
- Mao, H., Kathuria, D., Duffield, N., & Mohanty, B. P. (2019). Gap filling of highresolution soil moisture for SMAP/sentinel-1: a two-layer machine learningbased framework. Water Resources Research, 55(8), 6986-7009.
- McFeeters, S.K. (1996). The use of the Normalized Difference Water Index (NDWI) in the delineation of open water features, International Journal of Remote Sensing, 17:7, 1425-1432.
- McInnes and Everard 2017. Rapid Assessment of Wetland Ecosystem Services (RAWES): An example from Colombo, Sri Lanka. Ecosystem Services. Volume 25, June 2017, Pages 89-105
- Millennium Ecosystem Assessment (2005). (*Ed.*): Rashid Hassan, Robert Scholes and Neville Ash. Published by Island Press, 1718 Connecticut Avenue, Suite 300, NW, Washington, DC 20009.
- Pekel, J.-F & Cottam, Andrew & Gorelick, Noel & Belward, Alan. (2016). Highresolution mapping of global surface water and its long-term changes. Nature. 540. 10.1038/nature20584.
- Rahmani, A.R., Kumar, B., Ahmad, S., Mehta, P. & Rahman, F. (2019). Sarus Crane in North Uttar Pradesh: Status survey of Sarus and mapping of its wetland habitats. Bombay Natural History Society, Mumbai, pp 1 - 109.
- Ramsar Convention on Wetlands. (2018). Global Wetland Outlook: State of the World's Wetlands and their Services to People. Gland, Switzerland: Ramsar Convention Secretariat.

- Ramsar Convention Secretariat. (2010): Laws and institutions: Reviewing laws and institutions to promote the conservation and wise use of wetlands. Ramsar handbooks for the wise use of wetlands, 4th edition, vol. 3. Ramsar Convention Secretariat, Gland, Switzerland
- Reed, P.B. Jr. (1988). National list of plant species that occur in wetlands: national summary. U.S Fish Wildl. Serv. Biol. Rep. 88 (24). 244 pp.
- Rouse, J.W., Haas, R.W., Schell, J.A., Deering, D.W., Harlan, J.C., 1974. Monitoring 915 the vernal advancement and retrogradation (Greenwave effect) of natural vegetation. 916 NASA/GSFCT Type III Final Report. Greenbelt, MD, USA: NASA/GSFCT.
- Sarkar, U. K., S.C Rebello., G.E Khan., V.K Dubey., A.K Pathak and S.P Singh. (2013). Patterns of fish biodiversity in Uttar Pradesh: current status and challenges for sustainable management of resources. *In* Water & Biodiversity. Souvenir (2013) published by the Uttar Pradesh State Biodiversity Board.
- Shi, Z., Lamb, H. F., & Collin, R. L. (1995). Geomorphic change of saltmarsh tidal creek networks in the Dyfi Estuary, Wales. Marine Geology, 128(1-2), 73-83.
- Singh, S., Basu, D., Tripathi, A., Singh, R and Singh, Ram. (2009). An evaluation of distribution, status and abundance of freshwater turtles in Uttar Pradesh. In book: Freshwater Turtle and Tortoises of India- WII ENVIS Bulletin 2009 (pp.81-89). Published by Wildlife Institute of India, Dehradun.
- Sinha, Rajiv, Shivika Saxena, and Manudeo Singh. "Protocols for Riverine Wetland Mapping and Classification Using Remote Sensing and GIS." *Current Science* 112, no. 7 (2017): 1544–52.
- Sundar, K.S Gopi and Choudhury, B.C. (2006). Conservation of the Sarus Crane (*Grus antigone*) in Uttar Pradesh, India. Journal of the Bombay Natural History Society. 103.

# Annexes

Annex 1

# List of wetland plant species

Family	Scientific name	Common english name	Туре
Alismataceae	Sagittaria latifolia	Arrow head	Emergent hydrophytes
Amaranthaceae	Alternanthera philoxeroides	Alligator weed	Moist loving hydrophytes
Amaranthaceae	Alternanthera sessilis	Sessile joy weed	Moist loving hydrophytes
Apiaceae	Centella asiatica	Indian coinwort	Moist loving hydrophytes
Apiaceae	Bacopa monenieri	Pennywort	Moist loving hydrophytes
Araceae	Pistia stratiotes	Water lettuce	Free floating hydrophytes
Asteraceae	Xanthium strumarium	Rough cockleburr	Emergent hydrophytes
Cannabaceae	Cannabis sativa	Hemp	Emergent hydrophytes
Ceratophyllaceae	Ceratophyllum demersum	Horn wort	Submerged hydrophytes
Convolvulaceae	Ipomoea spp.	Ipomoea spp.	Emergent hydrophytes
Fabaceae	Oxalis tetraphylla	Four leaf clover	Free floating hydrophytes
Hydrocharitaceae	Hydrilla verticillata	Water thyme	Submerged hydrophytes
Lemnaceae	Lemna minor	Duck weed	Free floating hydrophytes
Menyanthaceae	Nymphoides hydrophylla	Crested floating heart	Submerged hydrophytes
Nelumbonaceae	Nelumbo nucifera	Lotus	Emergent hydrophytes
Nymphaeaceae	Nymphaea caerulea	Blue water lily	Emergent hydrophytes
Oxalidaceae	Oxalis acetosella	Wood sorrel	Emergent hydrophytes
Plantaginaceae	Veronica anagallis- aquatica	Water speedwell	Emergent hydrophytes
Poaceae	Phragmites spp.	Common reed	Moist loving hydrophytes
Polygonaceae	Polygonum plebeium	Knot weed	Moist loving hydrophytes
Polygonaceae	Persicaria hydropiper	Water pepper	Moist loving hydrophytes
Pontederiaceae	Eichhornia crassipes	Water hyacinth	Free floating hydrophytes
Potamogetonaceae	Potamogeton nodosus	Long leaf pond weed	Submerged hydrophytes
Ranunculaceae	Ranunculus sceleratus	Cursed buttercup	Emergent hydrophytes
Trapaceae	Trapa natans	Water chestnut	Free floating hydrophytes
Typhaceae	Typha spp.	Cattail	Moist loving hydrophytes
Zosteraceae	Zostera marina	Eel grass	Submerged hydrophytes

Annex 2

# List of fish species

Family	Common name	Scientific name
Cyprinidae	Hamilton's barila	Barilius bendelisis
Bagridae	Gangetic mystus	Mystus mystus
Clariidae	Walking catfish	Clarias batrachus
Cyprinidae	Rohu	Labeo rohita
Cyprinidae	Spotfin swamp barb	Puntius sophore
Cyprinidae	Common carp	Labeo catla
Cyprinidae	Ticto barb	Pethia ticto
Cyprinidae	Silver carp	Hypophthalmichthys molitrix

## Annex 3

# List of amphibian species

Family	Common name	Scientific name
Bufonidae	Common Indian Toad	Duttaphrynus melanostictus
Dicroglossidae	Indian Bullfrog	Hoplobatrachus tigerinus

# List of reptilian species

Family	Common name	Scientific name
Agamidae	Garden Lizard	Calotes versicolor
Colubridae	Checkered Keelback	Xenochrophis piscator
Colubridae	Indian Ratsnake/Dhaman	Ptyas Mucosus
Elapidae	Black Cobra	Naja naja
Scincidae	Indian Skink	Sphenomorphus indicus
Trionychidae	Indian Flapshell Turtle	Lyssemys punctata
Gavialidae	Gharial	Gavialis gangeticus
<u>Crocodylidae</u>	Mugger crocodile	Crocodylus palustris

Annex 5

### List of mammalian species

Family	Common name	Scientific name
Bovidae	Blue bull	Boselaphus tragocamelus
Canidae	Golden Jackal	Canis aureus
Leporidae	Indian Hare	Lepus nigricollis
Sciuridae	Five-striped Squirrel	Funambulus pennantii
Herpestidae	Common Mongoose	Herpestes edwardsii
Mustelidae	Smooth-coated Otter	Lutra perspicillata
<u>Cervidae</u>	Hog deer	Axis porcinus
<u>Cervidae</u>	Swamp deer	Rucervus duvaucelii

### List of bird species

Family	Common name	Scientific name
Podicipedia	e: Grebes	
	Little Grebe	Tachybaptus ruficollis
Phalacroco	racidae: Cormorants	·
	Indian Cormorant or Indian Shag	Phalacrocorax fuscicollis
	Little Cormorant	Phalacrocorax niger
Anhingidae	Darter	
	Darter or Snake Bird	Anhinga malanogaster
Ardeidae: H	erons, Egrets, Bitterns	-
	Cattle Egret	Bubulcus ibis
	Grey Heron	Ardea cinereal
	Indian Pond Heron	Ardeola grayii
	Large Egret	Casmerodius albus
	Little Egret	Egretta garzetta
	Purple Heron	Ardea purpurea
Family Cicc	niidae: Storks	
	Asian Openbill	Anastomus oscitans
	Black-necked Stork	Ephippiorhynchus asiaticus
	Painted Stork	Mycteria leucocephala
Family Thre	eskiornithidae: Ibises, Spoonbills	·
	Black Ibis	Pseudibis papillosa
	Eurasian Spoonbill	Platalea leucorodia
	Oriental-white Ibis	Threskiornis melanocephalus
Family Ana	tidae: Ducks, Geese	·
	Bar-headed Goose	Anser indicus
	Brahmini Shelduck	Tadorna ferruginea
	Comb Duck	Sarkidiornis melanotos
	Common Pochard	Aythya ferina
	Common Teal	Anas crecca
	Eurasian Wigeon	Anas penelope
	Gadwall	Anas Strepera
	Gargany	Anas querquedela
	Greylag Goose	Anser anser
	Mallard	Anas platyrhynchos
	Northern Pintail	Anas acuta
	Northern Shoveller	Anas clypeata
	Red-crested Pochard	Rhodonessa rufina
	Spot-billed Duck	Anas poecilorhyncha
Family Acci	pitridae: Kites, Eagles, Vultures etc.	
	Black Kite	Milvus migrans
	Egyptian Vulture	Neophron percnopterus
	Greater Spotted Eagle	Aquila hastata
	Pallid Harrier	Circus macrourus

	Shikra	Accipiter badius
	Steppe Eagle	Aquila nipalensis
	Western Marsh-Harrier	Circus aeruginosus
Family Falco	onidae: Falcons	
	Eurasian Hobby	Falco subbuteo
Family Phas	sianidae: Pheasants, Partridges	
	Black Francolin	Francolinus francolinus
	Grey Francolin	Francolinus pondicerianus
	Indian Peafowl	Pavo cristatus
Family Gruio	dae: Cranes	
	Sarus Crane	Grus antigone
	Common Crane	Grus grus
Family Ralli	dae: Rails, Coots	
	Common Coot	Fulica atra
	Common Moorhen	Gallinula chloropus
	Purple Moorhen	Porphyrio porphyrio
	White-breasted Waterhen	Amaurornis phoenicurus
	Watercock	Gallicrex cinerea
Family Jaca	nidae: Jacanas	
	Bronze-winged Jacana	Metopidius indicus
	Pheasant-tailed Jacana	Hydrophasianus chirurgus
Family Rostr	atulidae: Painted Snipe	
	Greater Painted Snipe	Rostratula benghalensis
Family Chara	adridae: Plovers, Lapwings	
	Little-ringed Plover	Charadrius dubius
	Northern Lapwing	Vanellus vanellus
	Red-wattled Lapwing	Vanellus indicus
	White-tailed Lapwing	Vanellus leucurus
Family Scolo	ppacidae: Sandpipers, Snipes etc.	
	Black-tailed Godwit	Limosa limosa
	Common Greenshank	Tringa nebularia
	Common Redshank	Tringa totanus
	Common Sandpiper	Actitis hypoleucos
	Common Snipe	Gallinago gallinago
	Green Sandpiper	Tringa ochropus
	Little Stint	Calidris minuta
	Marsh Sandpiper	Tringa stagnatilis
	Pintail Snipe	Gallinago stenura
	Ruff	Philomachus pugnax
	Spotted Redshank	Tringa erythropus
	Wood Sandpiper	Tringa glareola
Family Recu	rvirostridae: Stilts, Avocet	
	Black-Winged Stilt	Himantopus himantopus
	Pied Avocet	Recurvirostra avosetta

Family Burh	inidae: Stone curlew	
	Stone-Curlew	Burhinus oedicnemus
Family Colu	mbidae: Pigeons, Doves	•
	Blue Rock Pigeon	Columba livia
	Eurasian Collared-Dove	Streptopelia dacaocta
	Little Brown Dove	Streptopelia senegalensis
	Red Collared-Dove	Streptopelia tranquebarica
	Yellow-legged Green-Pigeon	Treron phoenicoptera
Family Psitt	acidae: Parakeets	
	Rose-ringed Parakeet	Psittacula krameri
Family Cucli	dae: Cuckoos, Crow Pheasants	•
	Asian Koel	Eudynamys scolopacea
	Brain Fever Bird	Hierococcyx varius
	Greater Coucal	Centropus sinensis
	Eurasian Cuckoo	Cuculus canorus
Family Tyto	nidae: Barn Owls	
	Barn Owl	Tyto alba
Family Strig	idae: Owls, Owlets	1
	Dusky Eagle Owl	Bubu coromandus
Family Alced	dinidae: Kingfishers	
	White-breasted Kingfisher	Halcyon smyrnensis
	Pied Kingfisher	Ceryle rudis
	Small Blue Kingfisher	Alcedo atthis
Family Merc	pidae: Bee-eaters	
	Blue-tailed Bee-eater	Merops philippinus
	Small Bee-eater	Merops orientalis
Family Cora	ciidae: Rollers	
	Indian Roller	Coracias benghalensis
Family Upup	bidae: Hoopoes	
	Ноорое	Upupa epops
Family Buce	rotidae: Hornbills	•
	Indian Grey Hornbill	Ocyceros birostris
Family Picid	ae: Woodpeckers, Wrynecks	•
	Lesser Golden-backed Woodpecker	Dinopium benghalense
Family Alau	didae: Lark, Bushlark	
-	Common Crested Lark	Galerida cristata
Family Hirur	ndinidae: Martins and Swallows	
	Common Swallow	Hirundo rustica
	Plain Martin	Riparia paludicola
	Wire-tailed Swallow	Hirundo smithii
Family Mota	acillidae: Wagtails, Pipits	1
-	Citrine Wagtail	Motacilla citreola
	Large-pied Wagtail	Motacilla maderaspatensis
	Paddy-field Pipit	Anthus rufulus

	Yellow Wagtail	Motacilla flava
Family Campe	ephagidae: Minivets	
	Small Minivet	Pericrocotus cinnamomeus
Family Pycnor	notidae: Bullbulls	
	Red-vented Bulbull	Pycnonotus cafer
Family Laniida	ae: Shrikes	
	Rufous-backed Shrike	Lanius schach
Family Musica	apidae: Redstarts, Chats, Robins	
	Black Redstart	Phoenicurus ochruros
	Blue-throat	Luscinia svecica
	Common Stonechat	Saxicola torquata
	Indian Chat	Cercomela fusca
	Indian Robin	Saxicoloides fulicata
	Oriental Magpie Robin	Copsychus saularis
	Pied Bushchat	Saxicola caprata
	Common Babbler	Turdoides caudatus
	Jungle Babbler	Turdoides striatus
	Large Grey Babbler	Turdoides malcolmi
	Striated Babbler	Turdoides earlei
	Ashy Prinia	Prinia socialis
	Common Chiffchaff	Phylloscopus collybita
	Common Tailorbird	Orthotomus sutorius
	Plain Prinia	Prinia inornata
	Rufous-fronted Prinia	Prinia buchanani
	Streaked Fantail-Warbler	Cisticola juncidis
	Red-throated Flycatcher	Ficedula parva
	Asian Brown Flycatcher	Muscicapa dauurica
Family Nectar	iniidae: Sunbirds	
	Purple Sunbird	Nectarinia asiatica
Family Estrildi	idae: Munias	
	Black-headed Munia	Lonchura malacca
	Red Munia	Amandava amandava
	Spotted Munia	Lonchura punctulata
	White-throated Munia	Lonchura malabarica
Family Passer	ridae: Sparrows	
	House Sparrow	Passer domesticus
	Baya Weaver	Ploceus philippinus
	Black-breasted Weaver	Ploceus benghalensis
	Streaked Weaver	Ploceus manyar
Family Sturnic	dae: Mynas, Starlings	
	Asian-pied Starling	Sturnus contra
	Bank Myna	Acridotheres ginginianus
	Brahminy Myna	Sturnia pagodarum
	Common Myna	Acridotheres tristis

	Common Starling	Sturnus vulgaris	
Family Orioli	dae: Orioles		
	Eurasian Golden	Oriolus oriolus	
Family Dicru	ridae: Drongos		
	Black Drongo	Dicrurus macrocercus	
Family Corvidae: Crows, Treepies			
	House Crow	Corvus splendens	
	Indian Treepie	Dendrocitta vagabunda	
	Jungle Crow	Corvus macrorhynchos	

Stay in touch

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# Conserving and Sustainably Managing Gangetic Floodplain Wetlands of Uttar Pradesh

Management Plan for Upstream of Gomti Confluence to Muzaffarnagar Sub-basin, Uttar Pradesh





2023

Funded By National Mission for Clean Ganga, Government of India Ministry of Jal Shakti



#### **Uttar Pradesh State Wetland Authority**

The Uttar Pradesh State Wetland Authority (UPSWA) is the apex body in the state for conservation and management of wetlands present within the state of Uttar Pradesh. Constituted as per provisions of the Wetlands (Conservation and Management) Rules, 2017 as the nodal policy and regulatory institution within the state, It is entrusted with a plethora of functions like preparing list of wetlands of the State and those to be notified; Recommending identified wetlands for regulation; Preparing and updating comprehensive digital inventory of all wetlands; Developing a comprehensive list of activities to be regulated and permitted within the notified wetlands and their zone of influence; Defining strategies for conservation and wise use of wetlands; Reviewing Integrated Management Plan for each of the notified wetlands; Recommending mechanisms for maintenance of ecological character; Identifying mechanisms for convergence of implementation of the management plan with the existing State development plans and programs; Ensuring enforcement of the Wetlands (Conservation and Management) Rules and other relevant Acts; Reporting and coordinating activities. The Authority is headed by the state's environment minister.



#### Wetlands International South Asia

Wetlands International South Asia Wetlands International South Asia is a non-government organisation working for sustaining and restoring wetlands, their resources and biodiversity in the South Asia region. Its office in New Delhi (India) was established in 1996 as a part of Wetlands International network. Wetlands International is a global, independent, non-profit organisation dedicated to conservation and restoration of wetlands, and presently works in over 100 countries through a network of 18 regional and national offices and expert networks headquartered in The Netherlands. Wetlands International is also one of the five International Organization Partners of the Ramsar Convention. In 2005, Wetlands International South Asia was registered under the Societies Registration Act of Government of India (retaining remit of South Asia region), consequently gaining an Indian legal entity while subscribing to the goals and targets of the Wetlands International network. The organisation endeavours to use a mix of approaches including technical knowledge, policy dialogue and field demonstrations for addressing various issues related to wetland management. To leverage change, the organisation works with national and state governments, knowledge centres, civil society as well as the private sector, often acting as catalysts to enable joined up actions. Given that securing a positive change in the status of wetlands and linked livelihoods takes considerable time, the organisation works for long-term engagement, forging strategic and innovative partnerships.

# **Conserving and Sustainably Managing Gangetic Floodplain Wetlands of Uttar Pradesh**

Management Plan for Upstream of Gomti Confluence to Muzaffarnagar Sub-basin Uttar Pradesh





Uttar Pradesh Forest Department





Funded By National Mission for Clean Ganga, Government of India Ministry of Jal Shakti

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# Acronyms

ARC	Above Ramganga Confluence
BAPS	Basin Assessment and Planning System
BMTPC	Building Materials and Technology Promotion Council
BSI	Botanical Survey of India
CEPA	Communication Education Participation and Awareness
CIFRI	Central Inland Fisheries Research Institute
CPCB	Central Pollution Control Board
DDMA	District Disaster Management Authority
DGPC	District Ganga Protection Committee
DWC	District Wetlands Committee
DRR	Disaster Risk Reduction
GOI	Government of India
HGM	Hydrogeomorphic classification system
HWLS	Hastinapur Wildlife Sanctuary
India-WRIS	India Water Resource Information System
KVKs	Krishi Vigyan Kendras
mbgl	below ground level
mg/l	milligrams-per-liter
MoEFCC	Ministry of Environment, Forest and Climate Change
NBSSLUP	National Bureau of Soil Survey and Land Use Planning
NCC	National Cadet Corps
NDMA	National Disaster Management Authority
NMCG	National Mission for Clean Ganga
NPCA	National Plan for Conservation of Aquatic Ecosystems
NSS	National Service Scheme
OA	Overall accuracy
PA	Producer accuracy
RGB	River Ganga Basin
RAWES	Rapid Assessment of Wetland Ecosystem Services
SAC	Space Application Centre
SMCG-UP	State Mission for Clean Ganga-Uttar Pradesh
SWaRDAC	State Water Resources Data Analysis Center
SwaRA	State Water Resources Agency
SWaRDAC	State Water Resources Data Analysis Center
SOI	Survey of India
UA	User accuracy
UPSBB	Uttar Pradesh State Biodiversity Board
UPSDMA	Uttar Pradesh State Disaster Management Authority
UPSWA	Uttar Pradesh State Wetlands Authority
UPWaMReC	Uttar Pradesh Water Management and Regulatory Commission
WWF – India	World Wildlife Fund – India
ZSI	Zoological Survey of India

# 1. Introduction

## Background

River Ganga flows through 27 Districts of Uttar Pradesh covering 1180 km, entering the state at Kotwali in Bijnor District and exiting at Dokti in Ballia District. The floodplains flanking the main channel provide an ecological and hydrological continuum rendering vital ecosystem services and biodiversity habitats. Effective management of these wetlands is crucial for achieving river integrity, and food and water security for the dependent communities.

The 'Vision Ganga' under the National Mission for Clean Ganga (NMCG) is an integrated conservation mission, approved as the 'Flagship Programme' by the Union Government of India. The mission is structured along four dimensions of the river system, namely: a) Aviral Dhara (uninterrupted flow), b) Nirmal Dhara (unpolluted flow), c) Geological entity, and d) Ecological entity. The main objectives of the Ganga River Management have been articulated to be: a) maintenance of environmental flows in rivers and tributaries to fulfill their geological, ecological, socio-economic, and cultural functions; b) ensuring that water quality in all rivers and tributaries is consistent with their governing geological, ecological, socioeconomic and cultural functions; c) judicial use of water and other aquatic resources to enable sustainable development in the entire basin; and d) transparent and inclusive review of all existing, ongoing and planned anthropogenic activities in the basin. Action programmes to realize the objectives have been organized around eight missions, namely: a) aviral dhara, b) nirmal dhara, c) ecological restoration, d) sustainable agriculture, e) geological safeguarding, f) disaster protection, g) river hazards management, and h) environmental knowledge building and sensitization.



Bakwatal wetland provides immense ecological subsidies

Within any basin, including the River Ganga Basin (RGB), management of hydrological regimes and linked ecosystem processes, services, and biodiversity values needs to be based on complementarity and interactions between lentic ecosystems (i.e., the wetlands) and lotic systems (i.e., the river). Floodplains, especially the active part, harbour significant riverine wetlands, which are unique, highly productive, and perform a wide range of functions such as flood control, water purification, carbon storage, groundwater recharge, and water storage. In terms of biodiversity, these wetlands provide refuges for fauna in times of flooding, are food reservoirs and breeding sites, and participate in the dispersion of plant and animal species. Owing to the variability of the geomorphological, physicochemical, and hydrogeological contexts in which they are created, riverine wetlands offer a unique diversity of ecological situations that has no equivalent in other wetlands on similar scales.

Conservation and wise use of wetlands, recognition of their role, and wide-ranging ecosystem services are essential aspects of river basin planning and management. Degradation and loss of wetlands, and rapid changes in the river basins of which these wetlands are integral elements, which lead to the disruption of natural hydrological cycles, often leading to enhanced frequency and severity of flooding, drought and pollution, and imposing significant economic and social losses and costs to the human populations within these river basins. Proper consideration of the role and importance of wetlands in river basin management can significantly assist in securing safe, reliable sources of water and meeting development objectives identified within the Ganga Vision.

The Government of Uttar Pradesh constituted the Uttar Pradesh State Wetlands Authority as the nodal policy-making, regulation, and management organization at the state level. The NMCG, with an objective of supporting conservation and sustainable management of Gangetic wetlands of Uttar Pradesh, sanctioned a technical assistance project to UPSWA. The project has an overall objective of 'effective management of floodplain wetlands in River Ganga Districts' to ensure sustained provision of wide-ranging ecosystem services naturally provided by these ecosystems and securing diverse habitats. The specific objectives were to:

- Define and characterize floodplain wetlands regimes within the Ganga Districts.
- Put in place institutional arrangements for managing floodplain wetlands by notifying under Wetlands (Conservation and Management) Rules, 2017.
- Develop stakeholder-led integrated management plans for securing ecosystem services and biodiversity values.
- Design and implement a monitoring regime to enable periodic assessment of wetland ecosystem health and effectiveness of management.
- Creating and developing the available infrastructure, capacity building and generation of awareness of the stakeholders.

This management plan has been prepared under the aegis of the NMCG funded project and reflects the commitment of the Government of Uttar Pradesh for ensuring the conservation of floodplain wetlands of the state. The Gangetic floodplain wetlands in Uttar Pradesh fall within three sub-basins of the River Ganga: a) Above Ramganga Confluence, b) Gomti Confluence to Muzaffarnagar and c) Ghaghra Confluence to Gomti Confluence (Map 1). In line with this, the wetland management plans have been prepared at the sub-basin level, articulating description and evaluation of the ecological character, identification of threats and management needs, management objectives and outcomes, and actions. It is envisaged that a basin sub-level wetland plan will provide better synergies with water resource planning and implementation, as well as with districtlevel developmental planning. The current management plan provides a framework for action for conservation and wise use of floodplain wetlands located within the Upstream of Gomti Confluence to Muzaffarnagar sub-basin.

### Management planning purpose and objectives

India, as a signatory to the Ramsar Convention, is committed to achieving wise use of all wetlands in her territory. Wise use of wetlands is defined in the text of the Ramsar Convention as 'the maintenance of their ecological character, achieved through the implementation of ecosystem approaches, within the context of sustainable development.' Ecological character is 'the combination of ecosystem components, processes, and services that characterize a wetland.' Ecosystem management of wetlands thus seeks to achieve the goal of 'maintenance of ecological character' or 'wetland wise use'.

Wise use is the longest established example amongst inter-governmental processes, implementation of which have become known as ecosystem approaches for conservation and sustainable development of natural resources, including wetlands (Finlayson et al. 2011). The approach recognizes the human interdependency with wetland functioning and accommodates sustainable utilization of these ecosystems for the benefit of humankind in a way compatible with the maintenance of natural properties of the ecosystem. Wise use encourages stakeholder engagement and transparency in negotiating trade-offs and determining equitable outcomes for wetland conservation while promoting maintenance of environmental, economic, and social sustainability (Finlayson 2012). The purpose of management planning is to outline the pathway through which wetland wise use can be achieved (Ramsar 2010).

The term 'wise use' is often misinterpreted to indicate that the Ramsar Convention promotes the human use of all wetlands. However, wise use as a wetland management approach is much wider than the use of a wetland. The phrase 'in the context of sustainable development' recognizes that development, which may be inevitable in some cases, is not an objective for every wetland. Whenever development is to take place, it has to be facilitated in sustainable ways by approaches elaborated in the Ramsar Convention. 'Ecosystem approaches include the elements elaborated by the Convention on Biological Diversity – integrated management, stakeholder's participation in the decision-making process, transparency about trade-offs, and equitability of the outcomes. In totality, wise use is about 'maintaining the capability of the wetland' to support human well-being at present and in the future, rather than 'use' or 'development' at present.



Map 1: River Ganga and her three sub-basins in Uttar Pradesh

The wetland management plan aims at putting in place effective management arrangements which enable integration of biological diversity and ecosystem service values of these wetlands in river basin conservation and developmental planning. The following are specific objectives:

- Describe the wetlands in terms of their ecological character and their governing factors.
- Assess the risk of adverse change in wetlands and their underpinning reasons.
- Define monitoring requirements for detecting changes in ecological character.
- Define management objectives and strategies for achieving these objectives.
- Support resource mobilization.
- Enable communication within and between sites, organizations, and stakeholders.
- Ensuring compliance with local, national, and international policies and regulatory frameworks.

### Management planning approach and method

Wetlands under the Gangetic floodplains evolve and function within physical templates, characteristics of which are determined primarily by the interaction between water and sediments. The ecological components, processes, and services are influenced by land and water management practices within the immediate as well as indirect catchments of the wetland complex. Management planning, therefore, calls for an approach that recognizes the interconnectedness of wetland biological diversity and ecosystem services with land and water management in the river basin taking into account the external, natural, and induced factors. The approach also needs to address climate change which has direct as well as indirect implications for wetland features as well as factors governing these features. The wise use principle encourages stakeholder engagement and transparency in negotiating trade-offs and determining equitable outcomes for wetland conservation while promoting maintenance of environmental, economic, and social sustainability.

The National Environment Policy (2006), Government of India, recommends the integration of conservation and wise use of wetlands into river basin management involving all relevant stakeholders, in particular local communities, to ensure maintenance of hydrological regimes and conservation of biodiversity. It further recommends the integration of wetland conservation into sectoral development plans for poverty alleviation and livelihood improvement, and link efforts for conservation and sustainable use of wetlands with all ongoing rural infrastructure development and employment generation programmes. If considered as a natural infrastructure capable of providing water and food security, buffering extreme events, and supporting adaptation to climate change, the ecosystem services of Kanwar can support achieving outcomes for several sectoral development plans, particularly for water resources, agriculture, rural development, and disaster risk reduction. The Wetlands (Conservation and Management) Rules, 2017; The River

Ganga (Rejuvenation, Protection and Management) Authorities Order, 2016 (amended 2019), and the minimum environmental flows notification of 2018 provides the regulatory framework to prevent any fragmentation of hydrological regimes through hydraulic structures, diversions, encroachments, or impeding flow pathways.

Much of the region along the 10-kilometer buffer of the Ganga River channel is constituted by river floodplains (Map 2 and Map 3). The uniqueness of floodplain ecosystems lies within their near-linear form, the high dynamism of their geomorphology, and the ability to processes large fluxes of energy and material from upstream areas. Several conceptual models and frameworks have emphasized upstream-downstream linkages along the river corridor, the influence of river basin form and climate on downstream areas, their horizontal linkage across the floodplain between the river channel and the floodplain, the vertical interconnection within the floodplain between overbank flooding, groundwater, and rainfall. Amongst several factors, hydrological inputs to floodplains play a significant role through a) their influence on the arrangement of landforms and vegetation communities, and b) the impact of flooding regimes on the regeneration and turnover time of floodplain vegetation.

River floodplains are specific areas typical of grid dynamics of natural, especially fluvial processes co-existing within anthropogenic influences and intensive use. There are several basic definitions to delimit the floodplains corresponding to the scientific disciplines concerned. From a geomorphological perspective, floodplains are accumulation plains along a watercourse constituted by unconsolidated sediment, transported by and deposited in this stream, usually partially or fully flooded during high floods. The geomorphological view of the floodplains emphasizes its genesis and relief morphology, bringing to focus two systems of fluvial processes i.e., erosional fluvial processes with predominant removal of material and accumulation fluvial processes, with predominant sedimentation. Geological definitions describe the floodplain as "flat valley floor activated during the flooding of a stream"; the floodplain is composed of horizontal young (Holocene), gravel, sandy, loamy, or clay sediment, often displaying irregularities caused by braiding of a stream, origin of islands, meanders, alluvial fans, and delta plains, debris, landslides, etc. (Shi et al., 1995). Hydrological definition views floodplains as natural inundation areas suitable for water retention in the landscape during floods. In times of such high flood discharges, water is over-burdened with suspension loads, depositing in the inundation area. Floodplain regions are also characterized by the occurrence of fluvisols and glevsols. Ecological boundaries of floodplains are defined on the basis of the regionalization of floodplains, biochores, ecosystems, and plant and animal communities. Floodplains are indispensable ecological corridors for plant and animal migration and have other vital ecological functions in the landscape (such as climate moderation, water retention, and others).



Map 2: Wetlands within the active floodplain boundary on the either side of River Ganga in the Upstream of Gomti Confluence to Muzaffarnagar



Map 3: Section wise details

Floodplains apparently exist in two alternating phases. For most of the time, these ecosystems exist in a dry phase during which, at least superficially, is not substantively different from surrounding terrestrial ecosystems. However, during monsoons, these ecosystems are inundated wherein large, shallow floods driven by rainfall top up moisture in the soil, recharge the groundwater aquifers, and fill up depressions. This recharge provides the reservoir of water upon which the biota depends until the next flood event. These ecosystems have evolved to cope with these phase changes. Many aquatic plants have long-lived seeds that can withstand extended periods of drought. Similarly, many animals possess drought-resistant stages in the life-cycle or the physiological capacity for diapause or, like waterbirds, adopt highly mobile strategies in order to track scarce resources.

The gradients of flooding frequency, soil moisture, and vegetation create conducive environments for wetlands within these floodplains. Located at the interface of terrestrial and aquatic ecosystems, combining features of both, wetlands arise when inundation by water produces soils dominated by anaerobic processes, which in turn, forces the biota, particularly rooted plants to adapt to flooding. Ramsar Convention, an inter-governmental treaty defines wetlands broadly as 'areas of marsh, fen, peatland or water, whether natural or artificial, permanent or temporary with water that is static or flowing, fresh, brackish or salt, including areas of marine water the depth of which at low tides does not exceed six metres. All wetlands exhibit certain common indicators such as the presence of water permanently or seasonally, saturated soils, and hydrophytic vegetation. Hydrology, in particular, serves as a driving force for these ecosystems through its disproportionate impact on abiotic and biotic characteristics of wetlands. Abiotic characteristics such as soil texture and colour, water quality depend on the distribution and movement of water as do the abundance, diversity, and productivity of the range of species that use the wetlands as habitats.

The variable water regime in floodplains plays an important role in the structure and function of floodplain wetlands. Intermittent or seasonal floods transport organic matter and biota, triggering the life cycles of many aquatic and terrestrial organisms inhabiting wetlands. Wetting and drying are vital to the functioning of these ecosystems. During dry phases, eggs, and seeds of diapausing animals and plants remain in dry floodplain soils. Nutrients and energy to floodplain soils are also added by decomposing organic matter from leaf litter and stranded aquatic plants and animals. During floods, these organic reservoirs support emerging aquatic organisms and biota which colonise the newly inundated habitats. Heterotrophic organisms, in particular, assimilate these resources into the food webs, linking detritus to higher trophic levels. The temporal dynamics of water drive this complexity. Species like waterbirds and fishes depend on floodplain river connections to complete their life cycles.

The analysis of floodplain processes tends to be dominated by discussions of geomorphological, hydrological, and hydraulic processes which provide the physical background to the evolution of floodplain areas. However, floodplains are also subjected to a high degree of development and often urbanization which tend to significantly modify their natural properties and functions. A basic differentiator

of the impact of human activities is whether these occur on or off the floodplain. Development on the floodplain such as the intensification of agriculture can greatly alter the morphology of the region. The effect of the development of the floodplain can be just as significant in that they can have "downstream effects" on floodplain areas lower down the catchment. The urbanization that is not planned with in-built local storage for flood flows tends to increase both the volume of runoff and the speed of concentration. This means that the flood severity can increase in the floodplain storage areas downstream, while at the same time the lead time before the floodwater arrives decreased. Again, the flood damage potential is increased and the opportunities for ameliorative action during flood events are reduced.

Conservation of floodplain wetlands needs to be based on maintaining the carbon and biotic balance through appropriate water regimes and land management practices. The concentration of carbon, organic matter, dissolved oxygen, density, and diversity of micro-invertebrates as well as recruitment in fish, plants, and water birds can serve as key indicators of floodplain wetland ecosystem health. Wise use of floodplain wetlands entails that the underpinning ecological and hydrological processes, particularly the flood pulse are maintained in line with natural regimes. From this perspective, the management of floodplain wetlands is closely interlinked with the management of river systems within their basin and linked developmental planning.

Conservation and sustainable development of floodplain wetlands of Ganga require integrated planning and resource management at the river basin level recognizing the interconnectedness of the wetland system with its catchments. River basinlevel planning requires an understanding of the carrying capacity of the basin to produce desired outputs (goods and services) from a limited resource base and achieve an equitable quality of life while maintaining desired environmental quality in the region. The planning for management calls for trade-offs between desired production and consumption levels. It also emphasizes the development of supportive mechanisms within the generative capacity while maintaining the environmental quality. The challenge, therefore, is to conserve the ecological character and full range of ecosystem services of floodplain wetlands of Ganga while providing sustained benefits to the communities dependent upon the wetland for their sustenance.

The methodology for management planning is based on the New Guidelines for Management Planning for Ramsar Sites and Other Wetlands as adopted by the Contracting Parties to the Ramsar Convention on Wetlands in 2002. These guidelines also form the basis of the wetlands management planning guidelines of the MoEFCC's National Plan for Conservation of Aquatic Ecosystems (NPCA). In 2022, the Ministry also notified the Sahbhagita Guidelines – wherein a participatory and inclusive framework for wetland management has been outlined clarifying roles and responsibilities at various levels of administration.



Figure 1: Framework for integrated management planning

The NPCA guidelines recommend following a diagnostic approach – wherein the selection of management interventions is guided by knowledge of wetlands features and factors governing these features, and their relationship with broader societal conservation and development goals that wetland wise use is contributing to (Figure 1). Wetlands features are its ecological, social, and institutional attributes, which collectively characterize a wetland. Wetlands are dynamic systems, and thus their features undergo cyclical and temporal changes.

Factors (natural as well as anthropogenic) cause the wetland to move along a specific trajectory. The afore-mentioned wetland management planning method was implemented in the following steps in accordance to the NMCG project (implemented over 2020 – 2022):

a) Mapping and inventory of wetlands within 10km buffer along either side of the Ganga River channel: Inventory of 285 wetlands (of which 137 wetlands were in the Upstream of Gomti Confluence to Muzaffarnagar sub-basin) (Map 4), identified on the basis of 2020 land use and land cover map of the 10-km buffer region was undertake with the help of a rapid assessment tool. For each wetland, the following information was generated

**Wetland settings:** Official and vernacular names, geographical location, extent, wetland type, and features of the surrounding area.

**Description of wetland features:** Catchment, hydrology (topography, geology, geomorphology, soil, land use, and land cover, climate, major sources of water, number and status of inlets and outlets, water depth, connectivity, inundation regime, water flow direction, water permanence, and usage), Species and habitats (habitat types, availability of bird counts, invasive species status, macrophytes, fish, reptiles, birds, amphibians, and mammals), and Communities (permanent and temporary settlements present on the shoreline, population, and percentage of community dependence).



Map 4: Location of surveyed wetlands within 10 km buffer zone for the Upstream of Gomti Confluence to Muzaffarnagar Sub-basin

Values and benefits: provisioning services (freshwater - drinking, washing & domestic use, agriculture and livestock; food – fish and edible aquatic plants; fuel; fiber and fodder; natural medicines; ornamental resources; clay, sand, and mineral harvesting), regulatory(air quality regulation, local climate regulation, water regulation, flood hazard regulation, water during droughts, pest regulation, disease regulation – human and livestock, erosion regulation, water purification, pollination, salinity regulation, fire regulation, and noise and visual buffering), supporting services (soil formation, primary production, nutrient cycling, water recycling, and provision of habitat), and cultural services(cultural heritage, recreation and tourism, aesthetic value, spiritual and religious value, inspiration value, social relations, educational and research, and transportation).

**Threats:** adverse changes faced in the ten years, major direct threats, and major indirect threats.

**Management:** Pattern of land ownership within the wetland, the pattern of land ownership in the area surrounding the wetland, and pre-existing rights and privileges in the wetland.

The inventory data of 285 wetlands was uploaded into an electronic database of the Uttar Pradesh Forest Department (upforest.org/wetland.aspx).

**b) Preparation of wetlands health cards:** For each wetland, the inventory information was used to develop an ecosystem health report card on the basis of nine indicators related to wetland extent, hydrology and catchments, biodiversity, ecosystem services, and governance.

**c) Hydrogeomorphic classification and prioritisation**: Wetlands were prioritised on the basis of scores generated for threats, and a cumulative score of ecosystem service index and hydro-geomorphic function score.

A systematic classification of wetlands is a necessary step for their management and conservation. The current classification system used for mapping wetlands by Space Application Centre (SAC) are based on a three-tier system wherein at the first level, the wetlands are classed into inland and coastal categories, at the second level into natural and human-made categories and at the third level, the wetlands are placed either of the twenty categories (thirteen natural and seven humanmade). This classification system is largely based on ecosystem structure attributes (such as hydrology or plant communities) and does not readily lend itself to attribution of ecosystem functions (such as groundwater recharge, flood buffering and water purification). The latter is of critical importance for integrating wetlands in management of River Ganga. The project, therefore, uses a hydrogeomorphic (HGM) classification system to enable focus on wetland functions within a given landscape.

The hydrogeomorphic (HGM) classification of wetlands emphasizes the wetland hydrological processes and functions and their ecological significance within a generalized landscape context (Semeniuk et al., 2016). The HGM classification

renders the wetlands classes which have distinctive ecological character as they represent the hydrogeomorphic functions of wetlands. The classification system used in the project has been modified from those applied in Australia, South Africa and other countries and uses landform and water characteristics as the dominant features and wetland size and vegetation as descriptors.

d) Stakeholder Consultations: Significant data was generated based on preliminary consultations with relevant stakeholder groups, Government department(s), and/or agencies from varied relevant sectors for wetlands conservation and management planning. The varied sectors considered for consultation and their corresponding stakeholder groups included wetlands management (State Wetlands Authority, District Ganga Committees, Nodal departments entrusted for management of wetlands), Biodiversity conservation (State Biodiversity Board, Forest Department), Water resources (Water resources department, State Pollution Control Board), Agriculture (State Agriculture Department), Fisheries & Animal Husbandry (State Fisheries and Animal Husbandry Department), Climate Change (Science and Technology Council), Planning (Department of Planning), Disaster Management (State Disaster Management Authority, District administration), Culture & Tourism (Department of Culture & Tourism, Religious bodies present around wetlands, Tour Operators (public and private), Hoteliers and Hotel Associations), Research and Academia (College, Universities and research institutes conducting research & monitoring on wetlands), State governance (Elected political representatives, District Administration), Civil society (NGOs engaged in developmental and conservation activities around wetlands) and Resource users (Fishing communities and others which depend directly on wetlands) respectively.

### **Management Plan Structure**

The management plan follows the format prescribed by the MoEFCC and is organized in three sections with eight chapters. Following the introduction, Section one of the plan (comprising Chapters 2, 3, and 4) contains a description and evaluation of the wetlands. Chapter 4 includes an analysis of current institutional arrangements in terms of the capability of addressing the risk of adverse change identified in Chapter 2 and 3 and ensuring wetlands wise use. Section 2 of the plan (containing chapters 5 and 6) discusses the management framework (management goal, purpose, strategy and objectives, and monitoring arrangements thereof. Section 3 (comprising chapters 7 and 8) includes the detailed action plan, budget for five years and possible financing arrangements.
# 2. Description of Wetlands Features

## Wetland location, and extent

The Upstream of Gomti confluence to Muzaffarnagar sub-basin is situated between 77.51° E and 83.09° E longitudes and 24.86° N and 29.64° N latitudes and spans ~30782 km<sup>2</sup>, encompassing about 3.6 % of the Ganga basin area. The 10 km buffer zone on either side of the Ganga River channel falls within 79.55 ° E and 83.09 ° E and 27.28° N to 25.02° N in 12 districts (Hardoi, Unnao, Kanpur Nagar, Kannauj, Fatehpur, Rai Bareli, Kaushambi, Pratapgarh, Prayagraj, Sant Ravi Das Nagar, Varanasi, Mirzapur) and spans 8958 km<sup>2</sup>.

The Ganga River floodplain was delineated using the Global Surface Water data for 1984-2020 (Pekel et al., 2016). The data provides occurrence, change, recurrence, transitions, seasonality for 32 years and maximum extent at 30m resolution. The maximum extent of inundation was used as the active floodplain boundary. This was digitized using visual interpretation, and rectified at a constant scale of 1:1000 to ensure accuracy in capturing the landscape details (Rozo et al., 2014).

Wetlands dynamics in the 10-km buffer was assessed using cloud-free postmonsoon (October) Landsat images (30 m resolution) of 2000 and 2020. This spatial resolution is suitable for 1:50,000 scale mapping. Satellite images downloaded from USGS Earth Explorer were radiometrically and atmospherically corrected. The river channel was extracted from satellite imagery using a binary mask generated by a decision tree based on spectral band reflectance (SWIR 1; 1.57–1.65 m), Normalized Difference Vegetation Index (NDVI) (Rouse et al., 1974) and the Normalized Difference Water Index (NDVI) (Mcfeeters, 1996).



Bela Kachar wetland in Raebareli district, Uttar Pradesh

The wetland mapping method used herein has been adapted from National Wetland Atlas (SAC, 2011) and Sinha et al., (2017)) and is presented in Figure 2. Water-dominated areas (including wetlands, river channel, river bed, and aquatic vegetation) were extracted from the current LULC map (i.e., the Year 2020) in the GIS environment. Additional information pertaining to the wetland types mapped were derived from satellite imagery-based spectral indices including Normalized difference vegetation index (NDVI) (which indicates the extent of aquatic vegetation) and Normalized Difference Water Index (NDWI) (which depicts the open water extent within the wetland) (Map 5). Proximity to linear infrastructure was used to segregate the human-made waterlogged areas. To improve the accuracy of the land use and land cover classification, 2837 ground truth points were used, evenly dispersed across the study region. The overall accuracy of the land use and land cover maps was 98.49% (2020) and 98.2% (2000).



Figure 2: Classification approach used in the study

The active floodplain area in 2020 was assessed to span 1054 km<sup>2</sup> (11.67% of the 10-km buffer area). In 2020, wetlands spanned 15844ha, of which 77% were located within the active floodplain area and the rest outside. Spatially, the wetlands were distributed in two broad classes: a) wetlands located along river channels (riparian wetlands); and b) wetlands located in isolated shallow depressions (isolated sumplands). In 2020, riparian wetlands constituted a majority of the overall wetland area (76%), followed by isolated sumplands (24%).

The wetland area in Upstream of Gomti Confluence to Muzaffarnagar sub basin has shrunk by 72% during 2000-2020 (from 57310 ha to 15844 ha). It was observed that the reduction in isolated sumplands outside the active floodplain boundary (87% since 2000) was higher as compared to riparian wetlands inside (58%). The conversion of 16552 ha of riparian wetland to agricultural land between 2000 and 2020 may be related to the ephemeral nature of wetland ecosystems. Similarly, isolated sumplands witnessed a change of 20646 ha to the agricultural class over the past 20 years. From 2000 to 2020, isolated sumplands experienced a greater conversion of wetland area to terrestrial vegetation than riparian wetland areas (5313 ha and 2934 ha, respectively). Similarly, isolated sumplands (1126 ha) experienced a greater rate of urbanization than riparian wetlands (168 ha) (Figure 3 and Figure 4)



## (Area in hectare) Figure 3 :Wetland conversion within two decades to other land use type in

Upstream of Gomti Confluence to Muzaffarnagar sub basin.



Map 5: Wetland extent in the 10km buffer zone on either side of the river Ganga in the Upstream of Gomti Confluence to Muzaffarnagar sub basin during the years 2000 (left) and 2020 (right)



Figure 4: Wetland area within area categories for the Upstream of Gomti Confluence to Muzaffarnagar sub basin

#### **Wetland Catchments**

Wetlands in the 10 km buffer zone receive inflows from the entire Upstream of Gomti confluence to Muzaffarnagar sub basin. The sub basin is elongated in shape and runs south of the Above Ramganga Confluence sub basin. It lies entirely in the plains of Uttar Pradesh between Ganga River and Yamuna and covers 23 districts (Muzaffarnagar, Meerut, Ghaziabad, Bulandsahar, Aligrah, Hathras, Etah, Firozabad, Mainpuri, Farukkhabad, Kannauj, Hardoi, Unnao, Jaunpur, Kanpur Nagar, Fatehpur, Rai Bareli, Kaushambi, Pratapgarh, Prayagraj, Sant Ravi Das Nagar, Varanasi, Mirzapur and small parts of Chandauli. presents the elevation profile of the upstream of Gomti Confluence to Muzaffarnagar sub-basin.

#### Drainage and land forms

The upper half of the sub basin is part of the Ganga-Yamuna interfluve. The sub basin contains minor tributaries of the Ganges as the Kali River East, Nim Nadi, Isan, Pandu and Tamas (Tons) Rivers among others that flow from North West to South East. The rivers are mostly single channeled and seasonal. As documented, these plains fed channels originate from springs within the interfluves, and are monsoon driven systems that remobilize interfluve sediments.

Highly polluted River Pandu, near Kanpur, that receives ash slurry from Panki Power Thermal Plant and industrial effluents, originates in Farrukhabad and passes through Kanpur is a single channel, 25 m wide and 5 m deep River with sinuosity ranging from 1.5 to 2.5, locally as high as 4.0 (Tandon et al. 2005). Kali River East drains the middle Doab (interfluve) region. The River is seasonal and flows only during the monsoon months. In the present times the river originates in a depression at Antawara near Khatauli in Muzaffarnagar district and travels a distance of 150 km through the districts of Meerut, Hapur, Bulandsahar, Aligarh, Kasganj to meet Ganga in the Kannauj District. Its upstream portions remain dry till its confluence with the Khatauli drain which carries industrial as well as domestic sewage. Besides Khatauli drain a number of wastewater drains from nearby towns join the Kali River<sup>1</sup>. The Tamas or Tons River is around 264 km long and originates in Tamakund in the Vindhyans in Satna district. The River finds a mention in the epic Ramayana.

The major drainages are notably incised. Steep cliffs incised through alluvium, as high as 30 m above low-stage river level are found along both banks of Yamuna from Agra to Allahabad, a distance of about 500 km. The Ganga River is strongly incised near Kanpur, where it occupies a valley about 20 km wide, and for at least 120 km upstream, although cliffs are generally modest. Incision is minor downstream of the Yamuna–Ganga confluence (Map 6).

There have been major land use changes and hydrological interventions since the medieval ages that has altered the natural catchment profile and water regimes<sup>2</sup>. Anthropogenic activity, has reduced the hydrograph of most rivers over the past 150 years. Canals have extracted water for irrigation since the 1800s and dams are present on some major rivers. Like the Above Ramganga Confluence sub basin, extensive canal network covers the western parts of the sub basin. The region is fed by the Upper and the Lower Ganga canal, and the Eastern Yamuna canal. Lower Ganga canal taken from the Ganga near Narora in Bulandsahar district in 1878. Its main branches are Etawah, Kanpur, and Fatehpur. It irrigates about 4.6 lakh hectares of agricultural lands in the districts of Bulandsahar, Farrukhbad Mainpuri, Aligarh, Etah, Etawah, Fatehpur, Kanpur and Allahabad. The length of canal including its distributaries is about 6000 Km.

#### Topography

The alluvial tract of the sub basin is long and narrow. Excluding river courses, relief on a cross-interfluve traverse is only a few meters. The Vindhyan ranges in the south- eastern part of the basin presents a stark contrast to the gentle relief of the plains. The Vindhyans border the southern bank of the Ganges in the districts of Mirzapur and Varanasi at a distance of 15 -80 km but reaching up to the river bank at Chunar. The maximum elevation rises abruptly from 100 m to 200-300 m. The Vindhyans tablelands extend to Kaimur hills in the east. The landscape is dotted with abruptly rising scarp of low hills, tablelands, waterfalls and rivers. The soil is inferior and is broken in to ravines (Map 7).

<sup>&</sup>lt;sup>1</sup> These are Chhohiya drain, Abu Nala 1 and 2, Odean drain in Meerut, Hapur and Hapur city drain in Hapur, Khadrabad drain from Modinagar and Gulawathi drain. An action plan has been prepared by the UPPCB for restoration of ecological health of Kali River (UPPCB Action plan for Kali River restoration).

<sup>&</sup>lt;sup>2</sup> Evidences show that the Kali River East and Kali River West, a tributary of the Hindon used to follow a combined common course historically originating in the Siwaliks. The separation of the two rivers is said to be a recent phenomenon brought by human interference. The Hindon canal was constructed by *Firozshah Tughlaq* to bring water from Kali Nadi to Delhi thus giving rise to the two channels. The construction of the Upper Ganga Canal and the construction of distributaries and escapes chopped off the connection between upper and lower Kali creating two rivers artificially (Khan 1987).



Map 6: Elevation profile of the Upstream of Gomti Confluence to Muzaffarnagar sub-basin



Map 7: Topography map of the Upstream of Gomti Confluence to Muzaffarnagar sub-basin

### **Geology and Geomorphology**

Nearly 95 % of the total basin is part of the central Ganga alluvial plains. Extensively flat tracts are interrupted by sand undulations at places formed by the smaller rivers. 5 % of the basin in the south east fall under central highlands.

Major channels and their floodplains separate interfluve areas, which comprise four zones - active plains-fed channels and associated floodplains, inactive channel areas, slightly dissected areas, and highly dissected areas or badlands. Plains-fed channels originate from springs within the interfluves, and are monsoon driven systems that remobilize interfluve sediments.

The sub basin borders the southern cratonic region. As compared to the foreland basin this region is more stable and experiences less or little earthquake activity. The fluctuation in monsoon intensity is marked and probably exercises an overwhelming influence that is bared in historical artifacts and landforms present in the region (Map 8).

Lakes and eolian landforms are present locally. Lakes expanded in this area during an early to mid Holocene wet phase (Sharma et al. 2001), and eolian sands accumulated during a mid-late Holocene arid period (Srivastava et al. 2003). The interfluves have remained out of range of major river flooding prior to the recent period of human interventions. Eolian soil mobilization due to less monsoon activity coupled with a drier climate led to formation of isolated bodies of wetlands. Floodplain detachment close to the modern Ganga at Bithur, marked by a change from floodplain to lake and eolian deposits, probably took place between about 23 and 30 ka, corresponding broadly with a decline in monsoonal precipitation from MIS 3 (Marine Isotope Stage 3) into the Last Glacial Maximum (LGM) in MIS 2. This suggests that the parent river inundated its floodplain much less frequently and possibly became underfit within its valley, although no definite information is available about whether channel dimensions and other parameters changed at this time.

A number of waterfalls as Wyndham, Kharanja, Tanda are found in the south eastern parts of the catchment in Mirzapur District and adjoining Chandauli District. These are sandstone areas. Many mesolithic rock paintings have been discovered here. The sandstone is mined by local contractors to make sandstone slabs used as a as roofing material in urban centres like Mirzapur and Varanasi. The Belan River<sup>3</sup> that skirts the southern boundary of the sub basin has pottery making prehistoric archaeological sites as Chopani- Mando, Koldihwa on its banks marking the advent of agriculture and human colonization.

 $<sup>^{\</sup>rm 3}$  Belan is tributary of the Tons River that joins the Ganges downstream of Allahabad at Sirsa



Map 8: Geomorphology map of the Upstream of Gomti Confluence to Muzaffarnagar sub-basin

#### Soil Characteristics and soil erosion

The sub basin soil is loam to silty loam. Soils majorly have have no or little soil profile differentiation. Stratified fluviatile, marine and lacustrine sediments containing fluvisols that are associated with water bodies are found in a narrow strip in the districts of Meerut, Jyotiba Phule Nagar and Bulandshahar. These are an extension of soils found in Dehradun and Haridwar districts. Deep and fertile Luvisols cover the districts of Saharanpur, Meerut and Muzaffarnagar (Table 1 and Map 9).

Soils with moderate profile development, Cambisols dominate the mid sub basin in the districts of Farukkhabad, Unnao, Kanpur, Kanpur Dehat, Mainpuri, Kannauj, Rai Bareli and Pratapgarh. In wetlands Cambisols are associated with Fluvisols. The transitional nature of soils indicates a situation of free internal and external drainage where slow and continuous erosion is in equilibrium with weathering processes. The Ganga – Brahmaputra alluvial plains and terraces have large continuous surfaces of Cambsiols in the tropics. The soils in these central regions as Hardoi, Kanpur districts is loamy and sandy loam, is fertile and widely used for agriculture.

Clay enriched sub soils are found in the lower reaches of the sub basin in the districts of Varanasi, Jaunpur, Allahabad, Sant Ravi Das Nagar and also in the upper parts of Meerut, Bulandshahr, Aligarh, Etah districts).

Ferric luvisols are also encountered in south eastern parts of the sub basin. Sedimentary rock formations dominate this landscape. Mixed red and black soils are found in Mirzapur district, parts of Allahabad and Varanasi district.

Southern parts of districts witness severe soil erosion issues (Table 2 and Map 10). The worst affected districts in the sub basin are Mirzapur, Firozabad, Allahabad, Kaushambi, Aligarh, Varanasi, Pratapgarh, Rae Bareli. The problem of soil salinity and or sodicity is more prominent in the semi-arid tract of the Gangetic plain covering 1.37 m ha. The soil of Aligarh, Mainpuri, Kanpur, Etah, Etawah, Sitapur, Unnao, Rae Bareli is salt affected and known as 'Usar' and 'Reh' soils (IWMP, 2009). Mostly areas in command areas suffer from this problem chiefly due to canal irrigation that artificially saturates the soil and alter the natural hydrological equilibrium of soil.

The eastern districts of Allahabad, Mirzapur, Varanasi, Farrukhabad, Etah, Ghazipur and Ballia also get affected by flooding. Parts of Mainpuri district is prone to water logging conditions in areas in proximity of major canals, indicating excessive seepage from these canals.

Soil Code	Class Name	Texture	Texture Class	% GRAVEL	% SAND	% SILT	% CLAY	Hydraulic conductivity (m/s)
3671	Eutric Cambisols	Medium	Loam	9	42	36	22	6 94F -06
0071	Eutric	Weddin	Louin		12	00		0.912 00
3675	Cambisols	Medium	Loam	9	42	36	22	6.94E -06
	Calcaric							
3739	Fluvisols	Medium	Loam	10	35	47	18	6.94E -06
	Orthic							
3798	Luvisols	Medium	Loam	4	47	32	21	6.94E -06
	Orthic							
3810	Luvisols	Medium	Loam	4	47	32	21	6.94E -06

Table 1: Soil characteristics of the Upstream of Gomti Confluence to Muzaffarnagar sub-basin (Source: NBSSLUP, Mao, 2019)

Table 2: District wise area under erosion

Districts	% Sub basin area with severe soil erosion (>15-20 t/ha/yr)
Mirzapur	44.17
Firozabad	26.32
Prayagraj	25.00
Kaushambi	24.41
Aligarh	24.21
Varanasi	21.54
Pratapgarh	21.43
Rae Bareli	17.73
Sant Ravi Das Nagar	12.73
Bulandshahr	9.24
Jaunpur	8.66
Unnao	6.52
Kannauj	5.44
Muzaffarnagar	4.73
Ghaziabad	4.03
Hathras	1.92
Chandauli	0.00
Etah	0.00
Farrukhabad	0.00
Fatehpur	0.00
Hardoi	0.00
Kanpur Nagar	0.00
Mainpuri	0.00
Meerut	0.00

Source: Based on analysis of NBSS&LUP Data.





Map 10: Soil erosion map of the Upstream of Gomti Confluence to Muzaffarnagar sub-basin

The major land use is agriculture and no significant forest cover in most parts of the basin except in Mirzapur district. As per FSI 2021, the total forest cover of Mirzapur district is 746.11 km<sup>2</sup>. Which is 16.94 % of its total geographical area. The forests have reduced by 57.62 km<sup>2</sup> in the district in last two years. The forest of Vindhya region is tropical dry deciduous type. The most important forest produce is Tendu leaves. Stone mines are found in many blocks of the district. Barkacha Reserved Forests, Chandraprabha Wildlife Sanctuary and Saman wetland are some of the protected areas.

Etah, Mainpuri, Kannauj, Kanpur Nagar, Unnao, Bulandsahr and Mirzapur are some of the major settlements in the sub basin. There are 94 industries in district Muzaffarnagar, Meerut, Hapur and Gulaothi town of district Bulandsahr. Mainly sugar mills, paper mills, textile, distilleries, slaughter houses and other industries along with villages situated near the river like River Kali East discharge effluent / sewage into the river. The water quality of the River is classified as Class – E, that can only be used for irrigation, industrial cooling or controlled waste disposal (UPPCB, Action plan for Kali River East restoration) and the River contributes to pollution load of the Ganga. Similarly, all the industrial and municipal effluents of Kanpur city drain in to the Pandu River.

The upstream catchment districts such as Bulandsahr intensely irrigate through predominantly tubewells and canals as well. Over the years, the area irrigated by canals has declined in all the districts. The tail regions do not benefit much from canal irrigation systems as most upstream engineering structures become inoperative and get submerged during the monsoons.

#### **Climatic set-up**

The Upstream of Gomti Confluence to Muzaffarnagar sub basin has a moderate subtropical climate. The average annual rainfall is about 1000 mm, out of which the main part is received during the monsoon period. There is a variation in rainfall across the sub basin with Muzaffarnagar reporting an average annual rainfall of 867 mm. Rainfall is more as one moves towards the upper reaches of Terai. The rainfall decreases gradually towards the middle of the basin to 740 mm in Kanpur and 600 mm in Etah. The rainfall again increases as one moves towards the south east of the sub basin with Allahabad receiving 900 mm, Mirzapur 942mm and Varanasi 1000 mm of annual rainfall (IMD 2020).

May is the warmest month of the year. The temperature in May averages  $34.2^{\circ}$ C. In January, the average temperature is  $14.41^{\circ}$ C. It is the lowest average temperature of the whole year. The temperatures vary across the basin, increasing from  $12.6^{\circ}$ C to  $15.6^{\circ}$ C as one moves from western to eastern parts of the sub basin Map 11 and Figure 5.



Figure 5: Correlation between precipitation and temperature for Upstream of Gomti Confluence to Muzaffarnagar Sub-basin during 2020

Recognizing Uttar Pradesh's climate vulnerability, rapid urbanisation, rising poverty, and increased drought and flood make this densely populated, agriculturally dominated state a very vulnerable landscape (Saxena, 2020). The anticipated increase by 20% in rainfall and rise in maximum temperature to 2°C by 2050's is alarming for water security (UP-SAPCC, 2014). The frequency of extreme temperature and rainfall events are constantly on the rise along with annual variation in rainfall (Tripathi, 2016). Climate change exacerbates water-related risks. Climate change exacerbates water insecurity by limiting per-capita supplies, water guality, consumption disputes, and deterioration of wetlands ecosystems. Climate change in the region has altered the precipitation regime, intensity rates, and indirectly impacting the flux and storage of water in wetlands (UP-SAPCC, 2014). Wetlands dynamics is impacted most by the changing climate, increasing temperatures and changing climatic patterns have led to drying up of wetlands in Uttar Pradesh. To combat the impacts of climate change. Uttar Pradesh has formulated action plan for seven missions (1) Sustainable agriculture mission (2) Solar Mission (3) Energy Efficiency Mission (4) Green UP Forestry Mission (5) Jal Mission (6) Strategic Knowledge Mission (7) Sustainable Habitat Mission (UP-SAPCC, 2014). The Jal Mission is of profound importance in this context as 70% of agriculture in the state is dependent on irrigation. Semi-arid and arid regions in the state are especially vulnerable to climate change and are anticipated to suffer decline in water resources. The expected annual precipitation variance would result in frequent and prolonged waterlogging, as well as saline intrusion into aquifers (UP-SAPCC, 2014).



Map 11: Spatial variation in annual precipitation during 2020 for the Upstream of Gomti Confluence to Muzaffarnagar sub-basin

## **Hydrological Set-Up**

The Upstream of Gomti confluence to Muzaffarnagar sub basin encompasses 3.6% drainage area of the Ganga basin. There are 40 watersheds in the sub-basin The size of the watershed ranges from  $364.16 \text{ km}^2 - 1281.12 \text{ km}^2$  (India-WRIS).

The river Ganga does not receive any major tributary until the Ramganga river joins at Kannauj district adding about 17.79 billion cum/annum of water. At Prayagraj district (1020 km from the source), the Ganga River is joined on the right by the Yamuna River, which actually contributes more water (57.24 billion cum / annum) than the main river itself, augmenting the flow volume of the river Ganga significantly.

The flow of Ganges River is regulated by dams and barrages in this sub basin. There are 14 dams and one weir. Mostly the dams have been constructed in Mirzapur District (Map 12). This includes irrigation dams Lower Khajuri, Rampur Pindaria, Dhenkwan and Hinauti dams. Two lift irrigation schemes exist in the subbasin - Bhupali Lift irrigation schemes and Dalmau Lift Irrigation scheme, stage I and II. The gauge, discharge, sediment, water quality is measured at seven Hydroobservation stations and flood levels at flood forecasting stations of the CWC (Central Water Commission) present in the sub-basin, as shown in (India-WRIS).

### Flow direction and inundation regime

The major geomorphic elements in this region consist of lentic (wetlands, lakes) and lotic (streams) water bodies. The inundation regime in the Upstream of Gomti Confluence to Muzaffarnagar sub-basin is governed by the extent of river channels in different seasons, water logging due to the seepage through canals and embankments and the depressions formed due to geographical and topographic features. The wetlands in the surveyed 10 km buffer zone on either side of the river Ganga have different extent of inundation at various months of the year. Wetlands water regimes from a sample of 106 wetlands indicates that 23 % wetlands remain permanently inundated while 77 % are seasonally inundated (Map 13).

The connectivity approach has the potential to be applied extensively to the Gangetic floodplain for understanding the complexity of its wetlands and to design effective management protocols. Of the 106 wetlands analysed, only 8 % were perennially connected with the river and streams throughout the year while 14 % were connected seasonally i.e., during monsoons only. Rest 78 % wetlands remain completely isolated (Map 14).



Map 12: Hydrological monitoring stations and drainage map of the Upstream of Gomti Confluence to Muzaffarnagar sub-basin



Map 13: Seasonality of water in the 10km buffer zone on either side of the River Ganga in Upstream of Gomti Confluence to Muzaffarnagar sub-basin



Map 14: Connectivity and inundation regime of the surveyed wetlands

A snapshot of how flooding occurs in river cross-sections having embankments and not having embankments are shown in Figure 6. The maximum extent of inundation is shown in, prepared using 35 years of inundation data by Peckel et. al. 2016 (Map 15). Map 16 presents the flood risk hazard zone of Upstream of Gomti Confluence to Muzaffarnagar sub-basin as per the vulnerability map of Uttar Pradesh made by BMTPC, Sol and Gol.

Geographically isolated wetlands or wetlands that are completely surrounded by uplands might normally lack surface water connections, they can be hydrologically connected to downstream waters through intermittent surface flow or groundwater. Horizontal flow reflects connection between rivers and wetlands or between wetlands through flood pulses or inundation. Vertical flow reflects water flow between wetlands holding surface water to groundwater. 69 % of the surveyed wetlands are losing water to vertical flow 22 % exhibit horizontal flow in the surface and 9 % have both vertical and horizontal flows.





Figure 6: Rising surface water levels in relation to water logging in the neighboring areas (Bonsor et al., 2016)



Map 15: Maximum water extent within the surveyed wetlands in the 10km buffer zone on either side of the River Ganga in Upstream of Gomti Confluence to Muzaffarnagar sub basin



Map 16: Flood hazard zone in Upstream of Gomti Confluence to Muzaffarnagar sub basin

The study by Peckel et al., 2016 also highlights the transition of water from one form to another in terms of inundation. Within the 10km buffer zone on either side of the river Ganga, it is estimated that over the past 3 decades only six percent has remained permanent and unchanged. While most of the water (up to 38%) is ephemeral seasonal (i.e., land replaced by seasonal water that subsequently disappears) and 31 % is new seasonal water which is the conversion of land into seasonal water (Figure 7 and Map 17). The wetlands that do not fall within the river channel experience seasonal behavior as they are cut off from the main channel.



Figure 7: Transition of water within the 10 km buffer zone on either side of the river Ganga



Map 17: Transitions of Water

Monitoring of water quality parameters is important to understand the interactions between parameters and its effect on aquatic life, their growth and health. Each water parameter individually may not cause alarming situation, but several parameters together can reveal dynamic processes taking place in the wetland.

One time sampling was conducted in 2020 following standard protocols. Water sample was collected from 106 wetlands (Map 18). Water quality analysis was carried out at the respective regional laboratory, Uttar Pradesh Pollution Control Board. Samples were tested for DO, pH and nutrient load.

The results indicate that DO in the sampled wetlands (N = 65) situated in the 10 km buffer on either side of River Ganges in the Upstream of Gomti confluence to Muzaffarnagar sub -basin, ranged from 0.4 to 12.6 mg/l, the maximum number of wetlands (48%) have a DO ranging from 6 to 12.6 mg/l. Wetlands of Unnao and Mirzapur have high DO values greater than 9 mg/l (Figure 8). Except for the river stretch in Mirzapur district, the wetlands on the left bank of the Ganges River in general show better DO values in comparison to the left bank. Majority wetlands in Rae Bareli display poor DO values less than 3 mg/l. This can also be attributed to isolated nature of wetlands, seasonal inundation coupled with infestation by invasives. Of the sample of 106 wetlands, 34 % wetlands were recorded to be eutrophic (Figure 9). pH ranged from 7 to 8.8. Wetlands of Mirzapur district showed higher alkalinity, with pH > 8 as compared to the rest. Whereas wetlands of Unnao show near neutral pH.



Demonstration of water quality testing



Map 18: Variation in DO, pH and nutrient load for surveyed wetlands in Upstream of Gomti confluence to Muzaffarnagar sub-basin







Figure 9: Trophic status of surveyed wetlands in different districts within 10 km buffer in Upstream of Gomti confluence to Muzaffarnagar sub basin

## **Groundwater levels**

Groundwater in Upstream of Gomti confluence to Muzaffarnagar sub basin ranges from 0 to 40 mbgl. The distribution pattern remains within 4m mbgl throughout the year.

The groundwater has steadily declined in parts of Uttar Pradesh over the past decade as seen in Map 19. Groundwater which was once available at ground level to 3 metres below subsurface at majority of the catchment has been pushed to 10-20 meters in a decade. This can be attributed to the rising abstraction of groundwater for catering to the needs of growing population and the ease of abstraction. As groundwater is a readily available pollution free water there is a stark shift from the use of surface water to groundwater. This has led to the drawdown of groundwater way more than the recharge that is consistently leading to the decline in groundwater levels (Table 3).

Contaminants	Districts affected (in part)
<b>Salinity (</b> EC > 3000 μS/cm at 25 ° C)	Agra, Hathras,Mathura,
Fluoride (>1.5 mg/l)	Agra, Aligarh, Etah, Firozabad, Jaunpur, Kannauj, Mahamaya Nagar, Mainpuri, Mathura, Maunath Bhanjan
<b>Chloride</b> (> 1000 mg/l)	Mathura, Agra
<b>Iron</b> (>1.0 mg/l)	Azamgarh, Balia, Balrampur, Etawah, Fatehpur, Gazipur, Gonda, Hardoi, Kanpur Dehat, Kanpur Nagar, Lakhimpur, Lalitpur, Mau, Siddartnagar, Unnao
Nitrate (>45 mg/l)	Agra, Aligarh, Allahbad, Ambedkar Nagar, Auraiyya, Badaun, Baghpat, Balrampur, Banda, Barabanki, Bareilly, Basti, Bijnour, Bulandsahar, Chitrakoot, Etah, Etawa, Fatehpur, Firozabad, GB Nagar, Ghaziabad, Ghazipur, Hamirpur, Hardoi, Jaunpur, Jhansi, Kannauj, Kanpur Dehat, Lakhimpur, Mahoba, Mathura, Meerut, Moradabad, Muzaffarnagar, Raibarelli, Rampur, Sant Ravidas Nagar, Shajahanpur, Sitapur, Sonbhadra, Sultanpur, Unnao
Arsenic (>0.05 mg/l)	Agra, Aligarh, Balia, Balrampur, Gonda, Gorakhpur, Lakhimpur Kheri*, Mathura, Muradabad

Table 3: Ground water quality and associated problems across Upstream of Gomti confluence to Muzaffarnagar sub-basin



Map 19: Groundwater levels in different parts of Uttar Pradesh over the past decade

## **Species and Habitats**

Many plant and animal species live in the wetlands, including a number of rare and endangered species. Such species are characteristic to their environment and often described as indicator species that are used to monitor environmental changes, assess the efficacy of management, and provide warning signals for impending ecological shifts. Reed (1988) first described the indicator status of a species (floral or faunal) through its expected occurrence in the wetland as follows:

Obligate wetland species	Occur almost always (estimated probability >99%) under natural conditions in wetland habitat
Facultative wetland species	Usually occur in wetlands (estimated probability 67%–99%), but occasionally found in non-wetlands habitat
Facultative	Equally likely to occur in wetlands or non-wetland habitat (estimated probability 34%–66%)
Facultative upland	Usually occur in non-wetland habitat (estimated probability 67%–99%), but occasionally found in wetlands (estimated probability 1%–33%)
Obligate upland	Occur almost always (estimated probability >99%), under natural conditions in the non-wetland habitat

## **Plant species occurrence**

The Gangetic ecosystem forms a unique environment for hydrophytic, semihydrophytic, and submerged floral association. The vegetation pattern in the Ganga basin varies according to seasonal changes, hydrology, flood level, and different soil types. These factors have a sharp influence on plant species distribution and composition.



Saras Crain in Naraintal, Raebareli District



Figure 10: Hydrophytic plant species recorded in the Upstream Gomti Confluence to Muzaffarnagar sub-basin

The present study was conducted in the Upstream Gomti Confluence to Muzaffarnagar sub-basin. 134 wetlands across the 12 districts were sampled. 27 wetland plant species representing 25 families were identified (Annex 1). Family Amaranthaceae and Apiaceae were recorded as dominant. The plant species were grouped as; emergent, free-floating, moisture-loving, and submerged (Figure 10). The occurrence of free-floating hydrophytes was recorded maximum (63%). Water hyacinth *Eichhornia crassipes*, Hornwort *Ceratophyllum demersum*, and Hemp *Cannabis sativa* were recorded as major invasive wetland plant species.

Vetiver grass was recorded only from wetlands within the river channel which were also dominated with *Phragmites* sp. *Typha* sp. dominated the isolated wetlands. Herbs like *Ipomea* sp. were recorded from the isolated wetlands.

Wetland vegetation, despite offering high resource availability is often affected by habitat loss and fragmentation. In the present study, it was recorded that wetlands are being converted for permanent farming. Overuse of resource extraction was also recorded. It has brought about adverse impacts giving the rise to spread of invasive species like water hyacinth, leading to eutrophication indicating a non-conducive ecological regime.



Flora species occurrence

Comprehensive information on the aquatic biodiversity and various ecological aspects of the river Ganga has been documented but the status of wetlands faunal elements in Uttar Pradesh state remains feebly documented. Studies have largely been conducted to document the distribution, habitat use, and breeding of the Sarus Crane *Grus antigone*, a globally vulnerable species and India's only resident breeding crane (Rahmani et. al. 2019; Sundar 2006). Few other noteworthy studies include patterns of fish diversity (Jha and Das, 2019); amphibians and their ecological importance (Kanaujia and Kumar, 2013), and, the status and abundance of freshwater turtles in Uttar Pradesh (Singh et. al. 2009).

In the present study, the occurrence of fauna was documented based on direct sightings during field visits and secondary data in the form of peer-reviewed published articles was also referred to. Species conservation status was described following the IUCN Red List. A total of 19 species of fish (Annex 2), four species of amphibians (Annex 3), eight species of reptiles (Annex 4), ten species of mammals (Annex 5), and 66 species of birds were recorded (Annex 6). Three species of high global conservation significance were recorded from this sub-basin (Figure 11). The floodplain wetlands are an important habitat for over 60 bird species, including at least 25 water birds (Figure 12).

The walking catfish *Clarias batrachus* was recorded as a dominant fish species. It is a freshwater fish species that require wetlands as spawning grounds and as nursery areas for their young ones. In the downstream sections of the River Ganga in Mirzapur district, juvenile Gharial *Gavialis gangeticus* have been observed to seek refuge in oxbows from harsh conditions. Pond Turtle *Actinemys marmorata* and the Indian Flap Shell Turtle *Lissemys punctate* have been recorded to commonly occur in isolated ponds. Riverine turtle species such as the vulnerable Ganges softshell turtle often move between rivers and wetlands to find suitable foraging, mating, nesting, rearing, and overwintering habitat throughout the year.

Floodplain wetlands are effective in improving habitat quality by mitigating the effects of fragmentation. Manpur, Rawat Pond, Dhanuhikheda Lake, Unchagaon Pond, Ursaila Jheel and Baraila Jheel form a wetland-complex of ~ 92.24 ha in the Unnao and Raebareilli districts. This continuum of riverine-wetlands complex serves as a suitable corridor linking habitats for free movement and recolonization of species. Local forest staff have reported Swamp deer *Cervus duvacelli*, a critically endangered species to use this wetlands-complex as a natural migration route (Map 20).



Figure 11: Species of high global conservation significance recorded in floodplain wetlands in Upstream Gomti Confluence to Muzaffarnagar sub-basin



Figure 12: Status of wetlands bird species recorded


Map 20: Continuum of riverine-wetlands complex in Unnao and Raebareilli districts forms a natural migration route of Swamp deer Cervus duvacelli

# Wetlands Ecosystem Services and Livelihoods

#### **Demographic features**

The landscape in the flood buffer zone of Upstream of Gomti Confluence to Muzaffarnagar Basin presents a mosaic of largely clustered settlements interspersed with agricultural fields. Although predominantly rural in character, the region houses many large and ancient cities like Prayagraj, Varanasi as well as industrial towns of Kanpur and Mirzapur. Number of households are around 1,29,8253 with an approximate population of 84,71,270 inhabiting targeted 10km area from the main stream of the Ganges. Male to Female ratio is 1117:1000 with literacy rate of 46%.

#### **Regulating services**

A key indirect value of floodplain wetlands to the communities living in the vicinity is their ability to buffer extreme events like floods, droughts and heatwaves. Gangetic floodplains are some of the most susceptible areas in India prone to flooding and experience frequent loss of life and property. Also, with climate change, there is a possibility of an increased occurrence of these extreme weather events increasing the risk of natural hazards. The role of wetlands as buffers, therefore, becomes more critical and of urgent nature. It was recorded that around 61.6% of surveyed wetlands and their complexes provide a buffer to bank inundations by absorbing the flows and thereby reducing the risk of damages within the settlements around the complex. Wetlands like Usraila Jhil and Kondra Jhil in RaeBareli district and Numaiya dahi jhil in Prayagraj district exemplify such buffering function of wetlands. Lack of understanding of the role of wetlands as nature-based solutions in disaster management and more focus on structural engineering has led to fragmentation of natural regimes of these wetlands.

Around 61% of surveyed wetlands were perceived to contribute to micro-climate regulation by contributing to lowering of temperatures. Numaiya dahi jhil in Prayagraj and Bakulahi river in Raebareli are examples of such wetlands that are thought to contribute to such regulation, by the local inhabitants. (Figure 13).

#### **Provisioning services**

The survey zone across the 12 districts lies in the highly fertile floodplains of the River Ganges, hence agriculture is the key economic activity, accounting for nearly 79.74% of the land use (Figure 14).

Culture fisheries within the sub-basin essentially form the base of livelihoods of more than 39.2% of respondent households. It was also observed that village ponds are generally leased out by Gram Panchayats on a time-bound basis for pisciculture activities. This provides additional employment opportunities to locals. Also, capture fishery is practiced in almost 26.1% of surveyed wetlands. *Mallahs* constitute an exclusive caste of occupation fishers. However, locals living near wetlands also resort to occasional fishing. Changes in inundation patterns and decline in connectivity with riverine environments also impact fishing practices. The deeper areas are used for net fishing, whereas traps are used in the marsh areas

located in the margins. Also, the reduction in areas under permanent and seasonal inundation has led to competition with conflicts arising on fishing rights, which is also impacted by transboundary siting of certain wetlands, such as Baraila Jheel which lies on boundary between Unnao and Rae Bareli. Locals also reported that fisheries have transformed from a high-value mix of Indian Major Carps to low economic value air-breathing fishes like Magur (*Clarias batrachus*) and Snakehead fish (*Channa* spp.). The use of very small mesh (mosquito size nets) and traps has further impacted species recruitment. Fishing is restricted in wetlands lying within protected areas such as Manikpur Reserved Forest in Fatehpur district and in wetlands considered sacred such as Bhuiya Koh wetland and Jogiya Dari Nala in Mirzapur district.

For the villages adjacent to the wetlands most predominant human use of aquatic vegetation is that of macrophytes mainly as food, fodder for the cattle, fuel and raw material of herbal medicines. Plant of Lotus (*Nelumbo nucifera*), leaves, and stem of Water Spinach (*Ipomoea aquatica*) locally called Nari ka saag are harvested from the wetland complex and used as vegetables. 14% of wetlands leased by the Gram Panchayat are used for harvesting fruits of Water Chestnut (*Trapa natans*). Wetlands such as Belwan and Bhokawa Bandha in Mirazapur district are used for sourcing medicinal plants like *Safed Pyaz (Allium cepa)* and *Beha (Ipomoea carnea)*. Jal kumbhi (*Eichhornia crassipes*) and Mootha (*Cyperus spp.*) are the major species used as fodder. Dried Kans ghass (*Saccharum spontaneum*) and Narkul (*Phragmites karka*) are extensively used as fuelwood.

The south-eastern part of the landscape is dominated by sandstone formations and groundwater availability is low to moderate. It mostly occurs in joints and fractures of sandstone. Wetlands have been a major source of water for drinking, domestic as well as irrigation purposes. Reservoirs and ponds are constructed by damming the flow of water flowing downstream from the hilly terrain, many of which form a pivotal source of water. Lower Khajuri dam that is an important source of water for Mirzapur city and Tanda tal that provides water to Mirzapur campus of Banaras Hindu University are amongst such prominent wetlands.



Figure 13: Number of surveyed wetlands utilized for regulating services by communities



Figure 14: Number of surveyed wetlands utilized for provisioning services by communities

#### Supporting services

Supporting high avian diversity is one of the prominent features of the Gangetic floodplain wetlands. Wintering population of waterbirds, have been recorded in good numbers from the Samdha tal wetland in Sant Ravidas Nagar district. Though no consistent records are available on the number of waterbirds at many wetlands, in terms of habitat preference these wetlands serve as a safe refuge for birds, especially those migrating along the Central Asian Flyway. Considering these values, 14 wetlands of high ornithological value have been designated as bird sanctuaries, ten wetlands have been recognized as Ramsar Sites and 23 wetlands have been identified as Important Bird Areas. Three Ramsar sites of Samaspur, Sandi and Nawabgani lie within the select districts of Rae Bareilly, Hardoi and Unnao respectively Hydrological and ecological connectivity between the river channel, riparian zone, and floodplains underpin high habitat heterogeneity which enhances biological diversity in floodplain wetlands. The importance of cyclic inundation for the biodiversity of Gangetic floodplain wetlands is apparent. The exchange of fish brooders and juveniles between the river channel and the floodplains helps to sustain high fish biodiversity and productivity of the entire Indo-Gangetic plains (Figure 15).



Figure 15: Number of surveyed wetlands utilized for supporting services by communities

#### Cultural, educational and recreational services

The Ganges is the most sacred freshwater ecosystem in India. The aesthetics, mythological connotations, and spiritual appeal have made it the popular world over. Two major sites of pilgrimage, Prayagraj and Varanasi are located within the sub basin. Wetlands here too are interlinked with socio-cultural lifestyle of the Gangetic communities. Many wetland sites like "Chakrapushkarini Kunda", "Durga Kunda and "Lolarka Kunda" in Varanasi are considered sacred having mythological significance, with around 60 sacred wetlands getting mentioned in associated literature. Since, ancient times, rituals and ceremonies are held at banks of these waterbodies which are continued by tradition. The floodplains of Ganges support a burgeoning spiritual tourism industry with fairs being organized on occasions considered auspicious like Kartik Amavasya, Mahashivratri, Ganga Dussehra etc. Few wetlands like Pishachmochana Kunda and Kapildhara Kunda are also famous sites of ancestor worship, an important aspect of Hinduism. Several wetlands that are located adjacent to place of worship also hold religious significance. Motiva talab and Gerua talab situated near Ashtbhuja goddess shrine in Mirzapur district are well-known sacred sites along with Sita Kunda that is used for ritualistic bathing. Amongst surveyed wetlands many like Bhuiya khoh dam and Jogiya Dari nala in Mirzapur were found to be revered for a Mazar (tomb) and a temple located on their bank respectively.

Of the total surveyed wetlands, 12 wetlands have religious significance like UsrailaJhil in RaeBareli and Ismailpur Digan in Kannauj district witnessing major footfall of people during immersion ceremonies of idols by Hindus and *Tajias* by Shia muslims. Most of the isolated wetlands, situated within rural areas were also found to be culturally important with many ceremonies associated with local norms taking place nearly all the year round (Figure 16).



Figure 16: Number of surveyed wetlands utilized for cultural, educational and recreational services by communities

# 3. Evaluation of Wetland Features

# **Ecological character**

Wetlands are managed for their wise use which is the maintenance of their ecological character, achieved through the implementation of ecosystem approaches, within the context of sustainable development. Ecological character description is one of the key elements of the definition of 'wise use', incorporating the combination of the ecosystem components, processes, and services that characterise the wetland at a given point in time. Ecological character is the maintenance of wetland values and functions, while at the same time delivering ecological services and benefits now and into the future, for human well-being. Wise use, in promoting maintenance of environmental, economic, and social sustainability, encourages compromise (or trade-offs) between individual and collective interests. To achieve sound decisions on wetland, use, and management, decision-makers at local, regional, and national levels need to enable participation by relevant stakeholders and to balance a variety of objectives and perspectives.

Ecological character definition allows identification of critical components, processes and services, and identifies changes thereof, which require management intervention. Ecological character is an indicator of health of the wetland ecosystem, and thereby is an important benchmark for management. Changes to ecological character of the wetlands, outside natural variation may signal that uses of the site are unsustainable, and may lead to the breakdown of the ecological, biological and hydrological functioning of the wetland system (Ramsar Convention 1996, Resolution VI.1).

The framework used for describing ecological character for Ganga floodplain wetlands build on the Ramsar Framework (Resolution X.15) modified to the suit the local context. The following definitions have been used:

**Ecosystem components** include the living (biotic) and non-living (abiotic) constituents of wetland ecosystem.

- Geomorphic setting (landscape, catchment, river basin)
- Climate (precipitation, temperature)
- Physical setting (area, boundaries, topography, shape, bathymetry, habitat type and connectivity)
- Water regime (inflow, outflow, balance, surface groundwater interactions, inundation regime, quality)
- Wetlands Soil (Texture, Colour)
- Biota (Plant and animal communities)

**Ecosystem processes** comprise of processes that occur between organisms and within and between populations and communities, including interactions with non-living environment, that result in existing ecosystem state and bring about changes in ecosystems over time. These are:

- Physical processes (water stratification, mixing, sedimentation, erosion)
- Energy nutrient dynamics (primary production, nutrient cycling, carbon cycling, decomposition, oxidation reduction)
- Processes that maintain animal and plant population (recruitment, migration)
- Species interaction (Competition, predation, succession, herbivory)

**Ecosystem services** are benefits obtained by humans from wetland ecosystems. These are:

- Provisioning (fisheries, use of aquatic vegetation for economic purpose, wetland agriculture, biochemical products)
- Regulating (maintenance of hydrological regimes)
- Cultural (recreation and tourism, spiritual, scientific and educational value)
- Supporting (Soil formation, Primary production, Nutrient cycling, Water recycling, Provision of habitat).

The 106 surveyed wetlands of the Upstream of Gomti confluence to Muzaffarnagar sub-basin based on their local and hydrological characteristics can be placed under the two categories (Table 4):

- a) Riparian wetlands (sampled number of wetlands equals 15): which are located within the active floodplains and are directly or indirectly connected with the flood pulse of the river Ganga.
- b) Others/Isolated wetlands (sampled number of wetlands equals 91): which are located in depressions in the landscape with their hydrology sustained by catchment flows.

Table 4: Categories of wetlands in the 10-km buffer around River Ganga

Wetland Category	Landforms	Hydrology & hydrodynamics	Vegetation	Soil	Function	Representative examples
Riparian wetlands	Oxbows and paleochannels. Predominantly flats aligned with the channels.	Precipitation and river fed, connected with the river at least during monsoon, horizontal water flow, mostly inundated for less than 6 months.	Macrophytes largely on the margin, open water up to 80%.	Predominantly loam.	Significance as flood buffer and ground water recharge.	Maraunda, Jamalnagar lake, District Unnao
Other/Isolated wetlands (majority are isolated, a few are human made reservoirs)	Majority wetlands are isolated shallow depressions, and do not lie within the active river floodplain boundary	Fed by precipitation and basin flows, isolated patches, predominantly vertical flows, seasonally inundated wetlands.	Heavy infestation of macrophytes, open water up to 20 – 30 %.	Mix of clay and loam.	Significance for ground water recharge	Bhiti Taluka Talab, District Prayagraj

The ability of riparian wetlands to sustain its ecosystem services and biodiversity values is dependent on the following ecosystem processes:

- Connectivity of the wetland (lateral, horizontal and vertical) with the riparian environment enabling exchange of sediments, water, nutrients and aquatic organisms.
- Ecological integrity of the migratory corridors to suit the life-cycle requirements of migratory species.
- Landscape aesthetics which supports its touristic and recreational value.
- Cultural, spiritual, and religious values reflected in local practices like offering of libations to the gods, ritual bathing and others.

Sustaining the aforementioned ecosystem services and biodiversity values require:

- Prevention of floodplain fragmentation.
- Protection of species breeding, feeding, spawning grounds, and dispersal routes.
- Responsible tourism aligned with the ecosystem fragility restricting adverse anthropogenic footprint into the wetland.
- To promote relational values that communities hold with the river and its floodplains.
- Governance regimes that enable mainstreaming full range of ecosystem services and biodiversity values within developmental plans, programmes and investments.

The ability of the Others/Isolated wetlands to sustain its ecosystem services and biodiversity values is dependent on:

- Hydrological connectivity with the catchments.
- Pollution loading.
- An optimal balance between open water and macrophyte dominated areas.
- Landscape aesthetics and recreational value.

Sustaining the aforementioned ecosystem services and biodiversity values require:

- Maintenance of the inlets and outlets as per natural gradient.
- Abatement of pollution within the catchment.
- Maintenance and enhancement of recreational and educational values of the wetland.

A description of ecological character in terms of key wetland features is presented in Table 5.

Table 5: Status and trends in ecological character of surveyed wetlands with reference to them in the 10km buffer zone on either side of the river Ganga in the sub-basin Upstream of Gomti Confluence to Muzaffarnagar

Wetlands	Descriptors	Data	Current condition of mar	nagement categories
Features		Source	Within river channel (N=15)	Others/Isolated (N= 91)
Physical regime	Types	Sampled Data	Predominated by floodplain wetlands (53.3%), followed by sumplands (20%), Palusplains (13%), ponds and Permanent lakes.	Predominated by floodplains (48.4%), followed by sumplands (26.4%), ponds (11%), Permanent lakes (8.8%) and marshes (4.4%)
	Area (ha) (Range and Average)	Sampled Data	2.13 – 427 ha; 5.4 ha (Median)	0.16-579 ha; 5.26 ha (Median)
	Depth (m) (Range and Average)	Sampled Data	0.1-5 m; 1m (median)	0-15 m; 1 m (median)
	Loss (Decline in area and numbers since 2000)	Basin Wide	Wetland area has reduced from 28693 ha to 12119 ha. Wetland numbers have reduced from 12152 to 1772 number of wetlands.	Wetland area has reduced from 10969 to 3725 ha. Wetland numbers have reduced from 10969 to 3481 number of wetlands.
Hydrological regime	Water regimes	Sampled Data	Predominated by permanently inundated (53.3%), seasonally inundated wetlands (46.6%).	Seasonally inundated (82.4%), Permanently inundated (17.6%); Seasonally waterlogged (1.1%)
	Connectivity	Sampled Data	80% of wetlands are connected with connectivity that lasts from 3-4 months during monsoons to yearlong connectivity. 27 % wetlands have both inlets and outlets	12% wetlands get seasonally connected to River Ganga during monsoons. Rest are isolated. 26 % have both inlets and outlets

Wetlands	Descriptors	Data	Current condition of management categories		
Features		Source	Within river channel (N=15)	Others/Isolated (N= 91)	
	Hydrodyna	Sampled	whereas 13% have either inlets or outlets. Majority house flowing water	whereas 15.4% have only inlets and 8.1% have only outlets. Majority house static	
	mics	Data	(67%) with majorly horizontal flow direction while the rest house static water (33%) with vertical flow direction.	water (72.5%) with vertical flow direction while the rest house flowing water (19.8%), or a combination of flowing and static water (5.5%) depending on the month with horizontal flow direction.	
	Water chemistry (Range and Average)	Sampled Data	Alkaline pH ranging from 7.1 to 8.8. with median of 7.73, median DO value is 1 with 53 % showing mesotrophic nutrient concentration.	pH ranges from 6.6 to 9.5 but majority (96%) wetlands have alkaline pH with median value of 7.71. 44% wetlands have zero DO values. And median DO value is zero. The wetlands are majorly mesotrophic (60%)	
	Details	Data, IMD and secondary sources	catchments have a moderate subtropical climate with an average annual rainfall of about 1000 mm, received mainly during the south west monsoons. A variation in rainfall across the sub basin can be seen with Muzaffarnagar having an annual rainfall of 867 mm that decreases gradually towards the middle of the basin to 740 mm in Kanpur and 600 mm in Etah and again increases as one moves towards the south east of the sub basin with Allahabad receiving 900 mm and Varanasi 1000 mm of annual rainfall (IMD 2020).		
Catchments	Geology and Geomorphol ogy	Remote Sensing and GIS data,	95% of the total basin is part of the central Ganga alluvial plains. Extensively flat tracts are interrupted by sand undulations at		

Wetlands	Descriptors	Data	Current condition of management categories		
Features		Source	Within river channel (N=15)	Others/Isolated (N= 91)	
		Sampled data	places formed by the smaller rivers. 5 % of the basin in the south east fall under central highlands. Wetland commonly associated with flats and depressions geomorphic formations. Landforms influenced by both fluvial and eolian processes. Isolated wetlands are more common as rainfall is moderate and eolian processes dominate.		
	Land use and Land- cover of drainage basin	Remote Sensing and GIS data	Major Land Use Land Cover class in the drainage basin is Agriculture (79.74%), Vegetation and Built Up cover another 7.91 % and 5.01 % area respectively. A 5.34 % increase in area under agriculture and 1.92 % increase in vegetation is seen since 2000 with a concomitant decrease in barren area by 1.76 %, in wetland area by 4.66 % and Rivers by 1.23 %. 63.97 % of wetlands were lost to agriculture.		
	Species occurrence	Sampled Data	Occurrence of <i>Lutrogale</i> <i>perspicillata</i> was reported from only one wetland i.e. Khajuri Tal in Raebareli District while 100% wetlands house dominant obligate floral species like <i>Trifolium</i> <i>repens</i> , Phragmites <i>australis</i> , etc.	0% of wetlands house flagship obligate faunal species while 80% wetlands house dominant obligate floral species like <i>Nymphaea</i> <i>caerulea, Zostera spp.,</i> <i>Lemnoideae spp.,</i> etc.	
Species and Habitats	Species conservatio n status	Sampled Data	6% house vulnerable faunal species ( <i>Naja melanoleuca</i> , <i>Nilssonia gangetica</i> , etc.) while 45% house near threatened species ( <i>Python</i> <i>sp.</i> ).	0 % of wetlands house critically endangered faunal species and endangered animal species while 40% house vulnerable faunal species ( <i>Naja melanoleuca,</i> <i>Lissemys punctata, Grus</i> <i>antigone,</i> etc.) and	

Wetlands	Descriptors	Data	Current condition of management categories		
Features		Source	Within river channel (N=15)	Others/Isolated (N= 91)	
	Invasive species	Sampled Data	75% of wetlands house invasive species like <i>Cyprinus</i> <i>carpio</i> , etc. while 100% house invasive floral species ( <i>Eichhornia crassipes</i> ).	30.16% house near threatened species (Anhinga melanogaster, Python sp. etc.). 62% of wetlands house invasive species like Cyprinus carpio, etc. while 100% house invasive floral species (Fichhornia crassipes	
	Livelikeede	Compled		Ipomea spp., Cannabis sativa ssp., etc.).	
	Liveinoous	Data	46.6 % of wetlands have minimal dependency <i>i.e.</i> , < 20% of total village population was dependent on wetland while 33.3 % of wetlands have 20-40% of village population depending on the wetlands.	i.e., < 20% of wetlands have minimal dependency i.e., < 20% of total village population is dependent on wetland while in 29.5 % wetlands, 20-40% of village population were dependent on the wetlands.	
Livelihoods and Ecosystem Services	Provisioning Services	Sampled Data	Majorly serves as freshwater for livestock (73%), freshwater for agriculture (53 %), food - fish (47%) and provides fiber and fodder (27%) and freshwater for drinking, washing domestic use (20%). Edible aquatic plants usage is low (7%). While use as fuel is negligible, some use as natural medicines or pharmaceuticals (7%) exists.	Primarily provides freshwater for livestock (75%), followed by freshwater for agriculture (68 %), food-fish (30%), food - edible aquatic plants (21%), fresh water for drinking, washing & domestic use (13%), and fiber and fodder (10%). Fuel (2%) and natural medicines or pharmaceuticals (3%) are low.	
	Regulatory Services	Sampled Data	The regulatory services attributed to wetlands were local climate regulation (87%), water regulation (80%) and erosion regulation (80%), water during droughts (80%), flood hazard regulation (67%), salinity regulation (74%), fire regulation (60%) and air quality regulation (60%).	Primarily aids in pest regulation (76%), water regulation (68%) and flood hazard regulation (60%), erosion control (58%), local climate regulation (54%), salinity regulation (54%), air quality regulation (47%). Positive water	

Wetlands	Descriptors	Data	Current condition of management categories		
Features		Source	Within river channel (N=15)	Others/Isolated (N= 91)	
			The wetlands were perceived to increase risk of human diseases (67 %) as well as livestock diseases (60%). While 47% wetlands were perceived to have positive water purification benefits, 13% were said to have negative impact on water quality. The wetland also helped in noise, and visual buffering (33%).	purification benefits perceived for 36 % wetlands whereas 29% were seen to degrade water quality. 73 % were said to increase risk of human diseases and 69 % livestock diseases. Fire regulation (42%), pollination (34%) and noise and visual buffering (23%) were seen as minor benefits	
	Cultural Services	Sampled Data	Primarily adds to the aesthetic value (33%), social relations (27%), cultural heritage (20%), recreation and tourism (20%), spiritual and religious value (20%). Wetlands had minor heritage (13%), educational and research (7%) values.	Primarily aids in adding to the aesthetic value (21%), social relations (14%), spiritual and religious value (10%), and, followed by recreation and tourism (8%) and educational and research (6.6%).	
	Supporting Services	Sampled Data	Primarily helps in nutrient cycling (80 %) and soil formation (80%), water recycling (67%), serves as biodiversity habitat (60%) and primary production (48%).	Primarily helps in soil formation (58%), nutrient cycling (57%), water recycling (51%) and primary production (51%), followed by habitat facilitation (42%).	
	Pre- existing rights and privileges in the wetland	Sampled Data	Primarily wetlands are used and can be used for bathing or wallowing of domestic animals (93%), grazing (87%, withdrawal of water for agricultural and fisheries (53%), community fishing (40%). Religious practices (33%) and harvest of aquatic plants (33%). Fishing under lease from the government department (20%) are some other	Primarily used for bathing or wallowing of domestic animals (84%), grazing (81%), fishing under lease from government department (43%), religious practices (27%), community Fishing without lease (24%), harvest of plants (without any lease) (19%), withdrawal of water	

Wetlands	Descriptors	Data	Current condition of management categories		
Features		Source	Within river channel (N=15)	Others/Isolated (N= 91)	
			rights being availed by the communities. No harvest of aquatic plants under lease is done in these wetlands. plying of boats (23%), agriculture or horticulture within the wetland (27 %) and withdrawal of water for domestic use (20%) are minor uses.	for agriculture or fisheries (25.40%), withdrawal of water for domestic use (21%). Agriculture or horticulture within wetland (13%), plying of boats (17%) and harvest of plants under lease from government department (17%) were also carried out in the wetlands.	
	Land tenure and administrati on: Pattern of land ownership within the wetland	Sampled Data	Dominated by Government Gram Panchayats-Full (35.71%) and Partial (35.71%), followed by Government Revenue Land- Partial (28.57%) and Full (21.43%), Government Revenue Land-Full 1(4.29%), Government Irrigation Dept Partial (7.15%), and finally Government Forest Department-Partial (7.14%).	Primarily dominated by Government Gram Panchayat-Full (60.32%), followed by Government Revenue Land-Full (12.70%), Government Gram Panchayat-Partial (7.94%), Private-Full (6.35%), Government Revenue Land-Partial (4.76%), and Private- Partial (3.17%). A significant portion is Not Clear (12.70%).	
Institutions and Governance	Land tenure and administrati on: Pattern of land ownership outside the wetland Managemen t Plans	Sampled Data Sampled Data	Dominated by Private-Full (50%), followed by Private- Partial (21.43%), Government Revenue Land-Partial (14.29%), Government Revenue Land-Full (7.14%), Government Gram Panchayat-Full (7.14%), Government Gram Panchayat-Partial (7.14%), and Government Forest Department-Full (7.14%). Managed primarily under the Village Development Plan (42.86%), followed by Village Development Plan, Irrigation Water Management Plan (21.43%), Forest Working Plan + Village Development Plan + Irrigation Water Management Plan (14.29%), Forest Working Plan + Village Development Plan (14.29%)	Dominated by Private- Full (69.84%), followed by Private-Partial (14.29%), Government Gram Panchayat-Partial (11.11%), Government Gram Panchayat-Full (6.35%), and Government Revenue Land-Partial (3.17%). A small fragment is not clear (11.11%). Largely managed by the Village Development Plan (95.24%), followed by Irrigation Water Management Plan (57.14%) and the Forest Working Plan (44.44%).	

Wetlands	Descriptors	Data	Current condition of management categories		
Features		Source	Within river channel (N=15)	Others/Isolated (N= 91)	
			and Irrigation Water Management Plan (7.14%).		
	Laws and Regulation	Sampled Data	Equally governed by District Administration and Forest and Wildlife Protection Act.		
	Monitoring programme s	Sampled Data	Monitored by the District Ganga	a Committee.	
	Formal and informal institutions and networks	Sampled Data	Networks include District Administration (100%), Elected political representatives (100%), Local Forest Department (100%), Panchayati Raj Institutions (100%), State Agriculture Department (100%), State Biodiversity Board (100%), State Culture & Tourism Department (100%), State Fisheries and Animal Husbandry Department (100%), State Pollution Control Board (100%). Followed by Accademia/Colleges, Universities and Research Institutes 992.86%), NGOs (57.14%), Irrigation Department (50%), Hoteliers and Hotel Association (35.71%), and religious bodies present in the area near to wetlands (21.43%).	Networks include District Administration (100%), Elected political representatives (100%), Local Forest Department (100%), State Agriculture Department (100%), State Biodiversity Board (100%), State Culture & Tourism Department (100%), State Culture & Tourism Department (100%), State Fisheries and Animal Husbandry Department (100%), State Pollution Control Board (100%), Panchayati Raj Institutions (85.71%), Irrigation Department (65.08%), Accademia/Colleges, Universities and Research Institutes (61.90%), NGOs (42.86%), Hoteliers and Hotel Association (14.29%), and Religious bodies present in the area near to wetlands (1.59%).	

# Functional assessment and ecosystem services potential mapping

The 10–km buffer region around River Ganga channel has primarily the following three landform types which serve as host to the wetlands and determine its size and shape:

- River and irrigation channels linear, though not necessarily straight open depression formed by River Ganga, its tributaries and linked irrigation channels.
- Flats flat or slightly undulating terrain adjoining the channels which also serve as the floodplains.
- Basins contained, closed depressions in the landscape forming a trough.

Water distinguishes wetland habitats from other terrestrial habitats and influences biological response by its presence, depth, chemistry and movement. The period of water availability in the wetland also termed as 'hydro-period' usually characterized in terms of its permanence or intermittence, reflects the balance between precipitation and evaporation, recharge and discharge, permeability of underlying sediments and shape of the wetland. Generally, a mix of two hydrological conditions is seen in the landscape: inundated (free standing water over soils with soil below the surface being saturated), and waterlogged (soils that are saturated with water yet water does not inundate the soil surface). Therefore, three types of water permanence can be discerned in the landscape:

- Permanently inundated water covers the land surface throughout the year.
- Seasonally inundated surface water is present for extended periods especially post monsoon but gradually recedes by the end of winters or early summers.
- Seasonally waterlogged substrate is saturated for extended periods with surface water being seldom present.

Combining the various type of landforms with various types of water permanence provides five major wetland types, which are shown in the Table 6.

Hydrology Landform	Permanently inundated	Seasonally inundated	Seasonally waterlogged
Basin	Lake/Swamp/Marsh	Sumpland	Dampland
Flat		Floodplain	Palusplain
Channel	River	River / Irrigation Canal	River / Irrigation Canal

Table 6: Hydro-geomorphic classes of wetlands in River Ganga floodplains

Wetlands were further classed on the basis of macrophytic vegetation / tree cover as sparsely vegetated (<20 %), moderately vegetated (20 – 40%), and abundantly vegetated (>40 %). The latter two categories are termed as 'marsh' or 'swamp' depending on whether the predominant vegetation is herbaceous or woody. All wetlands having area  $\leq$ 5ha and with emergent vegetation cover of up to 30% in the study landscape have been classed as ponds (Richardson et al., 2022). The category of river and canal are mentioned with reference to Ramsar classification system; however, these were not included within the current project. A wetland function score was derived for functions like flood buffering, groundwater recharge and water purification for each of the 93 wetlands surveyed in this sub basin. The classification scheme was based on 7 components (a) geomorphology (b) water source (c) water permanence (d) hydrodynamics (e) soil type (f) vegetation cover (g) wetland area. The properties of these following components were given weights with respect to the significance of their delivery to the function as shown in the Table 7. Wetlands were classified as per the properties of each component and the properties were rated as per their significance of the property to deliver the respective functions. The ratings are as shown in the Table 8. The functional score was estimated using the equation given below

$$FS = \sum W_C \times R_C$$

In terms of water purification, flood buffering and groundwater recharge performed by the wetlands, the following assumptions have been used:

- Depressions and flats offer a certain degree of water storage as per the depth. Deeper the depression, more will be the water stored in the wetland.
- Wetlands that a greater ability to store precipitation and surface run off offer better groundwater recharge.
- Wetlands having a horizontal mobility of water offer better water purification due to exposure to sunlight and horizontal flushing.
- Soil with high permeability have more hydraulic conductivity, thereby storing and transporting more groundwater. High permeability also allows water to flow through a porous media which act as a filtration unit. It can also help in storing excess water during flooding event.
- Vegetation along wetlands trap excess sediments and heavy metals thereby helping in flood buffering and purification of water. However, a lesser vegetation cover facilitates greater groundwater recharge owing to the fact that vegetation cover is inversely proportional to the surface area of water in the wetland. The influence gradient for each category on the functions has been listed in Figure 17.

Components/Functions	Flood	Groundwater	Water
	buffering	recharge	purification
Geomorphology	0.6	0.6	0
Water source	0	0.6	0
Water permanence	0.6	0	0.6
Hydrodynamics	0.6	0.6	0.3
Soil type	0.3	1	0.6
Vegetation Cover	0	1	1
Wetland Area	1	0.6	1

Table 7: Weights of the components to deliver the respective wetland function



Figure 17: Functional score gradient of major identified functions based on its characteristics features

<b>Components/Functions</b>	Properties	Flood	Groundwater	Water
		buffering	recharge	purification
Geomorphology	Flat	5	5	5
	Depression	10	10	10
Water source	Only			
	precipitation	10	10	10
	Precipitation			
	and surface			
	runoff	5	5	5
	Groundwater	1	1	1
	Surface water			
	and			
	groundwater	8	8	8
Water permanence	Seasonal	1	1	1
	Intermittent	5	5	5
	Permanent	10	10	10
Hydrodynamics	Horizontal	10	5	10
	Vertical	5	10	5
Soil type	Soil with high			
	permeability	10	10	10
	Soil with low			
	permeability	5	5	5
Vegetation Cover	Total	10	1	10
	Partial	8	5	8
	Peripheral	5	8	5
	No Vegetation	1	10	1
Wetland Area	<1 ha	1	1	1
	1 to 5 ha	3	3	3
	5 to 10 ha	5	5	5
	10 to 20 ha	7	7	7
	20 to 30 ha	8	8	8
	>30 ha	10	10	10

Table 8: Ratings of the properties of components to deliver the respective wetland function

The functional scores for each function of all wetland classes are shown in Figure 18







Figure 18: Functional scores for each function of all wetland classes

An assessment of the ecosystem services of the 106 studied wetlands was undertaken using the Rapid Assessment of Wetland Ecosystem Services (RAWES) approach (Ramsar Convention 2018;

RRC-EA in press). RAWES was developed to support ecosystem service assessment of wetlands recognizing practical time and resource limitations faced by operational staff, providing a simple, user-friendly, cost-effective approach supporting systemic assessment of the full range of wetland ecosystem services (McInnes and Everard 2017). RAWES addresses the four ecosystem service categories (provisioning, regulatory, cultural and supporting services) defined by the Millennium Ecosystem Assessment (2005).

Expert assessors interacted with numerous local stakeholders, community groups, government officials, and non-governmental organisations. Consent to use anonymized feedback from interviewees was sought prior to interviews and meetings.

Semi-quantitative importance of each service is scored on a scale from 'significantly positive' (+) through 'neutral' (0) to 'significantly negative' (-) or 'unknown' (?). Data captured in hand-written RAWES field assessment sheets were transposed into spreadsheet format, with some modification in dialogue amongst assessors and other experts where more information became available. Groups of ecosystem services (all 36 assessed services or within Millennium Assessment categories) were summed and divided by the number of services in that category (up to provisioning n=9, regulating n=14, cultural n =7, supporting n=6 but reduced where services were not relevant) to derive a single comparable ecosystem services index (ESI) (based on similar index methods by Butchart et al. (2010), calculated using Eq. 1. The potential ESI range is from +1 to -1 when calculated for each of the four ecosystem service categories, though compound values for all services can exceed these limits where benefits are realised at multiple geographical scales.

$$ESI = \frac{\sum (n_{+1.0} + n_{+0.5}) + \sum (n_{-1.0} + n_{-0.5})}{\sum n_{TOTAL}}$$

Based on the range of ESI scores for each of the services, the Figure 19 below was constructed illustrating the combined ESI scores for all ecosystem services under each category i.e., within river channel wetlands and Others/Isolated wetlands for all 106 wetland sites, as well as a breakdown of ESI for each service category (provisioning, regulating, cultural, supporting). As revealed from the data analysis, riparian wetlands reported higher ESI scores as compared to the Others/Isolated wetlands.



Figure 19: ESI scores of the services



Experts conducting community training for assessing ecosystem services index

## **Ecosystem health assessment**

Wetland Health Cards for the surveyed wetlands were prepared to help identify immediate threats and identify priority areas for future conservation works. The scores assess wetlands using nine indicators across four broad categories - Area, Hydrology, Biodiversity and Governance. The wetland health scores were categorized from A+ to E as per Table 9. Both riparian and Other/isolated wetlands uniformly exhibit poor health in the subbasin. 72 % wetlands had worse health scores. (Figure 20 and Map 21).

Health Score	Excellent	0.96-1.00	A+
	Very Good	0.91-0.95	А
	Good	0.86-0.90	B+
	Moderate	0.81-0.85	В
	Fair	0.76-0.80	C+
	Bad	0.71-0.75	С
	Very Bad	0.61-0.70	D
	Worse	0.51-0.60	E

Table 9: Categorization of health score based on the ecosystem health assessment

The wetlands in Muzaffarnagar receive seasonal streams from the Vindhyan highlands and were an exception and show Good to fair health scores. Some of these wetlands fall within Protected Areas. 33 % of the riparian wetlands show fair to good health scores whereas only 3 % of the rest of the wetlands which are Others/Isolated wetlands have fair or better health scores.



Figure 20: Health scores of surveyed wetlands

As discussed in Chapter 2 the confluence of Kali River at Kannauj and Yamuna at Allahabad augment the domestic and industrial pollution load. Several towns, industries and agricultural activities contribute to the point and non-point pollution load. Major industries include a number of leather tanneries in Kanpur and Unnao districts in addition to several dying, textile and bleach and chemical industries.



Map 21: Surveyed wetlands under different categories of health score in the 10km buffer zone on either side of the River Ganga in the sub-basin Upstream of Gomti confluence to Muzaffarnagar

#### **Risk of Adverse Change**

Gangetic floodplain wetlands in Uttar Pradesh have been subjected to a wide range of anthropogenic disturbances accentuated by rapid and unregulated development along with an increase in use of chemicals in agricultural inputs since advent of green revolution. As an offshoot of the same, the region saw an increase in population due to rapid economic activities with repercussions for natural ecosystems including wetlands.

Assessments of change in land use and land cover has brought to fore the loss of wetlands to the tune of 41,466 ha amounting to 72% for the landscape, assessed for the period of 2000-2019. The primary causes underpin conversion to non-wetland uses, pollution, declining groundwater levels and unsustainable harvest as major stressors that have contributed to this loss of wetlands. Also, embankments constructed as a response to annual flood inundation regime of River Ganga which covers an area of 310 km (With over ~60%) in the state, has caused a significant reduction in riverine connectivity and have adversely influenced hydrodynamics of floodplain wetlands.

Requirements of water intensive crops introduced by green revolution has also added to non-judicious abstraction of groundwater often influencing the local hydrodynamics of the region. Also, indiscriminate use of chemical inputs like pesticides and fertilizers, required for achieving higher agricultural productivity of such crops, have increased the risk of their leaching into wetlands with consequences like excessive nutrient loading, proliferation of invasive floral species and eutrophication for the ecosystem with implications for population of native species and ecosystem's life sustaining functions.

Increasing upstream demand for water for agriculture and fragmentation of hydrological regimes through the construction of dykes and channels have caused an overall reduction in water availability, Increase in sedimentation, and shrinkage in the wetland floodplain area. It was also observed during baseline survey that overall vulnerability of wetlands was also increased due to a general lack of awareness about values and functions of wetlands amongst shoreline communities, that at many places consider them as mere "wastelands". This attitude of apathy amalgamated with broader governance and management issues has led to overall deterioration in condition and functions of wetlands in the landscape.

Identification of direct drivers of adverse change in wetlands is an important step in designing of efficient and cost-effective strategies for management of such threats. For the wetlands located within landscape, 25 direct drivers of threat (parameters) were identified, based on secondary research and field data collected on the same by means of semiqualitative primary survey. These parameters were further classified under 4 broad classes and 9 sub-classes based on the schematic threat analysis provided by "Global Wetlands Outlook" 2018, as shown below in Table 10

The threat data obtained through survey was then graded on a scale of 0-3, with 0 signifying none to 3 indicating high level of threat faced by wetlands. Scoring was done by considering highest score in respective sub class and then calculating percentile score based on sum of highest score attained and a grading system generated for the same based on following criteria.

Score Range	Assigned grade	Threat level
14 and above	A+	Very High
11	A	Very High
9	В+	High
7	В	High
4	C+	Moderate
3	С	Moderate
2	D	Low
1	E	Very Low

Table 10: Threat levels ascertained based on the score range and consequent threat grade

All 106 sampled wetlands were assigned grades based on the threat scores and further analyzed for selection of corrective management interventions required for checking identified drivers of adverse change. Baseline survey showed that extent of risk of adverse change was determined by the location of wetlands that influenced socio-economic, hydrological and developmental factors. Wetlands sited within river channel are found to be comparatively less threatened than those that are sited as isolated systems within the landscape. Although the nature of anthropogenic threats was found to be somewhat similar across the three categories, the extent of vulnerability varied. A brief description of major threats, based on sample survey of 106 wetlands has been provided below:

Wetlands sited within river channel are found to be threatened most by introduction of pollutants majorly due to discharge of nutrient rich run-off from agriculture and discharge of untreated sewage. In certain wetlands, discharge of untreated black water wastewater was also witnessed. Almost 44% of wetlands were found to be affected with wastewater discharge. While wetlands like Bela Kchar Prayagraj witness moderate pollution load due to wastewater discharge and solid waste disposal, others like Maraunda Jamalpur wetland in Unnao district have reported higher loads owing to leaching of cattle waste. Over abstraction of water for irrigation from within and shoreline & overgrazing were other threats that these wetlands are reported to be exposed to. Almost 88% of such riverine wetlands were used for such sourcing of water. Most of these wetlands have agriculture as preeminent land use in surrounding region that makes them susceptible to such trends of water abstraction. Milkipur wetland in Rae bareli and Katri bajidpur in Kanpur nagar district exemplify such trends with high levels of water abstraction. Excessive sediment deposition has also been reported as a threat in almost all sampled riverine wetlands with Katri Jaisarmau in Kanpur nagar and Jogiya dariya nala in Mirzapur districts reporting very high levels of siltation. This trend adversely affects the water holding capacity, adversely affects wetlands productivity, degrades biodiversity and can eventually lead to filling up of the entire system (Figure 21).

Introduction of pollutants by discharge of wastewater, toilet sewage and solid waste disposal from the settlements present on the shoreline is reported to be the most dominant

threat being faced by these wetlands. Of the surveyed wetlands that lie in this category, around 97% were found at risk due to such introduction. It is also a major factor behind deterioration of water quality and has perilous impact on ecosystem services rendered by these ecosystems. Mama talab in Kanpur nagar, Sarai dangri wetland in Varanasi and Sanpkhera in Hardoi district exemplify such vulnerable wetlands.

Over exploitation of water and conversion to non-wetland uses was also found to be comparatively high in this category owing to illegal encroachments and filling of wetlands for personal use by members of shoreline communities as seen in Rehnas Talab in Kanpur nagar, Majhara piper kheda and Manpur lake in Unnao district. Overall, 58.7% of surveyed wetlands were found to be encroached within the landscape. Owing to their proximity to human settlements, dependency on these wetlands for resources like water, edible aquatic plants, fodder, fuel, soil etc. were found to be much higher, leading to risk of their over-exploitation. Overharvesting of biota was reported from around 62.8% of the sampled wetlands. Introduction of invasive plant species like Eichhornia crassipes was also found to be a major threat in around 24% of surveyed wetlands.



Figure 21: Comparative analysis of threats amongst two ecological categories

# 4. Institutional Arrangements

Institutions play an important role in governing and coordinating relationships between various wetland stakeholders, and thereby their fit with ecological character has an important influence on wise use outcomes. Institutional requirements for conservation and sustainable management of the wetland complex are defined by the ability to ensure integration of site management within broad-scale environmental management and development programming including river basin management, and enabling participatory management, particularly ensuring involvement of local communities whose livelihoods are linked to wetland ecosystem.

This section of the management plan presents an analysis of existing institutions and governance settings with the intent of arriving at recommendations for the management of Ganga floodplain wetlands of Uttar Pradesh. The chapter includes an overview of existing settings and emerging lessons and gaps, and recommendations for enhancing the effectiveness of the regimes to secure wise use of floodplain wetlands.

## Existing institutional and governance arrangements

#### Policy and regulatory frameworks

The National Environment Policy of 2006 articulated the core policy elements of wetlands: including their inclusion in poverty alleviation and rural development strategies, and taking into account explicit impact of developmental projects on wetlands. The National Water Policy of 2012 (currently under revision) recommends adoption of a basin approach for water resources management and identifies conservation of river corridors, water bodies and associated ecosystems as an essential action area. The National Action Plan for Climate Change includes wetland conservation and sustainable management in the National Water Mission and the Green India Mission. The National Disaster Management Plan takes into account several non-structural measures for flood and cyclone risk reduction measures and makes direct reference to wetlands.

Provisions of the Indian Forest Act, 1927, the Forest (Conservation) Act, 1980 and the Indian Wild Life (Protection) Act, 1972 define the regulatory framework for wetlands located within forests and designated protected areas. The Indian Fisheries Act, 1897, The Water (Prevention and Control of Pollution) Act, 1974, and The Biological Diversity Act, 2002 provide instruments for regulating various development threats on wetlands. Further, under the Biological Diversity Act, 2002, the Central Government can issue directives to State Governments to take immediate ameliorative measures to conserve any area rich in biological diversity, biological resources and their habitats especially when the area is being threatened by overuse, abuse or neglect. The said Act also gives State Governments the powers to notify areas of biodiversity importance as biodiversity heritage sites. In 2017, the Ministry notified the Wetlands (Conservation and Management) Rules under The Environment (Protection) Act, 1986. The MoEFCC issued an Office Memorandum on March 8, 2022, reiterating that the 2,01,503 wetlands (>2.25 ha) as per the National Wetland Inventory and Assessment (NWIA), 2011 should be protected as per Rule 4 of the Wetlands (Conservation and Management) Rules, 2017. This regulation thus protects wetlands from development threats by prohibiting a range of activities such as discharge of untreated sewage, and construction within 50 meters of high flood lines. The Environment (Protection) Rules, 1986, empowers the Central government to prohibit or restrict the location of industries and carrying on of processes and operations in different areas including wetlands.

The Ministry of Water Resources, River Development, and Ganga Rejuvenation Notification of October 7, 2016, namely the River Ganga (Rejuvenation, Protection and Management) Authorities Order, 2016 sets the overarching regulation and management framework for the Ganga River System, including tributaries, floodplains and connected surface and groundwater regimes. The order defines floodplains as 'areas of River Ganga or its tributaries which comes under water on either side of it due to floods corresponding to its greatest flow or with a flood of frequency once in hundred years'. Rule 4 (ix) provides that the entire floodplain zone to be construction free zone to reduce pollution sources, pressures and to maintain its natural ground water recharge functions.

Several statutes of the Government of India and the Uttar Pradesh state government directly or indirectly support wetland conservation in Uttar Pradesh. These are described below in Table 11.

Regulation	Purpose	Scope	Key implications for management of Ganga floodplain wetlands
Wetlands (Conservation and Management) Rules, 2017 under Environment (Protection) Act, 1986	Provides the regulatory framework for conservation and management of wetlands in the country	All wetlands >2.25 ha except those covered under the Indian Forest Act, 1927, the Wild life (Protection) Act, 1972, the Forest (Conservation) Act, 1980	Prohibits: Conversion for non-wetland uses solid waste dumping discharge of untreated waste and effluents from cities and towns poaching
The River Ganga (Rejuvenation, Protection and Management) Authorities Order, 2016, amended 2019	Constitutes authorities at central, state and district levels to take measures for prevention, control and abatement of environmental pollution in River Ganga and to ensure continuous adequate flow of water	Applies to the states comprising River Ganga Basin including Uttar Pradesh	National Mission for Clean Ganga, authority is constituted under the Act. It has administrative, appraisal and approval powers and duties, functions and powers to identify specific threats to River Ganga and remedial actions, make the River Ganga Basin

Table 11: Key regulatory frameworks relevant for Ganga floodplain wetlands

Regulation	Purpose	Scope	Key implications for
			management of Ganga floodplain wetlands
The Indian Wildlife	so as to rejuvenate the River Ganga to its natural and pristine condition Protection of wild animals birds and	Applies to all wild habitats,	Management Plan to maintain adequate ecological flows in the River Ganga and tributaries and prevention, control and abatement of environmental pollution. Regulatory framework for management of all
(Protection) Act, 1972 and The State Wildlife Protection Rules, 2020	plants and for matters connected in addition to that	animals, specified plants, wildlife trade and related matters	protected areas like National Parks, Wildlife Sanctuaries and Critically Endangered and Endangered Species.
Environment Protection Act, 1986	Umbrella law to provide for the protection and improvement of the environment, and for matters connected therewith	Covers all forms of pollution and empowers the central government to take any all measures for improving environment quality and lay down standards for emissions and discharges throughout the country	The Environment Protection Act, 1986 and related Acts as the Water Act, 1974, the Water Cess Act 1977, the Wetland (Conservation and Management) Rules 2017 lay the framework of regulatory tools to deal with pollution from industries, towns and settlements located along the Ganges and wetland management. The provision of the Act can be invoked to make new statutes. The NMCG was constituted under the provisions of EPA,1986. The Act has been used to designate Ecological Zones and to specify the land uses that are permitted around Protected Areas.
The Water (Prevention and Control of Pollution) Act of 1974	Aims to prevent and control water pollution and to maintain/restore wholesomeness of water by establishing central and state pollution control board to monitor and enforce the regulations	National (Rules pertain to the State of Uttar Pradesh)	Lays down effluent discharge standards of sewage and sullage Provides for the constitution of State Level Boards for enforcement of various provisions of the Act.
The Indian Forest Act, 1927	An Act to consolidate the law relating to forests the transit of forest-produce and the duty leviable on timber and other forest produce.	Applicable to whole of India. Wetlands lying within notified forest areas are regulated as per the provisions of the Indian Forest Act of 1927, Forest Conservation Act of 1980	Reserved/Protected status is accorded to the wetlands. Acts that are detrimental to forest (wetlands included) health are prohibited and punishable. It applies to all protected areas.

Regulation	Purpose	Scope	Key implications for
			management of Ganga floodplain wetlands
The Forest (Conservation) Act, 1980, amended in	Places a restriction on the de-reservation of forests or use of forest land for non-forest	National	Restricts conversion of forest and wetland habitats.
1966,1990	governments.		
The Biological Diversity Act, 2002	Conservation of biological diversity, sustainable use of its components and fair and equitable sharing of the benefits arising out of the use of biological resources, knowledge and for matters connected in addition to that or incidental thereto	National	Prohibits, without approval of the National Biodiversity Authority Obtaining any biological resource or knowledge associated thereto for research or for commercial utilisation or for bio-survey and bio-utilisation Transferring results for monetary consideration Application for intellectual property rights
The Uttar Pradesh Urban Planning & Development Act, 1973	Administration, protection, conservation and development of urban water bodies	Extends to the whole of Uttar Pradesh, excluding Cantonment areas and lands, owned, requisitioned or taken on lease by the Central Government for the purposes of defence	Legal basis for constitution and functioning of Development Authority Recommends activities to be undertaken or regulated
The Uttar Pradesh Fisheries Act, 1948	Protection, conservation and development of fisheries in the State of Uttar Pradesh	Extends to State of Uttar Pradesh	Vests all fishery with the Department of Fisheries, including powers to allocate rights, regulate fishing, and prohibit detrimental fishing Regulates fishing periods and practices; the formation of association of societies and the collection of funds for the uplift of fishermen and promotion of the fishing industry and designates fishery officer to investigate fishing offences
The Uttar Pradesh Water Management and Regulatory Commission Act, 2008 repealed in the year 2012 and re-enacted in year 2014 by ACT No. 321(2)/LXXIX-V-	To regulate water resources within the State of Uttar Pradesh, facilitate and ensure judicious, equitable, and sustainable management, allocation and optimal utilization of water resources, fix rates for water use and cess on lands benefitted by flood protection through appropriate	Applicable to Uttar Pradesh	The Act empowers the commission to Approve the integrated state water plan/Basin plans prepared by State Water Resources Agency (SWaRA) Determine the allocation and distribution of entitlements of various categories of water use at utility, project level and between various water use entity.

Regulation	Purpose	Scope	Key implications for
			management of Ganga
			floodplain wetlands
1-14-1(Ka)2-	regulatory instruments		Review and accord
2014	according state water		clearances to new water
	policy		resources projects
			proposed at the river basin
			level/sub basin level.
			Monitor conservation of
			environment and
			development of framework
			for preservation and
			protection of surface and
			groundwater quality
			Promote sound water
			management practices
			throughout the state
Northern India	To act and regulate	Guides the management of	Defines the functions of the
Canal and	irrigation, navigation and	irrigation canals and	Uttar Pradesh Irrigation and
Drainage Act No	drainage in northern	engineering structures in	Water Resource Department
8 of 1873	India. The Act entitles	the states of Uttar Pradesh	in the Ganga basin that
	the provincial	and the territories which	includes construction of
	governments to use and	immediately before 1 <sup>st</sup> Nov.	public works for irrigation,
	control for public	1956 were comprised in	drainage and flood control
	purposes the water of	the states of Punjab and	and navigation, develop
	all rivers and streams	Delhi and applies to all	hydropower, supply water
	flowing in natural	lands including	for irrigation, assess
	channels and of all lakes	permanently or temporarily	irrigation revenues, settle
	and other natural	settled or free from	disputes and provide famine
	collections of still water.	revenue.	relief.

# Major organisations and programmes relevant to wetlands conservation

#### A) Government Departments

#### Department of Environment and Forest

Uttar Pradesh State Wetland Authority

In line with the notification of the Wetlands (Conservation and Management) Rules, 2017 the Government of Uttar Pradesh constituted the State Wetland Authority with the Hon'ble Minister (Environment) as the Chairperson and Principal Chief Conservator of Forest (Wildlife) as the Member Secretary.

With reference to Rule 5 (6)(b) of Wetlands Rules, the UPSWA has constituted a Technical Committee and a Grievance Committee. The Technical Committee reviews the Brief Documents, Management Plans and advise on any technical matter referred by the State Wetlands Authority. The Grievance Committee consists of four members to provide a mechanism for hearing and forwarding the

grievances raised by the public to the UPSWA. The Uttar Pradesh State Wetland Authority (UPSWA) meets at least thrice in a year.

According to Rule 5 (4) of Wetlands Rules, the State Wetlands Authority exercises following powers to perform the said functions: a) Prepare a list of all wetlands of the State or UT within three months from the date of publication of these rules; b) Prepare a list of wetlands to be notified, within six months from the date of publication of these Rules, taking into cognizance any existing list of wetlands prepared/notified under other relevant State Acts; c) Recommend identified wetlands, based on their Brief Documents, for regulation under these rules; d) Prepare a comprehensive digital inventory of all wetlands within one year from the date of publication of these rules and upload the same on a dedicated web portal, to be developed by the Central Government for the said purpose; the inventory ought to be updated every ten years; e) Develop a comprehensive list of activities, to be regulated and permitted within the notified wetlands and their zone of influence; f) Recommend additions, if any, to the list of prohibited activities for specific wetlands; g) Define strategies for conservation and wise use of wetlands within their jurisdiction; h) Review Integrated Management Plan for each of the notified wetlands (including trans-boundary wetlands in coordination with Central Government), i) Recommend mechanisms for maintenance of ecological character through promotional activities for land within the boundary of notified wetlands or wetlands complex have private tenancy rights;; j) Identify mechanisms for convergence of implementation of the management plan with the existing State/UT level development plans and programmes; k) Ensure enforcement of these rules and other relevant Acts, rules and regulations and on a half-yearly basis (June and December of each calendar year) inform the concerned State Government or UT Administration or Central Government on the status of such notified wetlands through a reporting mechanism; I) Coordinate implementation of Integrated Management Plans based on wise use principle through various line departments and other concerned agencies; m) Function as a nodal authority for all wetlandspecific authorities within the State or UT Administration; n) Issue necessary directions for the conservation and sustainable management of wetlands to the respective implementing agencies. o) Undertake measures for enhancing awareness within stakeholders and local communities on values and functions of wetlands; and p) Advise on any other matter suo-moto, or as referred by the State Government/UT Administration.

Some of the recent major decisions of the UPSWA include:

- Notification of important wetlands under the provisions of Wetlands (Conservation and Management) Rules, 2017.
- Preparation of wetlands brief documents and their health report cards.
- 1,33,484\* wetlands have been notified in the State Revenue Records which gives protection from being used for any non-wetland use. (\*Ref. F.No. J-22012/36/2020-CS(W): Report submitted to National Green Tribunal).

#### UP State Biodiversity Board

The Uttar Pradesh State Biodiversity Board (UPSBB) was constituted in the year 2006 (notification no. 1498/14-5-2006-57/2006) under the provisions of Section 22 of the Biological Diversity Act, 2002. The UPSBB meets twice a year under the Chairmanship of the Principal Secretary, Forest Department, Government of Uttar Pradesh.

The main functions of the UPSBB include:

- Advising the State Government, subject to any guidelines issued by the Central Government on matters relating to the conservation of biodiversity, sustainable use of its components and equitable sharing of the benefits arising out of the utilisation of biological resources.
- Regulating by granting of approvals or otherwise requests for commercial utilisation or bio-survey and bio-utilization of any biological resource by Indians.
- Performing such other functions as may be necessary to carry out the provisions of this Act as may be prescribed by the State Government.

Some of the recent major decisions of the UPSBB include:

- Formulation of the Uttar Pradesh State Biological Diversity Rules, 2010 vide notification no. 570/XIV-5-2010-57/2006 dated April 9, 2010.
- Constitution of Biodiversity Management Committees for preparing, maintaining and validating People's Biodiversity Register (PBR) in consultation with the local people.
- Development of the state biodiversity strategy and action plan for 2030 & 2050

#### District Ganga Protection Committee

The District Ganga Protection Committee (DGPC) is constituted vide notification by the Central Government in consultation with concerned State Ganga Committee in every specified district abutting River Ganga and its tributaries. The DGPC plays a vital role in prevention, control, and abatement of environmental pollution in the river Ganga. The DGPC in each specified district consists of the District Collector as the Chairperson and the Divisional Forest Officer as the Convener. It is mandated that at least one meeting of the DGPC is convened every three months. The superintendence, direction, and control of the management of the DGPC (including financial and administrative matters) however vests with the National Mission for Clean Ganga which may be exercised by it either directly or through the State Ganga Committee or any of its officer or any other authority specified by it.

The DGPC have the following powers and functions, namely: (a) identifying activities which may be a threat in the area of specified district abutting the river Ganga for protection of the river and its tributaries or its river bed and making a plan for remedial action and take remedial action in respect thereof; (b) taking remedial action at its own end for protection of river Ganga and its tributaries or its river bed abutting in the specified District (excluding enforcement of the provisions

of this Order) (c) in the event of its inability to take remedial action, reporting (electronically as well as by sending written communication in hard copy) to the National Mission for Clean Ganga and concerned State Government, the State Ganga Committee, as the case may be, for issue of direction for protection of river Ganga and to formulate appropriate management or remedial actions. (d) taking suitable administrative and other measures, to give effect to the provisions of this order so as to prevent the environmental pollution in the river Ganga and its tributaries, not being inconsistent with the provisions of this order, or any law for the time being in force.

#### District Wetlands Committee

In 2009, the Government of Uttar Pradesh constituted the district-level wetland committees which were brought under the ambit of the State Wetlands Authority. The District Wetlands Committee works in association with the District Ganga Committee focusing at the basin level conservation efforts for water resources management. The District Wetlands Committee is entrusted with the task of surveying and demarcating wetlands of the district, creating a database on their current situation, and priority ranking for conservation and management needs based on traditional, social, and economic contexts. The committee is directed to forward the list of surveyed wetlands to the Principal Chief Conservator of Forests (Wildlife) for final notification.

The most significant informal institution engaged with the District Wetlands Committee in the management and conservation of Wetlands in Uttar Pradesh is the District Ganga Committee concerned with basin-level conservation efforts for water resources management. This organisation guides the engagement of the District Wetlands Committee with the multi-stakeholder forum through short-term and long-term action plans and work progress is evaluated through expert consultative meetings and workshops. The District Wetlands Committee also ensures to involve the network of Ganga Prahari and Wetland Mitras and empowers stakeholders to contribute to wetlands conservation. Ganga Praharis are motivated and trained volunteers from among the local communities working for biodiversity conservation and cleanliness of the Ganga River with the ultimate objectives of restoring the Nirmal and Aviral Dhara. These 'praharis' are selected through a series of site-level consultative meetings and workshops held in villages located on the banks of the Ganga River and its select tributaries. The local communities have been approached through other agencies too like State Forest Departments, Educational Institutes, National Cadet Corps (NCC), National Service Scheme (NSS) Mahila Mangal Dal, Yuva Mangal Dal, Nehru Yuva Kendras, and Ganga Vichar Manch, etc. to identify the potential Ganga Praharis. Wetland Mitras or 'Friends of Wetlands' are Motivated volunteers from diverse stakeholder groups working together to protect wetlands, and actively engage in conservation initiatives to manage natural resources.

### Department of Namami Gange and Rural Water Supply, Govt. of UP

State Mission for Clean Ganga-Uttar Pradesh (SMCG-UP)

It is an extended arm of the National Mission for Clean Ganga (NMCG) for the state of Uttar Pradesh and implements the Namami Gange and other programmes through various executing agencies. At the state level it is implementing arm of the State Ganga Committee constituted vide S.O. 3187 E dated 7th October 2016 under Environment protection act 1986.

The primary obligation of society include:

- To coordinate and implement the activities of networking of sewerage and sewage treatment structures, remedial steps for treatment of wetland area, river conservation works including using other measures, development of river banks (riverfront), etc. at the state level.
- To ensure the state government's consent on the programmes and structures of the National Ganga River Basin Authority and obtain approval of the state government's share in these programmes.
- To generate public awareness by information, education, and publicity drive regarding abatement of water pollution along with its control, and treatment, environmental cleanliness of River Ganga.

## Department of revenue and land records

State Disaster Management Authority

According to the guidelines laid down by the National Disaster Management Authority (NDMA), the Uttar Pradesh State Disaster Management Authority (UPSDMA) was set up in the year 2005. Following this, District Disaster Management Authority (DDMA) was instituted. The UPSDMA is accountable for various actions as envisaged in the National Disaster Management Act, as per Section 18 (2). It lays down guidelines to be followed by the different state and district departments for the purposes of integration of measures for prevention of disasters and mitigation in their development plans and projects and provides necessary technical assistance therein.

A committee was set up under the chairmanship of Principal Secretary Planning for mainstreaming Disaster Risk Reduction (DRR) into development. A Government Order on 'DRR Mainstreaming in development' was issued by the Chief Secretary on the basis of a study on entry points for DRR mainstreaming in development was conducted in the year 2013-4. The departments where mainstreaming initiatives are being carried out include; the Planning Department, Health Department, Fire Department, Civil Defence, Education Department, Panchayati Raj, State institute of health & family welfare, and State institute of rural development.

Integration of wetlands conservation and restoration in the district disaster management plan can be ensured which is critical for the long-term availability of water resources to meet various development needs. The government of Uttar Pradesh has created a state disaster mitigation fund.
#### Irrigation and Water Resources Department

The irrigation works started in Uttar Pradesh with the establishment of the first Irrigation Office in Saharanpur in 1823. Since then, the department has been responsible for execution, design and planning of irrigation and drainage and flood prevention works and overall water management in the state.

The department focus has been on supply side management of water resources and diverting water from the Ganges to meet the growing demands of cities such as Delhi, Noida, Greater Noida and Agra; thermal power plants; Agriculture as well as for pilgrimage purposes. Canal irrigation is guided by the Northern India Canal and Drainage Act No 8 of 1873 <sup>4</sup> when water demands were low. Similarly, other water projects in the basin have received environmental clearances without adequate considerations for the ecological needs of the river and its floodplains. As assessed, water diversions from the river<sup>5</sup> amounts to 60 % of the annual runoff for Ganga up to Allahabad. Dependence on ground water in Ganges canal command has increased with reduced water availability for surface diversion. This in turn has led to lowering of groundwater tables. Lateral seepage from the boundary streams has gone up as consequence regenerated flows in river downstream is reduced.

The State Water Resources Agency (SWaRA) was created in June 2001 for management, planning and sectoral allocation of Water Resources (both Surface & Ground) to various agencies and to give legal base to the above preparation and use of Surface/Ground water and to work as a technical secretariat to the State Water Board. State Water Resources Data Analysis Center (SWaRDAC) has been setup to provide water related data to the State Water Resources Agency (SWaRA) and other Central/State water plans for all river basins of the State.

The Uttar Pradesh Water Management and Regulatory Commission (UPWaMReC) was created as an executing and enforcement, regulatory and advisory body in 2014 to regulate and recommend the tariff for water used for agriculture, industries, drinking, hydro power and other purposes and also for levying cess on land benefited by flood protection and drainage works from the owners of land benefited through appropriate regulatory instruments according to State Water Policy and to assist the State for making policies and execution of the water resources within the State.

The State Water Resources Agency (SwaRa) in collaboration with an Israeli Consultancy firm undertook River Basin Assessments and Planning for all Major River Basins in Uttar Pradesh including the Ganga basin in 2020. The plan has identified encroachment of floodplains in the absence of demarcation of

 $<sup>^{\</sup>rm 4}$  the Northern India Canal and Drainage Act No 8 of 1873 and its UP-specific amendments

<sup>&</sup>lt;sup>5</sup> Water amounting to 27.3 BCM per year

<sup>(</sup>https://www.rid.go.th/thaicid/\_6\_activity/Technical-Session/SubTheme2/2.15-Ravindra\_K.pdf)

floodplains that is reducing groundwater recharge, Sand mining causing destruction of aquatic and riparian habitat, riverbed coarsening and degradation and other physical impacts as the major issues. The report also mentions the lack of coordination between different water user departments at the planning stage as the biggest hurdle in managing the water resources.

A more holistic approach to water management has been prescribed. The plan recommends the maintenance of Minimum Environmental Flow downstream of all possible diversions in the streams. Currently, there are no national guidelines available for such diversions. Most of such diversions are dealt with on case-tocase basis. Wetland specific actions proposed in the Ganga Basin plan are aimed at Wetland development for recharge and environmental & socio-economic benefits such as drinking, fisheries, recreation etc. in 60419.52 ha area, estimated to provide an additional recharge of 101.54 MCM with estimated cost of Rs 4495.21 crores (at 2017 price level) to be implemented by the UPIWRD, Rural Development Department, Fisheries Department, Agriculture Department. Integrated watershed development with emphasis on soil and water conservation in 383676 ha area will provide an additional recharge of 63.52 MCM with cost of Rs 1918.38 crores is proposed to be implemented by the UPIWRD, the Rural Development Department and the Agriculture Department. State Water Resources Data Analysis Center (SWaRDAC) has developed the web-based Basin Assessment and Planning System (BAPS).

#### State Department of Culture & Tourism

The department promotes responsible wetland tourism supporting the local economy to protect habitat from disturbing activities. The state government is promoting major wetlands as tourism, recreation, and water sports hubs. These include the Ramsar sites also and are being accorded more importance than National Parks as these are repositories of rich and diverse biodiversity. Many of these wetland sites have spiritual and religious significance. The promotion of wetlands as a popular recreational and tourism destination will also provide local livelihood opportunities. Uttar Pradesh has the maximum number of nine Ramsar sites amongst 49 designated sites in India. The development plan includes establishing boarding and lodging facilities and access to recreational activities like boating and water sports. The sites are being developed under the financial collaboration of the central and the state government.

In the sub-basin, some of the major tourist attractions are the Tanda Dari Tal and Lower Khajuri dam and numerous caves and waterfalls found in Mirzapur district.

### Panchayati Raj Department

The Gram Panchayat Development Plans serve as the vehicle for consolidated development of the village in the state popularly known as - Hamari Yojana hamara Vikas. The GPDP processes implementation started in the state in the year 2015-16. As per 15th Finance Commission recommendations, Rs. 1.42 Lakh crore tied grant were given to Panchayats for Water & Sanitation during 2021-22 to 2025-26 in

the country. Uttar Pradesh has received Rs 22,808 crore as grants for the above period. This is huge push to address issues of sanitation and environmental pollution as it will enable Gram Panchayats to shoulder the responsibility for potable water supply to every household and community centre and plan and take actions for greywater management, solid waste management, maintenance of open-defecation free status and improved sanitation in villages which will have a positive bearing on wetland health.

#### **Fisheries Department**

Uttar Pradesh Fisheries Department was established in the year 1947, under Animal Husbandry Department with a view to carry out fisheries development in a planned manner. Central Sector Scheme "Blue Revolution: Integrated Development and Management of Fisheries" has been launched in the year 2016-17, bringing all the centrally sponsored /centrally funded schemes in one umbrella, under which various programs of fisheries development can be conducted. The Blue Revolution or the Neel Kranti Mission guidelines aims to create an enabling environment for integrated development of the full potential of fisheries of the country while ensuring the sustainability of, bio-security and address environmental concerns for enabling sustainability of the fishing industry and has been formulated at a total central outlay of Rs 3000 crore for five years. The tentative fund allocation for the Financial Year of 2019-20 for the state of Uttar Pradesh was Rs 30 crores.

#### Department of Rural development

The Mahatma Gandhi National Rural Employment Guarantee Act 2005 requires preparation of a district labour budget for next financial year estimating the anticipated demand for unskilled labour work in the district and a plan for need based works as approved by the Gram Sabha based on the Gram Panchayat Development Plans for the engagement of workers therein. The labour budget includes a component on Natural Resource Management. Under the scheme, 100% of funds in the pre monsoon months can be utilised for water conservation works. The work is taken in convergence and with other programmes of watershed development and irrigation.

Creation of Natural Resource Management assets has led to several positive environmental impacts as increase in groundwater levels, improved water quality. However, scientific planning for wetland conservation is a critical factor mostly lacking as the communities need to have the knowhow of local landscape or hydrology. Supervision of assets being created (whether external or internal) under MGNREGA, maintenance of asset quality and capacity development of the persons involved in planning and execution is needed to for ensuring better outcomes for wetland conservation. For the financial year 2022-23 the approved labour budget is Rs 2600 lakhs in Uttar Pradesh. 730 lakh person days have been generated so far (MGNREGA Portal dashboard as accessed on 20/6/22).

The Uttar Pradesh government plans to construct 789 ponds, each of 0.4 ha in the state under the newly launched national Mission Amrit Sarovar that will help in

increasing the availability of water, both on surface and under-ground. The first Amrit Sarovar of the country was inaugurated in April 2022 in Rampur, Uttar Pradesh.

## Department of Agriculture

The Prime Minister's Agriculture Irrigation Scheme (Per Drop More Crop) is a micro irrigation program that encourages the adoption of drip and sprinkler irrigation system in various crops. The scheme covers all the districts of Uttar Pradesh. The priority areas include clusters of ponds constructed/renovated under intervention of per drop more crop in addition to overexploited, critical, semi critical blocks. The benefit of the scheme is admissible to farmers, members of cooperative societies, Self Help Groups, incorporated companies, Panchayati Raj Institutions, noncooperative institutions, trusts, members of group of producer farmers on a first come first serve basis. The amount of grant is directly transferred to the beneficiary's account by Direct Benefit Transfer.

## B) Research & Accademia

Educational institutions specializing in different aspects of floral and faunal ecology carry out short and long-term studies supporting the conservation and management of ecosystems. Uttar Pradesh Environment and Forest Department in collaboration with the Wildlife Institute of India, Dehradun; Department of Wildlife Sciences, Aligarh Muslim University; Chaudhary Charan Singh University, Meerut, and IIT-Kanpur has carried out substantial research on aspects of wetlands conservation in Hastinapur Wildlife Sanctuary. Although the studies have been carried out in silos, sharing and updating information and knowledge among different sectors is important. To address the data and information needs for management planning, strong and effective linkages need to be established amongst different sectoral institutions.

Krishi Vigyan Kendras have been functioning as Knowledge and Resource Centres of agriculture technology supporting initiatives of public, private and voluntary sector for improving the agricultural economy in each district of Uttar Pradesh.

## C) Civil Society Organisations

Under the supervision of the District Collector of several districts, Wetland Brief Documentation Committees have been formed consisting of the citizens (members) from the local community. In another district, Wetland Conservation and Development Authority has put forward the idea of appointing citizens as lake wardens and becoming a partner in conservation and management efforts by playing a watchdog and outreach role. The approach has however been revised by the MoEFCC and is incorporated as one of the pillars of the wetland rejuvenation programme. Other than this, a number of Non-profit organisations are engaged in developmental and conservation activities around the wetlands including the World Wildlife Fund (WWF) – India, which is making an effort to restore the ecological health of the Ganga in Hastinapur and trying to develop it into a model for aquatic biodiversity conservation. Another organisation is The Turtle Survival Alliance, which is presently undertaking a survey of turtle species in the Terai region of Uttar Pradesh.

#### **Ownership aspects**

The landscape is dominated by isolated wetlands present within village administrative boundaries. Almost 63.7% of total surveyed wetlands were found to be fully owned by the Gram Panchayats. These wetlands are common property resources with open access to community members. However, access and usage were also subject to regulation by Gram Panchayats. Wetlands leased out for culture fisheries and commercial cultivation of aquatic plants have partial access for community members. Wetlands like Kushrajpur pond in Unnao and Bakulahi River in Rae Bareilly are examples of such wetlands which are used for water chestnut cultivation.

Government departments own 19.6 % of the wetlands within the landscape. All wetlands (8.4%) present within protected areas are owned and managed by Uttar Pradesh Forest Department. Those wetlands that are located within villages that fall under Protected areas also come under the jurisdiction of the forest department, with restrictive regulations in place. Communities dependent on such wetlands exercise fewer rights as compared to those that are outside Protected areas and are owned by gram Panchayats. While few among them have seen conflict between the forest department and local community as witnessed in Tanda Dari Tal located in Mirzapur district, where setting up of a cowshed (gaushala) became a cause for confrontation, others like Matiya Mau in Hardoi are seen as examples of collaborative efforts for wetlands rejuvenation between forest department and gram panchayat.

Revenue, Railways, and Irrigation department are other government departments that own certain wetlands located within the landscape mostly situated near railway tracks and barrages/canals respectively. Bela kachar wetland in Prayagraj district is owned by Railways and is leased out for pisciculture activities. Belwan wetland in Mirzapur and Rawat Pond in Unnao district are examples of wetlands owned by the revenue department.

Certain individual members of the community also own wetlands that are majorly used for pisciculture activities. Such wetlands constitute personal property with restricted access for other members of the community. Of the sampled wetlands, around 1.8% were found to be fully owned by private individuals while 4.6% were co-owned with government entities or panchayats.

Joint ownership was seen with 26% of wetlands present within the landscape, with Government departments partially owning 9, Gram Panchayats 14 and Private entities co-owning 5 of the sampled wetlands. A complete ownership is generally found to be good for wetland health and management as it eases the implementation of restoration and management plans. Some of the wetlands that are fully owned by the local governing institutions have also seen the restoration of wetlands under flagship government schemes like the Mahatma Gandhi National Rural Employment Guarantee Act, 2005. Samdha tal wetland in Sant Ravidas Nagar district is one such example where the village panchayat is undertaking initiatives like marking of boundaries, catchment area plantation etc. Saibasi wetland in Kanpurnagar that is co-owned by gram panchayat and private entity and Benti wetland sharing ownership between forest department and gram panchayat can be cited as examples of such wetlands. Also, no wetland was found to have ambiguous ownership rights (Figure 22)



Figure 22: Graph showing the distribution of wetland ownership

## **Rights and privileges**

Wetlands in this landscape have such associated community rights and privileges which directly affect their usage, ecosystem characteristics as well as services.

Traditional privileges linked with livelihoods, that are determined by age-old practices are less within the landscape, with few members from traditional "Mallah" or the "Kewat" communities entrusted with activities of harvesting fish and rowing boats. Presently, these activities are not restricted to any community and are practiced by all. Buffalo wallowing, grazing on wetland shorelines, drinking water for cattle, collection of fibres, fodder and wild plants & religious practices are some of the activities that wetland-dependent communities are traditionally entitled to.

The communities enjoyed access to bathing/ wallowing of buffaloes and cattle grazing along wetland shorelines in 84.1% and 80.3% of the surveyed wetlands respectively. Capture fishery is not practiced widely, in spite of unrestricted access in about 26.1% of wetlands, mostly owing to the predominance of vegetarianism within the landscape. Around 39.2% of the wetlands were leased out for culture fisheries. Plying of boats is an associated activity that is mostly undertaken for fishing and transportation in monsoons when River Ganga and its tributaries are in spate but it was also observed in only 14 % of the wetlands. It is majorly restricted within protected areas and is allowed only for eco-tourism purposes.

Although less in number due to increasing abstraction of groundwater through borewells for agriculture, dependent communities in almost 33.6% of wetlands still have the privilege of withdrawing water for agriculture or fisheries. Bhokawa Bandha and Belwan wetlands in Mirzapur District and Gonda Subhans Tal in Sant Ravidas nagar District are examples of such wetlands which allow communities for abstracting water for irrigation purposes.

Amongst surveyed wetlands, 14% of wetlands communities were permitted to harvest wetland plants for fodder, fuel, fiber, food, medicine, or decorative items. It is mostly an unregulated activity. Yet, it is reported, with exception of grazing, that these pursuits have seen a sharp decline, majorly due to changes in choices, the deteriorating condition of wetlands, and a decline in the availability of wetland resources.

Many wetlands present in the landscape are integral to the socio-cultural life of the dependent communities. They are used for conducting religious ceremonies including immersion of idols and "Tajias". Community rights in the context of religious practices, exist for wetlands that are considered to be sacred and are associated with mythology and culture. Many annual fairs are also organized around wetlands. Religious privilege was found to be present to dependent communities in 30% of the surveyed wetlands. Sedha and Bharda Tal in Rae Bareli are examples of such wetlands.

Gram Panchayat-owned wetlands, especially those located within the agricultural landscape are used for carrying out agricultural activities in the dry season when the wetland has less water. Certain wetlands like the Unchgaon and Liloi Jhil wetland in Unnao District are leased out for the cultivation of Water Chestnut (Euryale ferox). Such wetlands constitute 11.2% of sampled wetlands. The activity is unregulated and happens mostly due to the absence of restricting laws, effective monitoring, community ownership mechanisms and lack of boundary demarcation. Encroachment, deterioration of soil characteristics owing to excessive use of chemicals are recognized threats associated with agriculture in and around wetlands. Rehnas Talab in Kanpur Nagar and Mela Ramkunwar in Unnao are wetlands that are getting converted for agricultural activities (Figure 23).



Figure 23: Graph depicting the distribution of Rights and Privileges associated with sampled wetlands

Rights and privileges though available in the majority of the wetlands are not uniformly enjoyed by the community, majorly due to poor water quality, deteriorating health, and availability of alternatives. There is a general lack of community ownership and stewardship for conservation and wise use of these ecosystems which is also a cause of the decline in its ecosystem services.

# **Evaluation of existing institutional arrangements**

Table 12: Identifying key gaps in the status of the different components of existing institutional arrangements

Enabling institutional	Status of current institutional	Key gaps
conditions and implications	arrangements	
for wetland management		
Defined user and resource bour	ndaries	
Presence of well-defined boundaries around Ganga floodplain wetlands is required to ensure that management zones and actions are defined in spatial terms and linked with user access rights, adverse land and water use change is prevented, and communities have incentives for protecting the wetland.	The wetlands have been entered in to land use records. Wetland maps prepared using satellite data are available with the UPSWA Of the surveyed wetlands 44 % of wetlands were owned by the Gram Panchayats, 23.7 % were present within protected areas, Government departments owned 31% of the wetlands.	Ground demarcation of wetland boundary is yet to be undertaken for a majority of wetlands. Maps available are not of required scale to permit site level management and regulation. For 4.3 % of wetlands, the ownership is not clear. For additional 32 % of wetlands, multiple ownership leads to lack of congruence in management arrangements Balancing of preexisting rights and privileges with conservation outcomes is a challenge
Congruence		
Rules for management of Ganga floodplain wetlands conform to the functioning of biophysical and social systems. The rules also balance the cost of enforcement of management with the benefit derived from wetland ecosystem services and biodiversity.	The River Ganga (Rejuvenation, Protection and Management) Authorities Order, 2016 sets the overarching regulation and management framework for the Ganga River System, including tributaries, floodplains and connected surface and groundwater regimes. The order defines floodplains as 'areas of River Ganga or its tributaries which comes under water on either side of it due to floods corresponding to its greatest flow or with a flood of frequency once in hundred years', Rule 4 (ix) provide that the entire floodplain zone to be construction free zone to reduce pollution sources, pressures and to maintain its natural ground water recharge functions.	Rules for conservation at floodplain level are clearly outlined but their harmonization with site level wetlands conservation is a challenge. There is limited clarity on activities which are prohibited, regulated and permitted within the wetland and its zone of influence. One third of the wetlands were found to have very bad health scores and another 18 % had worst wetland health scores suggesting deteriorating health status. This shows there is a lack of implementation of regulation and/or systematic monitoring of water quality along the River Ganges and its floodplains. Over abstraction of water that led to increased sedimentation and reduced flushing, decreased

Enabling institutional	Status of current institutional	Key gaps		
conditions and implications	arrangements			
for wetland management				
	Rule 4 of wetland conservation and management rules apply to all wetlands above 2.5 ha. Wetlands within PAs are regulated under the purview of Wildlife Protection Act, 1972 and the Ramsar convention. The Water (Prevention and Control of Pollution) Act, 1974 defines stream as a river; water course (whether flowing or for the time being dry); inland water (whether natural or artificial); sub-terranean waters; sea or tidal waters. Section 24 of the Act prohibits any person from knowingly cause or permit any poisonous, noxious or polluting matter determined in accordance with the standards laid down by the State Board to enter (whether directly or indirectly) into any stream or well or sewer or on land Northern India Canal and Drainage Act No 8 of 1873 guides the management of irrigation canals and engineering structures in the states of Uttar Pradesh and the territories which immediately before 1st Nov. 1956 were comprised in the states of Punjab and Delhi and applies to all lands, whether permanently or temporarily settled or free from revenue. Environmental clearances under the EIA Notification of 2006 are required for clearance of new projects and expansion and modernisation of existing projects	groundwater recharge and increased pollution concentration was reported from several wetlands. Supply side management of water resources, water diversions in the absence of adequate knowledge base on Gangetic floodplain ecology and ascertaining the ecological flows requirements of the River has increased the risk of water pollution and adversely impacted biodiversity habitats, fisheries and wetland based livelihoods.		
Conflict resolution mechanism	within the Galiya River Dasin.			
Low oost and effective	Soveral eases of conflicts were	Evicting ombiguities in wotland		
conflict resolution mechanism are available for supporting the implementation of wetland management.	reported. Between the Forest and Irrigation department - Haiderpur wetlands Forest department and the Gram Panchayat. Sikri village located in Muzzafarnagar District communities living within PA boundaries are not able to use the wetlands for fishing	ownership in land records yet to be settled. Gram Panchayats (and other wetland owners) do not resolve wetland use related conflicts in a timely manner. District Wetland Committees should take measures to resolve conflicts at the earliest		

Enabling institutional	Status of current institutional	Key gaps		
conditions and implications	arrangements			
for wetland management				
	Agriculturists and fishers - Expansion and intensification of agriculture is at the cost of fragmentation of wetland regimes and habitats Conflict resolution mechanism in the form of appeal to the relevant bench of National Green Tribunal is provided within the Wetland (Conservation and Management) Rules, 2017.	Wetland management needs to be co-adopted by concerned sectors. Stakeholder views as yet are not getting incorporated in management planning		
Minimal recognition of rights to	organize			
Rights of communities to define management objectives for Ganga floodplain wetlands are not counter to existing government rules and regulations.	Communities enjoy traditional rights and privileges to access wetland resources. Data suggests over extraction of wetland resources (water and biota in particular) that is adversely impacting the ecological character of wetlands.	Checks and balances to be placed to regulate community rights and privileges in accessing wetland resources subject to the threshold levels and to ensure equitable sharing of benefits and maintaining wetlands ecological character. There is no prescribed monitoring and regulatory tool to guide wetlands wise use and ensure adherence. Lack of community level interest and capacity for stewardship of wetlands particularly in case of the Gram Panchayat owned wetlands.		
Nested enterprises				
Institutional arrangements for management of Ganga floodplain wetlands are linked with wider developmental planning within the Ganga River Basin.	Multitier institutional arrangements are in place to support basin to site level conservation efforts for River Ganga and its floodplains with the District Ganga Committees constituted in 26 districts abutting Ganga and its tributaries in Uttar Pradesh under the superintendence and control of the State Ganga Committee. The existing District Wetlands Committees constituted by GoUP in 2009 is now guided by the Ganga Committee in the 26 Ganga floodplain districts. The Divisional Forest Officer is the Convener of the District Ganga Committee engages with a multi-stakeholder forum through the District Ganga Committee.	Aligning departmental programmes and priorities that traditionally have a sectoral focus and are antithetical to wetlands conservation is a challenge specifically those related to water management and agriculture development. Convergence opportunities are yet to be tapped in to. There is a lack of institutional capacities to guide and support integrated management of wetlands. The need was highlighted for all wetlands, during workshops on desired management actions across the districts. A weak coordination across sectors and amongst stakeholders was observed		

Enabling institutional	Status of current institutional	Key gaps
conditions and implications	arrangements	
for wetland management		
	There is an opportunity to integrate wetland conservation actions within the District Ganga Committee action plans. There are more funds available that can be deployed for wetland conservation through the NMCG. Now there is greater scope for scaling up wetland conservation actions and adoption of integrated river basin level approach to wetland management. The NMCG structure favours greater collaboration and capacities enhancement of different stakeholders (Government and Non-government bodies) including the nodal officers designated by District Ganga Committees.	Though UPSWA has the mandate to manage the Ganga floodplain wetlands, policy impetus for harmonized planning in the basin does not exist. As of now there is a greater focus on need based short term actions. Consultative mechanisms and cohesion amongst administrative units will help to align the objective of integrated management planning of the Ganga floodplain wetlands and its systematic monitoring, review and adaptation with the priorities of the District Ganga Committees.

## Proposed arrangements for managing Ganga floodplain wetlands

### Wetland management categories

The Ganga floodplain wetlands can be classified in to different categories based on the landscape setting, wetland use and whether the wetlands are situated within protected Area or outside (Table 13). Wetland ownership is heterogenous but ownership can be attached to each class based on the dominant institution.

 Wetlands within Protected Areas (PAs) - A number of wetlands are managed as protected areas. The management rests with the state Department of Environment and Forests. Tanda Dari Taal and Bhokawa Bandha wetland in Mirzapur district are sited within area of Reserve Forest. The protected area status allows securing biodiversity habitats by limiting outside human disturbances supported by dedicated conservation funding from the department.

Outside of PAs, wetlands can be grouped in to different categories based on their landscape setting i.e., Rural or Urban.

- Ponds The wetlands less than 5 ha are classified as ponds. Mostly these wetlands fall within the jurisdiction of a Gram Panchayat. Funds are earmarked as part of village development plans for the development of wetland and water resources. They can also be privately owned.
- Urban/Peri-urban wetlands The wetlands within urban limits are mostly managed by municipalities unless privately owned.

Another classifier is the wetland use and rights and privileges that communities enjoy in these wetlands. Mostly wetlands are used for agriculture.

• Agricultural floodplains - Agricultural floodplains occupy peripheral areas around villages, rivers, roads. Located away from human settlements, many serve as buffer zones and as connectors and migration corridors between national parks, wildlife sanctuaries and reserved and protected forests.

A description of the four categories of wetlands which emerge on the basis of clubbing hydrogeomorphic classes and institutional arrangements is presented in Table 13

Table 13: Distribution of the three different wetland types according to their management categories

Wetland types	Features of	Protected Area	Wetland Use
N= 106	surrounding	and Non-Protected	(Agriculture/Urban)/Ponds
	landscape	Area	
Within River	Rural – 13.1 %	Non-PA - 13.1 %	Agriculture – 11.2
Channel - 14.1 %			
			Ponds – 1.9 %
	Urban - 1.0 %		
Others - 85.9 %	Rural – 67 %	Non-PA – 62.1 %	Agriculture floodplains – 33.3 %
			Ponds – 28.8 %
		PA – 4.9%	
	Urban - 18.9%		

## Proposed institutional arrangements

Mission Sahbhagita launched in 2022 to commemorate 75 years of independence, is a Government of India initiative for conservation and wise use of wetlands of national and international importance. The Mission prescribes a multitier institutional arrangement for the management of wetlands that is relevant and can be suitably adopted in the given context. The following institutional arrangement is proposed for management for the management of Ganga floodplain wetlands.

- At Site level: A cadre of ground volunteers such as the Wetland Prabhari assisted by a network of Wetland Mitra/Ganga Praharis coordinating site management with government line departments and agencies, knowledge partners, civil society organisations and corporate sectors.
- At District level: District Wetland Committees ensuring that convergence is built with district-level conservation and development plans and programmes.
- At State level: The Uttar Pradesh State Wetland Authority reviewing and approving site management plans and providing access to funds for implementing management from central and state-level public sector schemes, as well as corporate sector partnerships.

## **Roles and Responsibilities**

## Wetland Prabharis

The Wetland Prabharis may be responsible for the following activities:

- Install signages displaying information on wetland site's uniqueness, conservation significance, cultural significance, and management arrangements
- Nurture a network of 'Wetland Mitras' for stakeholder engagement in wetland management actions
- Coordinate development of action plan for conservation and sustainable management
- Identify 'cultural icon(s)' and run community campaigns relating the icon to wetlands conservation and sustainable management
- Organize events linked to local legends/cultural values of the wetland.
- Design and implement citizen science programme such as Asian Water bird Census' to engage citizens in wetlands monitoring and management
- Coordinate targeted stakeholder education, awareness and behaviour change campaign to incentive affirmative actions for wetlands conservation and sustainable management through existing or refurbished wetland interpretation centres
- Commission baseline wetland inventories through the support of knowledge partners, corporate and civil society partners
- Connect with Panchayats and Municipalities in the vicinity; connect with local schools and teachers for awareness-raising among children and youth
- Coordinate implementation of the wetland action plan through funds from ongoing development plans and programmes, including through engagement with corporates
- Coordinate periodic wetlands monitoring and management effectiveness review to assess whether mid-course correction in wetland management implementation is required

## District Wetland Committees

The primary responsibilities of the District Wetland Committee include:

- Review wetland management plans, in consultation with all relevant departments and sectors
- Integrate wetland management actions in district level environment plans, disaster risk reduction plans, district development plans and others
- Build convergence of wetland management plan with district level development plans
- Periodic review of management plan implementation and monitoring outcomes

The Uttar Pradesh State Wetland Authority

The State Wetland Authorities will have the following key roles:

• Mapping of each wetland site with District Wetland Committees, Knowledge Partners, Corporate Sector and CSO Partners

- Designate a Wetland Prabhari for each wetland with a mandate to deliver roles and responsibilities as prescribed
- Review and approve management plans
- Ensure access to funds for implementing management plan actions by building convergence with conservation and development sector schemes
- Provide platform for business engagement in wetlands management
- Review wetlands monitoring information, and undertake mid-term course correction as may be required
- Notify wetland sites under Wetlands (Conservation and Management) Rules, 2017 and other extant regulation

Table 14: A detailed description of wetlands under the different management categories

Management	Area and other morphological	Ecosystem services	Threats predominance	Ownership	Rights & privileges
categories	features	predominance			
categories Wetlands within Protected Areas (N=5)	<b>features</b> Five wetlands fall under protected areas, inside reserve forests. Size of wetlands vary from 4 ha (Manikpur Reserve Forest) to 154 ha (Tanda Dari Tal). Human made reservoirs can be found along natural streams that drain the highland Vindhayan plateau. 75 % wetlands have inlets and have water that is flowing. Shoreline vegetation is present in most cases.	PA wetlands score better than other wetlands in providing ecosystem services. Supporting services (0.76) received highest value followed by regulatory (0.69), provisioning (0.34) and cultural services (0.3). Wetlands served as connecting corridors for species migration and supporting habitat heterogeneity and high species diversity.	Despite their protected status the wetlands face numerous threats. Water abstractions for irrigation emerges as key threat. Since the wetlands are connected, they also get affected by the alteration in natural water inflows reducing flushing. Deforestation and agriculture activities in catchment increase sedimentation risk. Discharge of nutrient rich runoff from adjoining agricultural fields is threat associated with it	60 % wetlands jointly owned by government and individuals. 20% fully owned by government and 20% private.	The rights and privileges availed are to meet the basic subsistence needs of local communities and not for income generation. 40% wetlands are used for sustenance community fishing without lease and harvest of aquatic plants (60%). Fishing under lease was also done in 20% wetlands. In 60 % wetlands water is withdrawn for agriculture. Grazing is permitted in most of the wetlands (80%). Use of wetlands for religious practices was nil.
Pond (N=34)	Small wetlands <5 ha area. The wetlands are naturally formed in flats or depressions. Majority wetlands (79%) are isolated. 59% do not have inlets or outlets. The depth varies from 1 to 15 m with a median value of 1 m. Majority (88 %) remain only seasonally inundated. 71% have static, vertically flowing waters.	Regulatory services are best perceived as wetlands providing water security benefits (0.55). Wetlands have little cultural value (0.07), most likely linked to pollution in these wetlands. The wetlands are also valued for their supporting functions (0.47). The provisioning services of wetlands are lower than agricultural wetlands.	Face numerous threats that are due to local factors. Prominent is water extraction of groundwater near wetlands for irrigation, discharge of nutrient rich agricultural runoff and the discharge of household toilet sewage and discharge of untreated sewage.	Majority wetlands are under village Panchayats (82%)	Fishing and harvesting of aquatic plants were high and practiced in half of the wetlands (30% without lease and 44 % under lease). 15 % used for agriculture. Religious ceremonies practiced around only 18 % wetlands. Water withdrawal for agriculture of fishing in 32% wetlands

Management categories	Area and other morphological	Ecosystem services	Threats predominance	Ownership	Rights & privileges
Urban and peri urban wetlands (N=20)	Majority wetlands are small. Mostly wetlands are natural. Majority have no inlets (65%) or outlets (60%) and have seasonal inundation (65%) . The wetlands are surrounded by built up as roads, settlements, railway. Depth varies widely from 0.16 to 21.75 m. 95 % are isolated.	The regulatory services (0.5) were perceived to be important followed by supporting services (0.3).	Close proximity to populous settlements subjects the wetlands to high intensity of threats as pollution most significant being discharge of untreated sewage and solid waste dumping. Groundwater extraction around the wetlands is high. Change in water availability and increased sedimentation were reported	70% owned by individuals. 36% by line departments. The wetlands are exposed to degradation and exploitation due to institutional neglect and lack of maintenance	The only major use of wetlands was as grazing lands (40%) or bathing of animals.
Floodplain agriculture wetlands (N=47)	Wetlands size varies from are 5.11-579 ha in size. 23% wetlands are larger than 50 ha in size. They occur on flats. 30 % wetlands are connected with a river or wetland. Shallow wetlands with depth of 0.2 to 6 m. 72% wetlands are seasonal. Shoreline has vegetation in many wetlands.	High supporting (0.67) and regulatory services (0.66) owing to their groundwater recharge, flood buffering functions and rural landscape setting supports several ecotone species.	The wetlands face threat of excessive groundwater extraction, nutrient loading from agricultural runoff, excessive extraction of fish, and structural modification through construction of power lines and conversions to agricultural/ horticultural uses.	66 % are owned by Panchayats. 25 % partly or fully owned by governments and rest have private ownership	Agriculture within wetland is practiced in 19 % wetlands but 42% wetlands are subject to water abstractions for irrigation. The wetlands serve as significant fishery resource. Community use these wetlands (30%) for capture fisheries. Fishing under lease is carried in 38 % wetlands and harvest of aquatic plants without lease is done in 30% wetlands. Majority serve as grazing grounds.

# 5. Management Framework

Management of floodplain wetlands of River Ganga needs to be based on the recognition of their full range of ecosystem services and biodiversity values, their relationships with ecosystem health, and mainstreaming into conservation development plans and programmes at all levels. The effectiveness of management will be reflected in the ability to sustain the multiple values of wetlands based on the traditional knowledge of communities that have evolved over time, without undermining the key ecological and social processes that underpin the functioning of these wetlands as socioecological systems. Wise use of floodplain wetlands of River Ganga will be realized when the capability of these wetlands to provide diverse ecosystem services and sustain rich diversity is maintained now as well as in the future, on pathways that are aligned with ecosystem principles and guided by sustainable development. The sustainable development framework, as adopted in 2015 calls for addressing five elements – People, Planet, Partnerships, Peace, and Prosperity.

The current chapter sets out the management planning framework including the management goal and purpose, management strategy, objectives, targets and indicators, and likely risks and risk-mitigation options pertaining to the implementation of the management.

#### **Management Goal and Purpose**

The overarching goal of managing the floodplain wetlands of River Ganga is "conservation and wise use of wetland ecosystems so as to sustain their full range of ecosystem services and biodiversity values including their contribution to River Ganga ecosystem health".

The purpose is to: a) enhance river ecosystem health, b) enhance water security in the Upper-Ganga basin, c) reduce water-related disaster risks to communities living in and around the wetlands, d) provide livelihood opportunities to local communities based on sustainable use of wetland resources and e) sustain habitats and migration corridors of wetland-dependent species.

#### **Management Strategy**

The ecological and hydrological connectivity of the floodplain wetlands with River Ganga provides the physical template in which these wetlands evolve and function. At the same time, the wetlands are also conditioned by the land use in the surrounding areas, traditional uses of the wetland, the cultural and relational linkages that communities have with wetland ecosystems, and the overarching regional developmental planning for different development sectors. Management of these floodplain wetlands is thereby proposed at two levels: a) the interventions at the sub-basin level which are aimed at ensuring that wetlands are embedded in the institutional and governance framework for water, land, and biodiversity management and b) interventions at wetland sites which address the direct drivers of adverse change.

## Strategies for integrating wetlands within sub-basin level plans and programmes

As land and water resources development plans and programmes at the sub-basin level have a bearing on the functioning of floodplain wetlands, the set of strategies at the sub-basin level will be aimed at ensuring consideration of the full range of wetland ecosystem services and biodiversity values in the sub-basin level plans and programmes. The following strategies are proposed:

- Including wetlands conservation within the mandate of the District Ganga Committee. The committees would maintain an overview of the ecosystem health of wetlands within their jurisdiction, review implications of sectoral plans and programmes, commission specific research to address the knowledge gaps and approve the implementation of interventions at specific sites.
- Inventory assessment and monitoring of sub-basin scale processes that influence wetlands. These include weather patterns, geology and geomorphology, water regimes (surface and groundwater), land use and land cover change, and other parameters.
- Ensures the convergence of wetlands conservation action within the district-level plans for the environment, disaster risk reduction, agriculture, fisheries, and other sectors.
- Commissioning strategic impact assessment of major infrastructural development projects in terms of their likely impacts on wetlands and identify necessary impact-mitigation and abatement measures and ensure the implementation through appropriate institutional arrangements including the District Ganga Committee.
- Enhances public awareness of wetlands ecosystem services and biodiversity values through coordinated district-level campaigns.
- Develops the capacity of wetland managers in determining water regime requirements for wetland ecosystem health and communicating and engaging with concerned government departments to ensure their implementation.

## Strategies for addressing drivers of adverse change within wetland sites

Based on the detailed inventory carried out, each of the floodplain wetlands and wetland complexes can be placed under one of the four categories: a) wetlands located within protected areas, b) floodplain agricultural wetlands, c) urban and peri-urban wetlands, and d) ponds within the jurisdiction of village panchayats (Map 22).

## Wetlands located within Protected Area Network

Management of such wetlands is essentially targeted toward the protection and conservation of endangered wildlife species and their unique habitats. Thus, management is often supplemented with the Protected Area Plan or the Forestry Working Plan. The provisions of the Wildlife Protection Act 1972, and the Forest Conservation Act 1980 provide the basis for the regular monitoring and management of such wetland. The focus should be on increasing the effectiveness of existing management arrangements for wildlife habitat conservation and restoration while reducing conflicts amongst stakeholders.



Map 22: Distribution of wetlands in the in the sub-basin of Upstream of Gomti confluence to Muzaffarnagar in accordance to their management category

The strategy involves:

- Consolidation and demarcation of boundaries.
- Management zoning with the introduction of core and buffer zones.
- High biodiversity areas under private ownership can be recognized as 'Community Reserves' to strengthen the protected area network.
- Stricter enforcement of legal provisions and surveillance arrangements.
- Encourage long-term research by engaging local academic institutes and NGOs.
- Promoting livelihood options for local communities through sustainable ecotourism.

## Wetlands within the jurisdiction of Village Panchayat

Ponds (interchangeably used with the phrase 'wetlands within the jurisdiction of village panchayats') provide decentralized storage and local water security benefits to village communities. Water conservation activities by promoting the management of ponds is also a priority mission of the Jal Shakti Ministry, to be achieved through the application of participatory and integrated approaches to water management. Watershed treatment and water conservation activities are listed as Panchayat subjects. Wetland conservation will benefit from the strengthening of Panchayat's capacities to appreciate the benefits of wetland conservation and undertake the required conservation actions.

The strategy involves:

- Systematic and regular capacity development for PRI members.
- Increased participation and contribution of communities to decisionmaking by providing representation to PRIs in the District Wetlands Committee.
- Development of SOPs for wetlands conservation and sustainable use to guide village development planning.
- Mapping and building consensus on desired wetland conservation actions through Gram Panchayat Development Planning.
- Implementation of actions through Gram Sabha and convergence funds.
- Capacity development and involvement of village communities in monitoring and assessments activities.

## Floodplain agriculture wetlands

Gangetic floodplains are extensively used for agricultural practices. Promotion of sustainable agricultural practices which economizes water use and enhances productivity should form the core strategy. This should also include regulating the cropping pattern within the core inundation area in line with fluctuating hydrological regimes, by reducing the cropping cycle, allowing for lands to be left fallow during monsoons for natural soil enrichment, and reducing area under water-intensive perennial crops. There is over-dependence on the use of groundwater for irrigation. This has a deleterious impact on the river ecosystem health and needs to be reduced.

The strategy involves:

- Awareness generation and incentivization to promote technology options such as the System of Rice Intensification (SRI) which are known to reduce water use by 40-50% and enhance productivity by 20-30%.
- Reducing the intensity of chemical fertilizer and pesticide use through promotion of organic cultivation and establishment of centers for the supply of quality agricultural inputs.
- Formation of SHG/farmers groups in villages to encourage adoption of alternate income generation programmes with technical support of Krishi Vigyan Kendras (KVKs) on Mushroom cultivation, Animal husbandry, and Poultry and dairy activities.
- Incentives in the form of farming equipment, training, and soft loans to be provided to farmer groups for the adoption of sustainable agricultural techniques.
- Sensitization of farmers on reducing groundwater use in agriculture and on the role of wetlands in providing local water security and irrigation benefits
- Monitoring and research activities pertaining to changes in land use and land cover within the wetland complex and basin, Overall water use pattern within the basin, Surface runoff, and trends in nutrient enrichment.

## Urban and Peri-urban wetlands

Wetlands in urban and peri-urban settings serve multiple functions like that a water treatment plant, flood buffer, carbon sink, groundwater recharge, sediment trap, fish farms, habitats for urban biodiversity, etc. They form an important part of our natural wealth and liquid assets. The conservation of wetlands will immensely support achieving the Government's goal of 'Nal Se Jal' in each household. Under the Wetlands (Conservation and Management) Rules, 2017; construction of any permanent nature, solid waste dumping, and discharge of untreated waste and effluents from industries, cities, towns, and villages into the wetlands have been listed as prohibited activities. Hence conservation of urban wetlands should be aligned with master plans forming an integral part of the city and urban planning.

## The strategy involves:

- Mapping of present and historical wetland regimes including landscape connectivity and preparation of a wetland restoration plan for all urban centres in consultation with water managers and all stakeholders.
- Revival of urban/peri-urban wetlands through various restoration measures (Such as boundary notification, removal of encroachment, restoration of inlets and outlets through selective dredging and desilting, cleaning, water treatment measures, catchment conservation measures) by embedding the restoration plan within AMRUT and Smart Cities mission.
- Creation of infrastructure for the interception, diversion, and treatment of point sources of pollution to manage the water issues (sanitation and availability of safe drinking water) of the city.

- Establishment of a systematic, monitoring and evaluation system involving various stakeholders to gauge the effectiveness of the implementation of wetland restoration actions and their benefits.
- Augment aesthetics of the wetlands for recreational benefits while preserving the ecological character of wetlands and their catchments.
- Plan for species conservation, habitat improvement, and maintenance of migratory routes should be developed as a core part of environmental protection.
- Capacity building, communications and outreach should be made an integral part of wetlands management.

# **Management Objectives and Performance indicators**

Table	15:	Managem	ent	objectives,	performance	indicators	and	desired	outcomes	in the	e study
wetlan	ds a	at the sub-l	basi	in and site le	evels						

Level	Objectives	Performance indicators	Desired outcomes
Sub-basin lev	el		
	Integration of multiple values of wetlands in sectoral development plans is enhanced	The number of sectoral plans and programmes wherein convergence with wetlands conservation has been achieved	Plans for water resources development, irrigation, land resources management, fisheries, and tourism do not lead to adverse impacts on wetlands
	A systematic wetland inventory assessment and monitoring system is used to inform management decisions and assess effectiveness.	Availability of long-term monitoring records on wetlands features Use of monitoring data and information to amend existing management framework	A hierarchical wetland monitoring and assessment system is functional Monitoring reports are produced periodically
	Compliance with existing rules and regulations is maintained	Number of natural wetlands notified under the Wetlands (Conservation and Management) Rules, 2017 Number of violations recorded of extant rules and regulations	All provisions of the Wetlands (Conservation and Management) Rules, 2017 and other extant rules and regulations are fully complied with
Site-level		-	-
Wetlands within PAs	Maintain hydrological connectivity with catchments	Duration of flood pulse and connectivity of river channels with wetlands	Inundation regimes (minimum and maximum) achieved in the past 30 years is maintained
	Maintain water quality to support ecosystem processes and services	DO levels	4mg/l or more
	Limit anthropogenically induced sedimentation	Sedimentation quantity and location	Natural profiles of inlets and outlets are maintained

Level	Objectives	Performance	Desired outcomes		
			No concertionation of the		
	Maintain the naturainess	The extent of the	No concretization of the		
	of shorelines	wetland shoreline	snoreline		
		devoid of any built-up	Maintenance of at least 50 m		
		area	buffer around the wetland		
	Maintain and improve	Habitat diversity	No species extirpation		
	habitat quality to support		Migration corridors for fish and		
	the diversity of wetland-		large mammais (Swamp Deer,		
	dependent species		Otters) are maintained		
			Signting of key species is		
			maintained in the range of 20%		
			the last five vege		
			Counto of migrotory waterbirde		
			counts of migratory waterbinds		
			are maintained in the range of		
			of the last five years		
	Maintain and anhance	Chaoigo diversity	Of the last live years		
		species uiversity,	species diversity, richness, and		
	high conservation	nonulations trands	stable or show an increasing		
	significanco		trond		
		The number of			
	wotlands biodiversity and	affirmative actions by			
		stakeholders for			
	amongst stakeholders	wetlands conservation			
		and wise use			
	Species invasion threats	Area of wetland under	Habitat is conserved		
	are reduced	invasive species	Species that are native,		
			ecologically sensitive, and of		
			conservation importance are		
			protected		
	Preserve the recreational	I ourist footfall and	Visitors are informed and aware		
	and touristic value of	ecologically sensitive	Number of tourists increases		
<u> </u>	Wetlands	benaviour of tourists			
Floodplain	Maintain nydrological	Duration of flood pulse	inundation regimes (minimum		
agricultural		and connectivity of river	and maximum) achieved in the		
wettands	wetiand catchment	channels with wetlands.	past 30 years are maintained		
	Promote good	Cropping practices that	No structural modification of		
	agricultural practices	do not modify water	wetland		
	aligned with wise use of	regimes or deteriorate	No introduction of chemicals,		
	wetlands	water quality or	fertilizers, and pesticides		
		introduce exotic	No introduction of exotic		
		species	species.		
			No intensive water abstraction		
	Maintain the naturalness	The extent of the	No concretization of the		
	of shorelines	wetland shoreline,	shoreline		
		devoid of any built-up	Maintenance of at least 50 m		
		area	buffer around the wetland		
	Maintain and improve	Habitat diversity	No species extirpation		
	habitat quality to support		Migration corridors for fish and		
	the diversity of wetland-		large mammals (Nilgai) are		
	dependent species		maintained		

Level	Objectives	Performance	Desired outcomes
		Indicators	Oighting of her on originalis
			Sighting of key species is maintained in the range of 20% deviation from the average of last five years Counts of migratory waterbirds is maintained in the range of 20% deviation from the average of last five years
	Enhance awareness of wetlands biodiversity and ecosystem services amongst stakeholders	The number of affirmative actions by stakeholders for wetlands conservation and wise use	Increase in affirmative actions
	Promote local stakeholder participation in wetlands management	Representation of local stakeholders in wetland management structures	Communities' views rights and capacities are reflected in wetland management decisions. Pro-active engagement of women, youth, and children in wetland management.
Urban and peri-urban wetlands	Maintain the naturalness of shorelines	The extent of the wetland shoreline, devoid of any built-up area	No concretization of the shoreline Maintenance of at least 50 m buffer around the wetland
	Maintain hydrological connectivity with the wetland catchment	Duration of flood pulse and connectivity of river channels with wetlands	Inundation regimes (minimum and maximum) achieved in the past 30 years is maintained
	Maintain water quality to support ecosystem processes and services	DO levels, heavy metal concentrations	4mg/l or more Heavy metal conc. in sewage brought to permissible levels
	Limit anthropogenically induced sedimentation	Sedimentation quantity and location	Natural profiles of inlets and outlets are maintained
	Maintain and improve habitat quality to support the diversity of wetland- dependent species	Habitat diversity	No species extirpation Migration corridors for fish and large mammals (Nilgai) are maintained Sighting of key species is maintained in the range of 20% deviation from the average of the last five years Counts of migratory waterbirds are maintained in the range of 20% deviation from the average of the last five years
	Preserve the scenic and aesthetic beauty of wetlands	Absence of built-up areas Landscape naturalness	Preserved naturalness of the landscape
	Preserve the recreational and touristic value of wetlands.	Tourist footfall and ecologically sensitive behaviour of tourists.	Registering higher revenues through tourism.
	Enhance awareness of wetlands biodiversity and	The number of affirmative actions by stakeholders for	Increase in affirmative actions

Level	Objectives	Performance	Desired outcomes
		indicators	
	ecosystem services	wetlands conservation	
	amongst stakeholders	and wise use	
	Promote local	Representation of local	Communities views rights and
	stakeholder participation	stakeholders in wetland	capacities are reflected in
	in wetlands management	management	wetland management decisions.
		structures	Pro-active engagement of
			women, youth, and children in
			wetland management.
Ponds	Maintain the naturalness	The extent of the	No concretization of the
	of shorelines.	wetland shoreline,	shoreline.
		devoid of any built-up	Maintenance of a 50 m buffer
		area.	around the pond.
	Maintain water quality to	DO levels	4mg/l or more
	support ecosystem		
	processes and services		
	Maintain non-declining	Fish harvest (size,	No individuals of below
	harvest of fish and	quantity, and diversity)	minimum harvestable size in
	wetland plants for	Plant harvest	fish catch
	economic use	(abundance and type)	No use of illegal mesh size and
			gear in wetland fisheries.
			No harvest beyond regenerative
			capacity
	Preserve cultural and	Celebration of traditions	Continuation and perpetuation
	spiritual values and	and practices aligned	of wise use aligned with
	traditional and	with the wise use of	traditional and customary
	customary practices	wetlands	practices
	aligned with the wise use		
	of wetlands		
	Enhance awareness of	The number of	Increase in affirmative actions
	wetlands biodiversity and	affirmative actions by	
	ecosystem services	stakeholders for	
	amongst stakeholders	wetlands conservation	
		and wise use	
	Promote local	Representation of local	Communities' views rights and
	stakeholder participation	stakeholders in wetland	capacities are reflected in
	in wetlands management	management	wetland management decisions
		structures	Pro-active engagement of
			women, youth, and children in
			wetland management

## Phasing

A functional score (FS) was derived for key functions of the wetland like groundwater recharge potential, flood buffering and water purification using the hydro-geomorphic approach wherein the wetlands were ranked as per the significance of functional attributes like geomorphology, water source, water permanence, hydrodynamics, soil type and vegetation. The score was then aggregated with the ecosystem service index (ESI) derived from the ecosystem services assessment using the RAWES tool for the surveyed wetlands. The aggregate score was the plotted in a quadrant chart against the threat score for the individual wetlands. Wetlands exhibiting High FS+ESI Score and High Threat Score were given High Priority for conservation and management. Wetlands having High FS+ESI Score and Low Threat Score and, Low FS+ESI Score and High Threat Score were given Moderate Priority for conservation and management Figure 24 and Map 23). The plotted graph (Figure 25 and Table 16 for all surveyed wetlands summarises the wetlands prioritised and categorized into three phases based on their significance for management interventions in the sub basin. Thus, Phase 1 corresponds to high priority, 2 to moderate priority and 3 to low priority wetlands respectively.



Figure 24: Phasing justification diagram based on cumulative aggregate of ecosystem services index, functional scores and threat scores



Figure 25: Categorising wetlands in the basis of their threat scores, ecosystem services index and phasing



Map 23: Surveyed wetlands under different categories of Priority in the 10 Km buffer zone on either side of the river Ganga in the sub-basin Upstream of Gomti confluence to Muzaffarnagar in Uttar Pradesh

Wetland Type	Phase 1	Phase 2	Phase 3
Village Ponds	Numaiya Dahi Jheel Khedwa Tal, and Kushrajpur Pond	Milkipur Tal, Bharda Tal, Saray Jay Chandra (Malak Tilhai), Liloi Jhil, Majharapiper kheda, Manpur Lake, Rawat Pond, Sarai Dangari, Okhara Kuwarpur, Itarora Pilkhini, Aliganj Nan Kheriya, Sanpkhera, Madar, Rehnas Talab, Bharwari, Saray Jay Chandra (Malak Tilhai), and Daulatpur Kashar	Dharampur, Talab (Rural), Unchagaon Pond, Kanti Pond, Nadsiya Gram Samaj, Jasauli, Tikuri Dashrathpur, Saray Jaychandra, Narsinghpur, Bhuiya Khoh Dam, Gauspur, Parsara, Bhalewa-I, Hindupur, Thari, and Karsawan,
Urban and peri- urban wetlands		Bela Kachar Talab, Nivari Tal, Chancha Tal, Chunagir Tal, Sanganv, Chakki, Mausampur Morara, Mama Talab, Shivrajpur, and Shivrajpur-2	Kanpurnagar, Dhobiyan Basti Talab Handia, Pandeypur, Sirathu NP, Sanigvan, Fatehpur MB, Fatehpur MB 2, Fatehpur MB 3, Fatehpur MB 4, and Fatehpur MB 5
Floodplain agricultural wetlands	Samdha Tal, Bada Talab, Upardaha, Mela Ramkaur Lake, and Katri Jaisarmau	Belwan, Jogiya Dari Nala, Karnawati Nala, Bhiti Taluka Talab, Gangsari Tal, Bara Sawayaya Hasan, Patti Tal, Jasauli Tal, Dudhwan Tal, Kondra Jhil, Matrauli Tal, Usraila Jhil, kamoli Tal, Bakwa Tal, Bakulahi River, Baraila Jhil, Dhanuhikheda Lake, Bhalewa-2, Terwakulli, Arwal Paschim, Murwa Shahabuddinpur, Gangdharapur, Madharpur Kannauj, Saibasi Pond, and Katri bajidpur	Gonda Shubans Tal, Kurauna Tal, Pura Rasai Tal, Maraunda (Jamalnagar Lake), Ismailpur Digan, Ramdas Patti, Devar Patti, Audhara, Basohani, Paliya Bujurg 1, Paliya Bujurg 2, Baburia Tal, Raipur Thappa Haweli Tal, and Bara Tal
Wetlands within PAs		Bhokawa Bandha, and Lower Khajuri Dam	Manikpur Reserve Forest, and Tanda Dari Tal

Table 16: Category of wetlands in the Sub-basin based on their phase and management category

# **Risks and risk-mitigation measures**

The management plan design is based on certain assumptions. Table 17 below identifies the risk associated with these assumptions in the management plan and possible risk-management measures.

Table 17: Proposed risk management measures at the goal and objective levels

Risk	Risk-management measures
At Goal Level	
District Ganga Committees have insufficient capacity to integrate wetlands in sectoral plans.	Formulate integrated management plans for conservation and sustainable use of prioritized wetlands. Build management and professional skills of sectoral authority members and staff to mainstream wetlands conservation in sectoral programmes and policies <i>inter alia</i> water resources development, rural development, agriculture, and urban development to ensure complementarity of the sectoral programmes with wetlands ecosystem services.
Wetland conservation actions are restricted to a few large wetlands and not taken at a landscape scale.	Regulate and control all activities detrimental to the maintenance of biodiversity and other ecological components, processes, and services of the wetlands Ensure compliance with the existing national and state-level regulatory frameworks related to wetlands conservation SWA to approach the state government for enactment of any regulation for achieving conservation and sustainable management of wetlands in the state.
Sectoral pursuits (such as agricultural intensification and large-scale afforestation programmes and urbanization) lead to wetland conversion.	Coordinate and facilitate implementation of the following activities (within the ambit of the site management plans) by different departments, organizations, institutions, and local agencies or communities: a) restoration of hydrological regimes, including improvement of water quality, b) control of silt load from catchments, c) management of plant and animal invasives, d) ecological restoration and habitat improvement, e) sustainable development of capture and culture fisheries, f) livelihood improvement and disaster risk reduction with communities living in and around wetlands, g) community-managed eco-tourism development. Ensure resolution of trans-catchment and multi-stakeholder conflicts.

Risk	Risk-management measures		
Ownership of wetlands is not clear with multiple departments and agencies staking their claim.	SWA to advise the state government, government and non-government agencies, and local authorities on matters pertaining to the conservation and management of wetlands. SWA to act as a nodal agency for clearing all technical matters related to wetlands conservation and management. Formulate policy guidelines for conservation and sustainable management of the wetlands of the state.		
Wetland monitoring systems are not established and there is no effort for monitoring the effectiveness of management.	Based on scientific guidelines, a wetlands inventory, assessment, and monitoring system are to be developed and maintained to assess and respond to changes in the wetlands components, processes, and services. Environmental Impact Assessments (EIA) for developmental projects likely to create detrimental impacts on wetlands ecosystem services and biodiversity values are to be commissioned. Collate and disseminate periodic reports on the status of wetlands in the state.		
At Objective Level			
Wetland management actions are not included within the approved PA management plans.	Management plans of protected areas must focus on the conservation of the forest ecosystem as one functional unit building management interlinkages between terrestrial and freshwater entities. Develop landscape-level approaches to ensure wetlands functioning and delivery of ecosystem services.		
Sufficient human capacity is not allocated for implementing wetland management.	Conduct capacity needs assessments and identify priority training areas. Devise capacity development programmes for wetlands management.		
Urban development projects lead to the concretization of wetland margins and an unsustainable concentration of infrastructural investment.	Recognize wetlands areas as ecologically sensitive within infrastructure development projects or plans.		
Tourism is promoted without any connection to ecological sensitivity.	Develop awareness and outreach material for tourists.		

Risk	Risk-management measures
	Conduct a capacity assessment to determine the level of tourism that can be supported at the site. Prepare do's and don'ts for activities permitted and prohibited in ecologically sensitive areas. Restrict tourist movement in ecologically sensitive areas.
Pollution abatement measures are energy-intensive and do not integrate the opportunity to use wetland-mediated solutions.	Promote nature-based solutions, such as wetlands management to ensure hydrological connectivity of the entire system. Restrict waste disposal activities that can alter wetlands water quality.
Livelihood concerns related to the adoption of good agricultural practices are not addressed.	Leverage compensatory schemes or provide alternative livelihoods such as through engagement in wetland-based tourism activities. Promote participatory management.
Conservation of ponds is not linked with Gram-Panchayat Development Plans.	The orientation of Gram-Panchayat towards the importance of wetlands and their management. Integrating wetlands functioning in Gram- Panchayat Development Plans. Promote participatory management.
Investment in behaviour change communication is insufficient and does not lead to awareness generation on wetland values and functions.	Consideration of stakeholder issues and feedback in management implementation.
Financing of wetland values and conservation is episodic and in project mode and not linked with systematic budget allocations.	Identify sectoral priorities and align them with the management of wetlands. For different wetlands management activities, an analysis of complementarity with ongoing development or conservation sector schemes may be done to assess the extent of funding that can be generated through convergence with these schemes. Opportunities for private sector participation should be identified and encouraged.

# 6. Monitoring Plan

Wetland management is an exercise in decision-making— choosing actions that are expected to best achieve the management objectives. Monitoring plays a central role in wetlands management because these ecosystems are dynamic and variable, and often do not align with the desired results of intended decisions and actions. There are several sources of uncertainty that affect natural resource decisions. Primarily, environmental variation in space and time often drives natural systems in ways that may or may not be consistent with management prescriptions. Secondly, many system variables are not measured directly (i.e., partial system observability), and thirdly, outcomes of management actions often deviate in degree and spatial extent from management prescriptions. Thus, by integrating monitoring into decision-making, adaptive management explicitly addresses these sources of uncertainty and allows decision-makers to simultaneously achieve management objectives and generate new knowledge about how the system responds to management.

Management of floodplain wetlands in the sub-basin spanning from upstream of Gomti confluence to Muzaffarnagar is primarily focused on meeting the objectives of achieving 'wise use'. Having a system to monitor, detect and describe changes in ecological character is therefore critical to support decision-making for wise use of wetlands. Equally important is ability to assess the effectiveness of management in terms of the capacity to develop and implement integrated planning, management, and evaluation systems to secure wise use of the wetlands.

This chapter describes a monitoring framework for the "Upstream of Gomti to Muzaffarnagar" sub-basin at the scale of both sub-basin and individual wetland sites to support integrated management for wetlands wise use. It essentially delineates monitoring objectives, strategy and associated resource requirements.

### **Monitoring Objectives**

Developing a monitoring plan for the Upstream of Gomti to Muzaffarnagar subbasin requires addressing the inter-related requirements of wetland inventory (which is the collection and/ or collation of basic information for wetland management) and wetland assessment (identification of status of, and threats to wetlands which provides a basis for wetlands monitoring. It is imperative therefore to put in place an integrated Wetland Inventory, Assessment and Monitoring System (WIAMS) to address the overall information needs for wetland management, and to provide a robust decision support system for the same. Following are the specific objectives for establishing WIAMS for the Sub-basin:

- Developing up-to-date and scientifically valid information on the status and trends of wetland features and influencing factors.
- Establishing a baseline for measuring the change in ecosystem components, processes, and services.

- Informing decision-makers and stakeholders on the status and trends in biodiversity, ecological functioning, and ecosystem services of the wetland.
- Supporting compliance with national and state specific legal requirements and regulatory regimes.
- Determining the impacts of developmental projects on ecosystem components, processes, and services.
- Identifying risks to the ecological character and supporting the development of response strategies.
- Assessing the effectiveness of wetland management.

# Monitoring Strategy

Monitoring is proposed to be undertaken at following two levels:

- Sub-basin level to explain status and trends in key hydrological and ecological processes that influence wetland functioning (Table 18).
- At specific sites that explain status and trends in wetland ecological character in response to natural and anthropogenic stresses (Table 19).

The monitoring parameters have been selected on the basis of their ability to reflect the degree to which management objectives are met.

Given the large number of wetlands in the floodplain zone, it is recommended that a few representative sites are taken up for monitoring purposes. These are as follows:

Wetlands within Protected Areas (PA):	Bhokawa Bandha, Lower Khajuri Dam, Tanda dari Tal (Mirzapur)
Ponds:	Sanpkhera (Hardoi); Bhalewa-1 (Fatehpur); Nadsiya Gram samaj (Kannauj); Rehnas Talab (Kanpur nagar); Milkipur (Rae Bareli)
Floodplain Agricultural wetlands:	Audhara, Basohani, Paliya Bujurg 1, Paliya Bujurg 2 (Fatehpur); Ismailpur Digan (Kannauj); Benti PA, Ramdas patti, Devar patti (Pratapgarh); Numaiya dahi jheel Kheduva (Prayagraj); Baburia Tal, Raipur Thappa Haweli Taal, Bara Tal (Rae Bareli); Maraunda, Dhahunikheda lake (Unnao); Samdha Tal (Sant Ravidas Nagar)
Urban and peri-urban wetlands:	Fatehpur MB 4, Chakki (Fatehpur); Madharpur, Mausampur Morara (Kannauj); Mama Talab, Sanignav (Kanpur nagar); Nivari Tal (Prayagraj)

The information needed for inventory are derived from the core datasets required to establish a baseline on ecological character for the sub-basin and contains all essential ecosystem components, processes, and services, as well as management related parameters that characterize the site. Within the aquatic environment, information needs pertain to water inflow, quality, and ecosystem services such as provisioning, regulating, culture and supporting.

At the level of wetland, information needs pertain to land-use and land cover change, and threats such as over discharge of household effluents. At the basin scale, the information required is related to geo-morphological and climatological setup, as well as basin-wide management arrangements, particularly those related to land, water resources and urban planning. At all levels, information on institutional arrangements and management practices is included so as to enable the creation of a database on sectoral programmes, and the linked stakeholders, which are likely / have an impact on the wetland state. While not explicitly mentioned, strategic environmental assessments can be commissioned for any developmental project that has/is likely to have a negative impact on the wetlands.

Information needs for monitoring the Gomti confluence to Muzaffarnagar subbasin have been derived from the assessment of ecological character carried out for the development of the management plan. Four clusters of needs have been identified: a) land use and land cover change, to assess the dynamics of land use within the catchment; b) hydrological regimes, to assess the flux of water, sediments, and nutrients; c) ecological components and processes, to assess the biodiversity, habitat quality and resource productivity; and d) socioeconomics and livelihoods to assess the trends in ecosystem services – livelihoods interlinkages. This monitoring information adequately addresses the needs of the sub-basin under the Wetlands (Conservation and Management) Act, 2017, and the NPCA Guidelines, 2019.

The monitoring and assessment needs are envisaged to be addressed by a dedicated monitoring programme and specific research and assessment projects. Inventory, being based on collated information on identified wetland features and management practices, will be developed based on the monitoring and assessment information, as well as secondary sources. Inventory, assessment, and monitoring form an integral part of wetland management, and thereby the core activity of UPSWA. The management plan proposes to establish a dedicated wetland monitoring unit with adequate infrastructure support to effectively deliver this function.

Linkages also need to be developed so that data from the existing monitoring networks of different agencies (for example, inundation and flooding information from Central Water Commission and Department of Water Resources; groundwater quality and quantity from Central Ground Water Board; select surface water quality parameters from Uttar Pradesh Pollution Control Board; and fish production from Fisheries Department) can be accessed and shared. Similarly, provision for participation of NGOs and civil society in a monitoring programme has also been built, especially for socioeconomics and livelihoods aspects and biodiversity monitoring (for example, the waterbird census being implemented by NGOs under the aegis of the Asian Waterbird Census). Thematic management needs-based research can be taken up by specialized agencies such as ZSI, BSI, and CIFRI, to complement the monitoring programme.

	Monitoring	Monitoring Indicator	Monitoring Method	Frequency
	parameter			D. i
Sub-	Ecological	Conservation Sector Plans	Number of wetlands	Review
basin	Changes		conservation &	Once in 10
			management	years
			activities proposed	
			Collaboration between	Review
			various stakeholders	Once every
				year
			Funds available	Review
			through various	Once every
			Central and State	year
			Government schemes	
	Landscape	Development Sectoral	Number of wetlands	Review
	Changes	Plans	conservation &	Once in 5
			management	years
			activities proposed	
			Collaboration between	Review
			various stakeholders	Once every
				year
			Funds available	Review
			through various	Once every
			Central and State	year
			Government schemes	-
	Institutional	Effective implementation of	Availability of WIAMS	Review
	Gaps	WIAMS (Wetlands	-	Once every
		Inventory, Assessment and		year
		Monitoring Systems)		-

Table 18: Monitoring Parameters and corresponding indicators at the sub-basin level.

Table 19: Monitoring Parameters and corresponding indicators at the wetland site level

	Monitoring parameter	Monitoring Indicator	Monitoring Method	Frequency	Location
sical regime	Ecological boundary & area	Wetland extent defined by inundation & hydrophytic vegetation	Remote Sensing & GIS	Once in 2 years	All Wetlands
	Boundary defined by Law & regulation	PA boundary as per the respective notification / Wetland boundary as per the notification	Literature review	Once in 5 years	Selected Wetlands
Phy	LULC within the wetland	% Cover of various LULC classes within the wetland boundary	Remote Sensing & GIS	Once in 10 years	Selected Wetlands
	Monitoring	Monitoring Indicator	Monitoring	Frequency	Location
----------------	-----------------------	--	---	-----------------------	----------------------
	parameter		Method		
		Inundation (Minimum, Maximum, Interannual variability)	Remote Sensing & GIS	Once in 2 years	All Wetlands
		Inflows (Number, Seasonality/Extent of choking)	Physical survey	Once every year	Selected Wetlands
		Outflows (Number, Seasonality/Extent of choking)	Physical survey	Once every year	Selected Wetlands
	Water regimes	Water use (Volume and Purpose)	Physical survey (Bathymetric profile)	Once in 2 years	Selected Wetlands
		Water balance	Monitoring	Once	Selected
		(Monthly)	gauging station	every year	Wetlands
		Water chemistry (DO, BOD, COD, pH,	Physical survey (Standard	Biannual (Winter &	Selected Wetlands
		Nutrients, Heavy metals)	protocols of CPCB to be followed)	Summer)	
		Sediment flux (Inflow,	Physical survey	Once in 2	Selected
		Outflow & Balance)	(Monitoring	years	Wetlands
logical regime		Soil texture	Physical survey (Standard protocols of CPCB to be	Once in 2 years	Selected Wetlands
dro		Soil pl I		Open in 2	Colootod
H	Sedimentary regime	Soli ph	(Standard protocols of CPCB to be followed)	years	Wetlands
		Soil organic carbon	Physical survey (Standard protocols of CPCB to be followed)	Once in 2 years	Selected Wetlands
		Bathymetry	Physical survey (Bathymetric profile)	Once in 2 years	Selected Wetlands
		Extent of flood pulse	Remote Sensing	Once	Selected
		(spatial and temporal)	& GIS	every year	Wetlands
		Active channels	Remote Sensing	Once	Selected
	Connectivity	between river and wetlands and within wetlands	& GIS	every year	Wetlands
		Migratory pattern of key groups (Fish,	Physical survey	Once every year	Selected Wetlands
		Reptile, Mammals, Birds)			

	Monitoring	Monitoring Indicator	Monitoring	Frequency	Location
	parameter		Method		
	Catchment	Catchment area	Remote Sensing	Once in 5	All
	boundary and		& GIS	years	Wetlands
	area				
nts	LULC	% Cover of various	Remote Sensing	Once in 10	All
me		LULC classes within	& GIS	years	Wetlands
[chi		the catchment			
Cat	Degree of	Location and Length	Remote Sensing	Once in 10	All
	fragmentation	of linear structures on	& GIS and	years	Wetlands
		wetlands inflow &	Physical survey		
		outflow			
	Different forms of	Richness &	Physical survey	Once in 2	Selected
	flora & fauna	Abundance List of		Years	Wetlands
		Flora & Fauna			
		Species distribution	Literature review	Once in 2	Selected
			and Physical	Years	Wetlands
			survey		
		Conservation status	Literature review	Once in 10	Selected
				years	Wetlands
		Relative abundance	Physical survey	Once in 2	Selected
				Years	Wetlands
		Keystone	Literature review	Unce in 2	Selected
			and physical	Years	wetiands
		L'annomia importance	Survey	Once in F	Colootod
		efflere		Unce in 5	Selected
			anu Friysicai	Tears	Wellanus
	Habitat	Type	Physical survey	Once in 2	Selected
	Tabitat	1,000	and	Years	Wetlands
			Remote Sensing	1.001.0	
tat			& GIS		
labi		Area	Physical survey	Once in 2	Selected
S S S			and	Years	Wetlands
es			Remote Sensing		
) ec			& GIS		
s.		Associated flora &	Physical survey	Once in 2	Selected
		fauna		Years	Wetlands
		Biological importance	Literature review	Once in 2	Selected
			and	Years	Wetlands
			Physical survey		
	vegetation cover	Туре	Physical survey	Unce in 2	Selected
			anu Domoto Sonoing	rears	wettands
			& CIS		
		Aroa	Romoto Sonsing	Onco in 2	Soloctod
		Alea		Vears	Wetlands
		Density	Physical survey	Once in 2	Selected
		Denoty	and	Years	Wetlands
			Remote Sensing		
			& GIS		
		Composition	Physical survev	Once in 2	Selected
			and	Years	Wetlands
			Remote Sensing		
			& GIS		

	Monitoring	Monitoring Indicator	Monitoring	Frequency	Location
	parameter		Method	. ,	
		IVI (Importance value	Physical survey	Once in 2	Selected
		index)	and	Years	Wetlands
		,	Remote Sensing		
			& GIS		
	Migratory species	Population Counts	Physical survey	Once each	Selected
				year	Wetlands
		Concentration areas	Physical survey	Once each	Selected
			and	year	Wetlands
			Literature review		
		Migration period	Physical survey	Seasonal	Selected
				(Winter	Wetlands
				Migrant;	
				Summer	
				Migrant)	
		Conservation status	Literature review	Once in 10	Selected
				Years	Wetlands
	Invasive species	Species list	Physical survey	Once in 2	Selected
		(Presence/Absence)	and	Years	Wetlands
			Literature review		
		Proliferation rate of	Physical survey	Once in 2	Selected
		invasive macrophytes		Years	Wetlands
		Proliferation rate of	Physical survey	Once in 2	Selected
		invasive fish species		Years	Wetlands
		Area occupied	Physical survey	Once in 2	Selected
				Years	Wetlands
	Species mortality	Incidental, Mass	Physical survey	Once in 2	Selected
				Years	Wetlands
	lype of	Provisioning	Field survey	Once in 5	Selected
	ecosystem service	(Presence/Absence)		Years	Wetlands
			Field survey	Unce in 5	Selected
		(Presence/Absence)	Field our you	Years	Vetiands
			Field Survey	Unce in 5	Selected
		(Presence/Absence)	Field oursess and	Pears Once in 5	Selected
spo				Voors	Wotlande
ğ		(FIESEIICE/Abseiice)		Tears	Wellanus
veli	Availability of the	Seasonal variation in	Field survey	Once in	Selected
Ē	ecosystem	ecosystem services		every	Wetlands
ŝ	services			season	11 clianao
vice	Beneficiaries of	List of stakeholders	Field survey	Once in 2	Selected
Ser	the ecosystem	dependent on wetland		Years	Wetlands
Ę	services	services		100.0	11 ottainao
rste	Demography	Population	Field survey	Once in 2	Selected
osy	around the			Years	Wetlands
В	wetland	Occupation profile	Field survev	Once in 2	Selected
				Years	Wetlands
		Duration of	Field survey	Once in 2	Selected
		dependency on the		Years	Wetlands
		wetland,			
		Income profile	Field survey	Once in 2	Selected
				Years	Wetlands

	Monitoring parameter	Monitoring Indicator	Monitoring Method	Frequency	Location
s & Governance	Stakeholder mapping	List of formal & informal institutions and networks related to wetlands management, their mandates, roles & responsibilities and decision-making process	Field survey; Workshops and Literature review	Once in 5 Years	Selected Wetlands
nstitution	Laws & Regulation	Policy, Legal and Regulatory Framework	Literature review	Once in 5 Years	Selected Wetlands
_	Resource availability (Finance & Human)	State, Central or CSR funds available	Literature review	Once every year	Selected Wetlands

# **Assessing Management Effectiveness**

Wetlands in the Above Ramganga Confluence sub-basin are dynamic ecosystems and so are their management needs. Management plans, which are developed based on assumptions known to managers, need to be periodically assessed to make sure that the set goals and objectives are being achieved.

The effectiveness of management towards achieving the overarching objective of maintenance of ecological character can be greatly enhanced if the following questions are periodically reflected upon:

- What is the current status of the wetlands in the landscape?
- Is the management achieving the goal of maintenance of ecological character?
- What are the current and future threats?
- Are adequate resources available for implementing management, and if not, how can they be accessed?
- Are management processes adequate, effective, and efficient?
- What other steps can be taken to improve management?

The Contracting Parties to the Ramsar Convention adopted R-METT (Ramsar Site Management Effectiveness Tracking Tool) to assist Ramsar site managers in assessing the effectiveness of management in achieving wetland wise use outcomes. The assessment looks into the following aspects:

- **Context** of management (wetland ecological character, threats, and risks of adverse change).
- **Management planning** defines how the management goals and objectives have been defined.
- **Inputs** including human, technical and financial resources applied to implement management actions.
- **Process** of management plan implementation.

- **Outputs** (tangible and intangible) that result from the implementation of management actions.
- **Outcomes** concerning the objectives defined by the management plan

It is proposed that management effectiveness assessments for Upstream of Gomti confluence to Muzaffarnagar wetlands be done at least once in five years so that management action plans are revised and updated to reflect the real time condition of wetlands as well as the ability of management to prevent adverse changes in ecological character. A baseline assessment is proposed to be done at the inception of the management plan.

# Infrastructure and Human Resources Requirements

Implementing the monitoring strategy as outlined in the previous sections requires the following physical and human infrastructure support:

- Remote Sensing and GIS unit with advanced capabilities of remote sensing image processing, preparation of maps and development and maintenance of spatial datasets.
- Ecological monitoring laboratory with capabilities for analysis of chemical, physical and biological properties of water and soil.
- Mobile-based citizen reporting system for recording and reporting illegal encroachments.
- Database management system for storing and retrieving monitoring and assessment data. The monitoring data would be stored along with metadata, as per the quality control procedures suggested in the following sections.
- Network of hydro-meteorological and water quality stations for real time monitoring of weather, hydrological and biological variables.

Deployment of the aforementioned resources can be done cost-effectively by applying the lessons and expertise of the existing infrastructure created by the state government for the management of floodplain wetlands. Need-based training programmes can also be conducted to upgrade the skills of the concerned state government departments and agencies.

# Reporting

Reporting constitutes an important element of the wetland monitoring programme. The intended user group, format, style and peer review requirements need to be set in the initial phases of set up of the monitoring programme. Periodic reports, for example as a part of the annual report of the UPSWA should aim to provide a summary overview of the outcomes of monitoring.

Special publications, for example, wetland atlases constituting thematic maps on various parameters are intended to inform stakeholders on wetland status and

trends. Outcomes of specific assessments, for example, ecological character status and trends, economic valuation, environmental flows etc. could be made available in the form of technical report series, with an extended summary for a general readership. As the monitoring programs get sophisticated over a period of time, real-time monitoring options through the use of satellite-based data communication techniques can be explored.

# **Quality control**

Monitoring systems are required to ensure the scientific validity of sampling, laboratory analysis, data analysis and reporting. They also play a critical role in preventing the introduction of random and systematic errors in data collection, analysis and reporting. It is recommended that a Quality Management and Assurance Plan is developed for the monitoring programme. The plan should, *inter alia* specify the following:

- **Data quality objectives:** Maximum amount of uncertainty that can be tolerated to ensure that the data is fit for the intended use.
- **Sampling programme design:** Statistical robustness of sampling frame; Means to ensure that samples are representative of the environment; Sample recording; Procedures for minimizing environmental impact.
- **Documentation:** Procedures for field sample record-keeping and methods documentation.
- Sample processing validity (especially for water quality and biological components).
- **Data quality control methods:** Processes for quality control samples, duplicates and replicates; Performance audit procedures including data and systems audit.

# **Review and Adaptation**

A periodic review of the monitoring programme is required to determine the extent to which the objectives of wise use are met, support to management is achieved, and the monitoring system remains relevant for maintaining the wetland state (particularly in the light of new and emerging threats). The review process should also aim at increasing the sophistication of the monitoring system to be able to assess complex landscape scale processes affecting the ecological character of wetland and related management. The review process should include documentation on the way wetland inventory, assessment and monitoring information is being used to support management planning and policy goals. The review should also include identification of appropriate mechanisms to ensure that wetland monitoring is continued in the event of a funding shortfall.

# 7 Action Plan

Actions to meet the management goal, purpose, and objectives (as outlined in chapter 5) are proposed at two levels, namely the sub-basin level to be coordinated by the UPSWA and site level to be coordinated by wetland managers working under the ambit of District Ganga Committees.

# Sub basin level action plan

#### Institutional Set-up

#### Notification of wetlands under Wetland Rules

It is proposed to notify the Ganga Floodplain wetlands under the Wetlands (Conservation and Management) Rules, 2017 to enable application of regulatory provisions. The Rules specifically prohibit conversion of wetlands for non-wetlands usages, direct discharge of untreated sewage from any source, dumping of solid waste, poaching, and any construction of permanent nature within 50 meters of the mean high flood level recorded in the last decade. The rules also require specification of a zone of influence and developmental activities which are likely to adversely influence ecological character of the site. Finally, the State Wetland Authority, notified as per provisions of the Rules has also been entrusted with the task of putting in place an integrated management plan, clearly specifying activities which are to be regulated and permitted within the site, with corresponding thresholds and mechanisms for enforcement of the rules.

Following activities are to be taken:

- Seeking formal consent of the General Body of the UPSWA, to notify Ganga floodplain wetlands under the wetland rules
- Preparation of brief document for notification of the wetlands, containing:
  - o Map of wetland boundary
  - Map of zone of influence
  - Ecological character description (information available in Chapter 3)
  - o Account of pre-existing rights and privileges
  - List of activities to be permitted within the Ganga Floodplain wetlands and their zone of influence
  - List of activities to be regulated within the Ganga Floodplain wetlands and their zone of influence
  - Modalities for enforcement of regulation (agency responsible for regulation, the mechanism through with regulation shall be done and penal provisions)
- Presentation of the brief documents and draft notification formulated as per the provisions of the Wetlands (Conservation and Management) Rules, 2017 for the approval of the UPSWA
- Publication of draft notification on website of UPSWA and the Government of Uttar Pradesh for the notice of general public
- Revision of the draft notification, incorporating comments and objections received
- Seeking final approval of the draft notification from the State Wetlands Authority

- Publication of final notification in the State Gazette (to be completed within 240 days from the day on which the approval of State Wetlands Authority to notify the site is obtained)
- Publication of communication material in English and in Hindi for dissemination of information to stakeholders, particularly local communities

## Notification/Reorganization of District Wetland Committees

It is proposed to constitute/reform existing district level wetland committees for recommending what activities need to be regulated or permitted within the wetlands in each district, establishing thresholds, and regulation and imposition of penal provisions. The committees must have representation from departments of fisheries, irrigation and flood control, urban development, revenue, agriculture, tourism, environment and wildlife. The committee may have representation from lakeshore fisher and farming communities to ensure that the regulations are arrived at by consensus and have support at various levels and of stakeholders.

In Uttar Pradesh, the District Wetlands Committee (DWC) were constituted in 2009 with an objective of inventorization of all wetlands in the state and their integration in land use records and bringing under the ambit of the State Wetlands Authority (SWA). The District Wetland Committees need to be reorganized and/or notified with a result oriented institutional structure. Specific activities to be undertaken in this regard include

- Finalization of Memorandum of Association and governance structure by the UPSWA, with government line departments, Panchayati Raj and Municipalities and other stakeholders
- Notification of the DWCs
- Staffing and work allocation as per the structure suggested.
- Conducting business as per the set Terms of Reference

# Infrastructure development-human resources

A reorganized DWC is proposed to include following units:

- Planning and Design unit: Responsible for strategic planning for conservation and wise use, including assessing adherence to the various policy mandates and regulatory provisions.
- Wetland monitoring unit: Responsible for systematic wetland inventory, assessment with the state wetland monitoring and research center acting as the functional node. The unit shall also be responsible for assessing progress in implementation of various components by line departments and agencies.
- Engineering unit: Responsible for carrying out minor engineering and construction works.
- Watershed management unit: Responsible for monitoring catchment conservation works within the direct basin of wetland complex.
- Community engagement unit: Responsible for liaison with community and civil society organizations, and ensuring integration of community concerns within management actions.
- Communication and outreach unit: Responsible for external communications,

based on a communications plan.

#### Integrated wetland inventory, assessment, and monitoring system

An integrated wetland inventory, assessment and monitoring system is proposed to be set up to address the overall information needs of wetland management and to provide robust decision support system for the same. Specific objectives and a detailed framework have been outlined in Chapter 6 of the management plan. The following activities are proposed:

#### Establishment of wetland monitoring and research centre

A state-of-the-art wetland monitoring and centre is proposed to be operationalized for monitoring the ecological, hydrological and socio-economic features of the Ganga floodplain wetlands.

#### Development of database management system

A database system for storing, retrieving, and analyzing the WIAMS is proposed to be set up in a GIS environment. This will include:

- Development of data quality management and assurance plan including specification of data collection objectives, data quality objectives, sampling program design, data and metadata documentation procedure, data quality control methods and performance audit procedures.
- Development of GIS based database management system.

## Wetland monitoring and evaluation

Wetland monitoring and inventory protocols for land use and land cover, hydrological regimes, ecosystem processes and biodiversity and socio-economics and livelihoods as proposed in Chapter 6 will be implemented.

## Ecosystem Health Report Card

It is proposed to develop an Ecosystem Health Report Card, and publish biannually to assess and communicate wetland monitoring information to decision-makers and stakeholders. The health report card summarizes indicators along major indices (water quality, catchment status, biodiversity status) which represent various ecosystem features of the wetlands, and are reported against respective thresholds set in line with management goals. Such a report card will be biennially published in English and Hindi.

## **Research Studies**

Following specific research studies are proposed to be commissioned to address the knowledge gaps in assessing status and trends in ecological character:

 Climate Risk Assessment - Climate risk and vulnerability to assess perception of climate risks based on sensitivity and adaptive capacity of critical ecological character elements; climate scenarios with respect to ecological character; and risk management options.

- Wetlands biodiversity assessments Study of floral and faunal abundance and community richness, population trends, conservation status, habitat suitability of wetland dependent species and waterbirds, mapping of migratory corridors of swamp deer, otters and hog deer and breeding and spawning ground of fish.
- Socio-cultural inventory of wetlands Identification and mapping of sociocultural and religious values and customs associated with wetlands, historical linkages, and heritage values of the floodplain wetlands.
- Multiple wetland values assessment Demographic and socio-economic profiling of wetland dependent communities, resource use and wetland dependency, assessment, and valuation of provisioning, supporting, regulating and cultural services.

## Capacity development

Systematic capacity development of wetland managers, concerned line departments of state government, civil society and other stakeholders is proposed.

Following activities are to be carried out:

- Training needs assessment of the UPSWA, concerned state government agencies, departments, and civil society. The assessment should be taken at two levels (at macro level aligned with strategic goals of wetland conservation at the state level and the needs of integrated management, and at meso level assess whether training is the solution, analyze performance and characteristics of the trainees). The assessment should identify: a) areas of training, b) who needs the specific training, c) mode of training and d) interventions required for maintaining built capacity.
- Development of a training plan for a five years period, and specify baseline for evaluation.
- Implement capacity development activities as specified in the training plan (training workshops, exposure visits, on-job training etc.).
- Use of the wetland webpage as a platform for wetland managers for the exchange of experiences and best practices.
- Conduct effectiveness assessment and revise program, as per need.

## Communication and outreach

Stakeholder engagement in wetland management will be promoted through creating awareness on biodiversity and ecosystem services values, management strategies adopted and opportunities for participation. The ultimate objective is to incentivize affirmative behavioral change for conservation and wise use of wetlands at various levels of planning, programming and decision making. The sub basin level activities will complement the site level communication and outreach interventions and will be largely targeted at levels higher than district. Specific activities to be undertaken include:

#### State wide wetland campaign

A wetland campaign is envisaged to be implemented at state level to promote higher awareness on the significance of wetlands and to promote citizen engagement in conservation and wise use of wetlands. Following activities are proposed

- Hiring of an expert agency to design the wetland campaign including key messages, target audience and communication objective, dissemination action (print media, electronic media, direct media, and key performance indicators.
- Implementing the campaign by reaching out to the target audience with specific messages
- Monitoring effectiveness of campaign through the key performance indicators

#### Webpage

A dedicated webpage on wetlands of Uttar Pradesh is proposed to be developed and periodically updated with information, datasets, and communication products. It is envisaged that the website would become an important interface of UPSWA and Government of Uttar Pradesh on issues related to conservation of wetlands.

## Resource material

Brochures, fact sheets and awareness materials on Ganga Floodplain wetlands are proposed to be published in English and Hindi for public distribution. A coffee table book is also proposed to be published for serious nature lovers.

## Newsletter

A biannual newsletter highlighting progress made in management plan implementation and key emerging issues related to Ganga Floodplain wetlands is proposed to be published in English and Hindi, and disseminated to all stakeholders.

## Workshops and public events

Public events are proposed to be organized on the eve of World Wetlands Day (Feb 2), World Environment Day (June 5) and International Day for Biological Diversity (May 22) as a means of reaching out to public on the issues of wetland conservation and wise use. Public events on specific issues, as pollution abatement, sustainable fisheries, waterbird conservation and water management are also proposed to be organized as a means of engaging with stakeholders.

## Management implementation and review

A mid-term and end-term review of management plan implementation is proposed to assess the extent to which stipulated objectives have been achieved with a high degree of resource efficiency and in participation with stakeholders. Wetlands International South Asia shall carry out the evaluation, specifically looking at the following elements:

• Degree to which wetland ecological character is being maintained as

a result of management being applied

- Implementation quality, timeliness, and resourcing of activities
- Quality and comprehensiveness of wetlands monitoring
- Effectiveness of management being applied, in terms of design, activities, outcomes and impacts
- Quality of stakeholder engagement in implementation of various activities and discharging wetland management functions
- Changes in external environment, requiring adaptation in management plan

# Site level action plan

Actions specific to four management categories are given below. The actions are guided by the wetland strategies outlined in chapter 5. While many actions others cater to category specific management needs, some of these activities apply to all categories. These are:

#### Agriculture floodplains

Activities to meet the objectives of the agriculture floodplains wetlands management category are proposed under different management interventions namely; institutional set-up, wetlands delineation and demarcation, enhancing hydrological regimes, pollution abatement, species and habitat conservation, resource development and livelihoods & monitoring and review (Table 20).

#### Institutional set-up

- Formation of a multi-stakeholder forum as a wetlands-mitra network is proposed as an effective arrangement for cross-sectoral coordination and multi-stakeholder engagement in wetlands management. Specifically, the network shall:
  - o Support implementation of various management activities on ground.
  - Promote awareness on wetland values and functions within community stakeholders.
  - Articulate community views and suggestions on various management interventions.
  - Support adoption of alternative and new knowledges/skills/technologies aimed at reducing livelihood vulnerabilities and advancing wise use of wetlands.
- Systematic wetlands inventory, assessment and monitoring system is proposed to be established to address the overall information needs of wetland management and support decision making and management.
- To support integrated management of wetlands, capacity building of stakeholders needs to be enhanced through professional training workshops on:
  - o Integrated wetlands management
  - o Wetlands inventory assessment and monitoring
  - Land use planning for multiple wetlands use
  - Wetlands and climate change mitigation and adaptation
  - Integrating wetlands wise use in developmental planning
- The site-management plan is to be prepared by the concerned Divisional Forest

Officer. After being endorsed by the PCCF-Wildlife (Principal Chief Conservator of Forests-Wildlife), it is subsequently approved by the SWA.

- Signage indicating the wetland as a Ramsar Site, an Important Bird Area or a Biodiversity Hotspot is proposed to be placed at all major entry points of the wetlands complex.
- Workshops and public events are proposed to be organized on the eve of World Wetlands Day (Feb 2), World Environment Day (June 5) and International Day for Biological Diversity (May 22) as a means of reaching out to public on the issues of wetland conservation and wise use.
- Public events on specific issues, as pollution control or water management are also proposed to be organized as a means of engaging with stakeholders.
- Development of resource material on the wetland including posters, brochures, pamphlets, films and education kits and Publication of newsletter.

# Wetlands delineation and demarcation

# Wetlands demarcation

It is proposed to demarcate wetland boundary by placing geo-tagged pillars all along the wetland periphery. Demarcation will be done using geo-tagged boundary pillars. Pillars will be placed at an interval of approximately 100 m or as the case may be. Approval of the demarcated boundary of the wetland will be obtained from the State Wetlands Authority. Activities to be carried out are as follows:

- Completion of field reconnaissance survey. Wherein detailed mapping of wetland extent using Remote Sensing and GIS and ground truthing will be undertaken.
- Removal of encroachments. The issue has to be addressed at the administrative level and removed following due legal processes.
- Placement of geo-tagged pillars. These will be concrete cemented pillars.

# Enhancing hydrological regimes

Clearing of inlets and outlets

• Identification and cleaning and maintenance of inlets and outlets to identify flow impediments.

# Pollution abatement

Constructed wetlands involving horizontal subsurface flow through large gravel and sand-filled channels that is planted with aquatic vegetation is proposed in prioritized wetlands as a pollution abatement measure. The location of constructed wetlands and design may be finalized in the first year of management plan implementation, and the wetland development work taken up in the second and third year of the management plan.

## Species and habitat conservation

Creation and maintenance of People's Biodiversity Registers

• With support from the State Biodiversity Board (SBB), People's Biodiversity

Registers are created at the local level under the guidance of the Biodiversity Management Committee (BMC).

- For creating the Peoples' Biodiversity Register, training by experts should be conducted to prepare document which contains comprehensive information on the landscape, demography of the village and locally available bio-resources. To prepare species inventories, training by wildlife experts should be conducted on habitat mapping and identification of local flora and fauna.
- Training on Asian Waterbird Census (AWC) must be conducted annually during winter season. This is a must for wetlands that are known to be frequented by migratory waterbirds of the central Asian flyway.

# Habitat mapping and surveillance

- Exposed to riverine flood pulses the floodplains serve as breeding and spawning grounds for fishes, migratory corridors for wildlife, and as habitats for ecotone species such as Sarus Cranes. Actions include mapping of key habitat and breeding areas followed by regular monitoring and surveillance through community groups.
- Community sensitization and formation of bird protection committees to monitor waterbird habitats and to control any human disturbance. Incentives in the form of recognition and training as bird guides could be provided to the committee members.

# Management of invasive species

- Growth of invasive macrophytes to be managed by either manual or mechanical removal of thick stands of emergent vegetation like Phragmites karka, Ipomoea aquatica, Eichhornia crassipes etc. to improve hydrological connectivity, check eutrophication and increase fish breeding areas.
- Control of invasive macrophytes such as Water Hyacinth can also be done through meshing of inlets.

## Resource development and livelihoods

Sustainable fisheries development

- Formation of user groups or fisher cooperatives as key community institutions managing fishery operations in the wetland complex. Revisiting institutional structure to ensure genuine co-operative character owned by their members, governed by their elected representatives, and managed professionally. Wherever required, bye laws for management of society operations may be facilitated.
- Microcredit support provided through linkages with Fisheries Department and NABARD.
- Training on sustainable fisheries development through workshops on: sustainable fish culture practices, management of fish hatchery, integrated fish farming and policy and regulatory requirements for fish culture.
- Regulating use of banned fishing gears like use of mosquito nets for harvesting of fish.

- Controlling harvesting of fingerlings.
- Controlling introduction of exotic species by measures such as selective netting.
- Gears of mesh size 4cm or above ought to be promoted. This must be enforced on an urgent basis as panchayat owned ponds that forms a common property resource frequently witness such kind of activities.
- Construction and upgradation of jetties.

# Promoting sustainable agriculture practices

Krishi Vigyan Kendras function as knowledge centres on agricultural technology and should be involved in developing farmers capacities on sustainable wetland agriculture practices. Related activities are:

- Organising district level workshops for farmers and others stakeholders to promote and adoption of natural farming in wetland catchment zones. Wetlands like Usraila jhil in Raebareli, Saibasi pond in Kanpur nagar and Manpur lake in Unnao districts having more than 85% of catchment area under agriculture should be prioritized for such activities.
- Capacity development of farmers on various aspects like soil aeration, intercropping, vermicomposting, soil conservation techniques, use of climate resilient and less water intensive crop varieties, water conservation techniques like drip irrigation, micro-irrigation etc. bio-manures, multiple cropping and adoption of eco-friendly practices should be facilitated in a zone/ district wise manner in collaboration with Krishi Vigyan Kendras.
- Facilitate availing of farm loans on Kisan Credit Cards for marginal farmers and credit under NABARD refinancing schemes.

## Monitoring and review

A mid-term review of management plan implementation is proposed to assess the extent to which stipulated objectives have been achieved with a high degree of resource efficiency and in participation with stakeholders. An external committee on wetlands is proposed to be formed by the SWA to carry out the evaluation, specifically looking at the following elements:

- Degree to which wetland ecological character is being maintained as a result of management being applied.
- Implementation quality, timeliness, and resourcing of activities.
- Quality and comprehensiveness of wetlands monitoring.
- Effectiveness of management being applied, in terms of design, activities, outcomes and impacts.
- Quality of stakeholder engagement in implementation of various activities and discharging wetland management functions.
- Changes in external environment requiring adaptation in management plan.

Mana	gement category - Flood	dplain Agricultural wetlands																																																
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# Table 20: Proposed phase-wise activities under the management category – Floodplain Agriculture

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	Wetlands		Hardoi Terwakuli	Arwal Paschim	Murwa Shahabuddinpur	Fatehpur Audhara	Basohani	Paliya Bujurg I	Paliya Bujurg 2	bnatewa-2 Kannaui	Ismailpur Digan	Hardoi	Gangdharapur Kanburnagar	Saibasi Pond	Katri Jaisarmau	Katri bajidpur Pratanarh	BentipA	Ramdas Patti	Devar Patti	Frayagraj Bada Talab (rural)	UPARDAHA (Rural)	Bhiti Taluka Talab	Numaiya Dahi Jheel Kheduva Tal (Rural) <b>Rae Bareli</b>	Gangsari Tal	Baburia Tal	Kaipur I happa Haweli Tal Bara Tal	Usraila Jhil	Bakulahi River	bakwa Tal kamoli tal	Matrauli Tal	Dudhwan Tal	Kondra Jhil	Patti Tal	Bara Sawayaya Hasan	Unnao Bereita hil	Mela Ramkunwar	Maraunda	Dhanuhikhe da lake	Manpur	Mirzapur	Belwan	Jogiya Dari Nala Karnawati nala	Sant Ravidas Nagar	Gonda Shubans Tal	Samdha Tal Kurranna Tal	Pura Rasai Tal	
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#### Ponds

Activities to meet the objectives of the pond management category are proposed under different management interventions namely; institutional set-up, wetlands delineation and demarcation, enhancing hydrological regimes, species and habitat conservation, resource development and livelihoods and monitoring and review (Table 21).

#### Institutional set-up

- Formation of a multi-stakeholder forum as a wetlands-mitra network is proposed as an
  effective arrangement for cross-sectoral coordination and multi-stakeholder
  engagement in wetlands management. Specifically, the network shall:
  - Support implementation of various management activities on ground.
  - Promote awareness on wetland values and functions within community stakeholders.
  - Articulate community views and suggestions on various management interventions.
  - Support adoption of alternative and new knowledges/skills/technologies aimed at reducing livelihood vulnerabilities and advancing wise use of wetlands.
  - Systematic wetland inventory, assessment and monitoring system is proposed to be established to address the overall information needs of wetland management and support decision making and management.
  - To support integrated management of wetlands capacity building of stakeholders needs to be enhanced through professional training workshops on:
    - Integrated wetlands management
    - Wetlands inventory assessment and monitoring
    - Land use planning for multiple wetlands use
    - Wetlands and climate change mitigation and adaptation
    - Integrating wetlands wise use in developmental planning
  - The site-management plan is to be prepared by the concerned Divisional Forest Officer. After being endorsed by the PCCF-Wildlife (Principal Chief Conservator of Forests-Wildlife), it is subsequently approved by the SWA.
  - Signage indicating the wetland as a Ramsar Site, an Important Bird Area or a Biodiversity Hotspot is proposed to be placed at all major entry points of the wetlands complex.
  - Workshops and public events are proposed to be organized on the eve of World Wetlands Day (Feb 2), World Environment Day (June 5) and International Day for Biological Diversity (May 22) as a means of reaching out to public on the issues of wetland conservation and wise use.
  - Public events on specific issues, as pollution control or water management are also proposed to be organized as a means of engaging with stakeholders.
  - Development of resource material on the wetland including posters, brochures, pamphlets, films and education kits and Publication of newsletter.

#### Wetlands delineation and demarcation

#### Wetlands demarcation

It is proposed to demarcate wetland boundary by placing geo-tagged pillars all along the

wetland periphery. Demarcation will be done using geo-tagged boundary pillars. Pillars will be placed at an interval of approximately 100 m or as the case may be. Approval of the demarcated boundary of the wetland will be obtained from the State Wetlands Authority. Activities to be carried out are as follows:

- Completion of field reconnaissance survey wherein detailed mapping of wetland extent using Remote Sensing and GIS and ground truthing will be undertaken.
- Removal of encroachments.
- Placement of geo-tagged pillars. These will be concrete cemented pillars.

# Creation of vegetative buffers

Afforestation activities to be promoted to arrest soil erosion. Indigenous soil binding plant species to be planted in consultation with local communities through PRA exercise. For raising plantations and maintenance following activities are proposed:

- Nursery raising through community organizations.
- Preparatory works, including deweeding and making pits for plantation.
- Plantation of saplings into the prepared pits.
- Protection measures (including watch and ward) from fire, cattle etc.
- The plantation shall be maintained for three years after creation, and handed over to the respective village committee for operation as per the approved Forest Working Plan.

# Enhancing hydrological regimes

Clearing inlets and outlets

• Identification and cleaning and maintenance of inlets and outlets to identify flow impediments.

# Selective desilting

• Selective desilting of highly silted up wetlands areas to enhance their water holding capacity and overall wetland water regime stability.

# Pollution abatement

Village ponds are the ultimate recipients of untreated sewage and sewerage from the settlements which dot its periphery. Also, intensification of agriculture in adjoining areas has led to increased use of fertilizers and pesticides. Coupled with changes in circulation and mixing pattern, excessive loading of nutrients has promoted growth of macrophytic vegetation. Activities for pollution abatement are as follows:

- Survey of wastewater nallahs that are clogging the channels and increasing waterlogging.
- Manual scouring of scum and other waste material. The waste-collectors will form an integral part of the solid waste management system.
- Applying of in-situ inflowing nallah treatment for efficient control of sewage quantity and quality received within the wetland.
- Relocation of dumping sites. The wetlands may be designated a zero-waste zone. A management framework for this purpose, including components on regulation and behaviour change may be drawn up, in consultation with

stakeholders. Screens/mesh are proposed to be placed at all inlets to prevent transport of solid-waste/plastic in the canal system of the wetland.

## Species and habitat conservation

Creation and maintenance of People's Biodiversity Registers

- With support from the State Biodiversity Board (SBB), People's Biodiversity Registers are created at the local level under the guidance of the Biodiversity Management Committee (BMC).
- For creating the Peoples' Biodiversity Register, training by experts should be conducted to prepare document which contains comprehensive information on the landscape, demography of the village and locally available bio-resources. To prepare species inventories training by wildlife experts should be conducted on habitat mapping and identification of local flora and fauna.
- Training on Asian Waterbird Census (AWC) must be conducted annually during winter season. This is a must for wetlands that are known to be frequented by migratory waterbirds of the central Asian flyway.

Habitat mapping and surveillance

- Identification of potential areas for restoration and improvement as waterbird habitats.
- Maintenance of different forms of waterbird habitats based on inventorisation and habitat mapping:
  - Open water areas as feeding areas for diving species, such as pochards, grebes and coots, and as open roosting areas for other flocking waterbird species.
  - Reed beds and channels for migratory ducks and geese.
  - Reed beds and open marsh vegetation for nesting species.
  - Trees along wetland edge for tree nesting species.
  - Patches of wet grasslands and open grounds for grazing ducks, geese, and shorebirds.
- Community sensitization and formation of bird protection committees to monitor waterbird habitats and to control any human disturbance. Incentives in the form of recognition and training as bird guides could be provided to the committee members.
- In areas important for reed nesting bird species, grazing and harvesting of macrophytes need to be completely banned during breeding season.
- For areas of tree nesting bird species, cutting of trees and tall bushes along the periphery of the wetland to be banned.

Management of invasive species

 Growth of invasive macrophytes to be managed by either manual or mechanical removal of thick stands of emergent vegetation like Phragmites karka, Ipomoea aquatica, Eichhornia crassipes etc. to improve hydrological connectivity, check eutrophication and increase fish breeding areas. • Control of invasive macrophytes such as Water Hyacinth can also be done through meshing of inlets.

# Resource development and livelihoods

# Sustainable fisheries development

- Regulating use of banned fishing gears like use of mosquito nets for harvesting of fish. Gears of mesh size 4cm or above ought to be promoted. This must be enforced on an urgent basis as panchayat owned ponds that forms a common property resource frequently witness such kind of activities.
- Controlling harvesting of fingerlings.
- Controlling introduction of exotic species by measures such as selective netting.

# Water Hyacinth-based enterprise

Promoting alternate/additional livelihood options based on value addition to existing resources e.g., develop a community led handicrafts enterprise based on macrophytic vegetation such as Water Hyacinth. Other micro-enterprises to reduce pressure on wetland resources such as apiculture may also be promoted.

# Multi-purpose shelter

Strengthening community managed disaster risk reduction capability in the villages through promoting contingency planning and community risk reduction interventions such as construction of flood shelters, fuel bank and grain bank.

Construction of approach roads as a comprehensive coverage of facilities to the villages. Other incentives particularly focusing on marginalised communities (fisher) include provisioning of safe drinking water supply, sanitation and health facilities, and community toilets.

## Monitoring and review

A mid-term review of management plan implementation is proposed to assess the extent to which stipulated objectives have been achieved with a high degree of resource efficiency and in participation with stakeholders. An external committee on wetlands is proposed to be formed by the SWA to carry out the evaluation, specifically looking at the following elements:

- Degree to which wetland ecological character is being maintained as a result of management being applied
- Implementation quality, timeliness, and resourcing of activities
- Quality and comprehensiveness of wetlands monitoring
- Effectiveness of management being applied, in terms of design, activities, outcomes and impacts
- Quality of stakeholder engagement in implementation of various activities and discharging wetland management functions
- Changes in external environment requiring adaptation in management plan.

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Management Category - Ponds

Wetlands	Hardoi	Sanpkhera	Madar	Dharampur <b>Fatehpur</b>	Bhalewa-I Thari	Okhara Kuwarpur	Karsawan Itarora Dilukini	kannauj	Nadsiya Gram Samaj Kannurnagar	Madara Rai Guman	Rehnas Talab Hindupur	Kaushambi	Bharwari Daulatpur Kashar	Gauspur	Prataparh	Jasauli	Tikuri Dashrathpur Saray Jaychandra	Saray Jaychandra	Narsinghpur	Talaab (Rural)	Rae Bareli	Milkipur Tal Phanda Tal	Unao	Kushrajpur Pond Unchgaon Pond	Liloi Jheel	Rawat Pond Kanti Pond	Manpur Lake	Majhara piper Kheda <b>Varanasi</b>	Sarai Dangari Mirzabur	BhuiyaKoh Dam
Institutional Set-up																														
Constitution of wetland mitra network		1	1	✓	<b>v</b> .	⁄ √	<b>√</b> 1	<ul> <li>Image: A set of the set of the</li></ul>	✓	✓	1	1	<ul> <li>✓</li> </ul>	✓ ·	1	✓	< </td <td>1</td> <td>✓</td> <td>1</td> <td></td> <td><b>√</b> .</td> <td>1</td> <td><b>√ √</b></td> <td><ul> <li></li> </ul></td> <td>√ √</td> <td><ul> <li>✓</li> </ul></td> <td>✓</td> <td>✓</td> <td>1</td>	1	✓	1		<b>√</b> .	1	<b>√ √</b>	<ul> <li></li> </ul>	√ √	<ul> <li>✓</li> </ul>	✓	✓	1
Training and orientation on wetland management	nt																													1
Issue-specific training		<ul> <li>✓</li> <li>✓</li> </ul>	/ /	✓	<ul><li>✓</li></ul>	11	<b>√</b> ,	<ul> <li>Image: A second s</li></ul>	✓	✓	11		√ √	<b>√</b> ,	1	✓	√ √	1	✓	1		<b>√</b>   •	1	<b>√ √</b>	′ イ	✓ ✓	<ul> <li></li> <li></li> </ul>	✓	1	1
Finalisation and endorsement of site-management	nt plan																													
Signage										✓																				
Outreach programmes		<ul> <li>✓</li> <li>✓</li> </ul>	/ /	✓	<b>√</b> ,	1 1	¥ 1	<ul> <li>Image: A second s</li></ul>	✓	✓	1	1	<ul> <li>✓</li> </ul>	<b>√</b> ,	1	✓	< </td <td>1</td> <td>✓</td> <td>✓</td> <td></td> <td><b>√</b> .</td> <td>1</td> <td><b>√ √</b></td> <td><ul> <li></li> </ul></td> <td>× *</td> <td>1</td> <td>✓</td> <td>✓</td> <td>1</td>	1	✓	✓		<b>√</b> .	1	<b>√ √</b>	<ul> <li></li> </ul>	× *	1	✓	✓	1
2 Wetlands delineation & demarcation																														
2.1 Wetland demarcation																														
Placement of geo-tagged boundary pillars		<ul> <li>✓</li> <li>✓</li> </ul>	/ /	✓	<b>√</b> ,	11	<b>イ</b> 1	<ul> <li>Image: A second s</li></ul>	✓	✓		<b>^</b>	<ul><li>✓</li></ul>	<b>イ</b> 、	1	✓	< <	1	✓	✓		<b>√</b> •	1	11	· •	<ul><li>✓</li></ul>	· •	✓	1	
Removal of encroachments		✓	1	✓	✓				✓			<b>^</b>	<ul><li>✓</li></ul>	1						✓		<b>√</b> •	1	11	· •	< <	1	✓	1	
2.2 Creation of vegetative buffers																														
Plantation of native species		11	11	∢	¥ ,	11	× ,	1	✓	1	1 1	1	11	1	1	1	1 1	1	✓	1		<b>،</b> ا	1	11	1	1 1	1	✓	1	1
Maintenance		11	11	✓	v ,	11	¥ 1	1	✓	1	1 1	1	1 1	¥ 1	1	1	1 I	1	✓	1		<b>،</b> ا	1	<b>√ √</b>	1	< <	1	✓	1	1
3 Enhancing hydrological regimes																														
3.1 Clearing inlets and outlets			1			1	,	<		✓			<b>√</b>	<b>√</b> ,	1	✓				1		✓		- ✓	·	✓				1
3.2 Selective desilting		✓	11		1	1	¥ 1	1		✓	11	1	11	<b>イ</b> 1	1							∢			1	✓	1	✓	1	1
4 Pollution abatement																														
Survey of wastewater nallahs		<ul><li>✓</li></ul>	1		•	1 1				1	1		1			✓	< </td <td>1</td> <td>✓</td> <td></td> <td></td> <td></td> <td></td> <td><b>√ √</b></td> <td>•</td> <td></td> <td></td> <td></td> <td>✓</td> <td></td>	1	✓					<b>√ √</b>	•				✓	
Manual scouring of scum and other waste mate	rials	<ul><li>✓</li></ul>	1		<ul> <li>✓</li> </ul>	11				✓	1		1			✓	√ √	1	✓	1				<b>√ √</b>	·			✓	1	
In-situ inflowing nallah treatment		1	1							1	✓		✓			1	1 I	1	✓					<b>√ √</b>	1				1	
Relocation of dumping sites		1	1		1,	11	<b>√</b> 1	1	✓											1		•	/	✓		•	·			

Mana	gement Category - Ponds																																	
	Wetlands		Hardoi Alisani Nan Kheriva	Sanpkhera Tirhi Gaon Pansala	Madar	Daarampur Fatehpur	Bhalewa-I	Thari Okhara Kuwarpur	Karsawan	Itarora Pilkhini <b>Kannauj</b>	Nadsiya Gram Samaj	Kanpurnagar Madara Rai Guman	Rehnas Talab	Hindupur Kaushamhi	Bharwari	Daulatpur Kashar Gausour	Parsara	Prataparh	Jasauli Tikuri Dashrathour	Saray Jaychandra	Saray Jaychandra	Prayagrai	Talaab (Rural)	Rae Bareli Milkinur Tal	Bharda Tal	Unnao	Kushrajpur Pond	Uncngaon Fond Liloi Jheel	Rawat Pond	Kanti Pond	Majhara piper Kheda	Varanasi Comi Dozzari	Mirzapur	BhuiyaKoh Dam
5	Species and habitat conser	rvation						i.																										
5.1	Creation and Maintenance of People's Biodiversity Registers																																	
				· · ·			✓ ✓	< <	<ul> <li>✓</li> <li>✓</li> </ul>	<b>√</b>	<b>*</b>	<b>_</b>	· •	✓ 	<b>√</b>	<b>v v</b>	· •		<ul> <li></li> <li></li> </ul>	· •	✓ ·	<u> </u>	<b>*</b>	•	/	-	<ul> <li>✓</li> <li>✓</li> </ul>	/ /	· ·	<b>v</b> •	<u> </u>	1	<u> </u>	✓
5.2	Habitat mapping and surveillance	Creation of People's Biodiversity Registers		•			•		•	✓	✓ 	~		•	~	••				• •	•	/	~	•			•			•••		1	_	-
		Mapping of key habitat areas		1									1	~	1		1			1	1		1					1						
		Formation of community groups to monitor habitats		1									1	✓			1				1		1				•	1						
		Community sensitization	-	· 🗸 🗸	• •	<ul> <li>Image: A second s</li></ul>	1	• •	<b>√</b> ·	✓		-	•	✓	1	v .	1 1		< <	• •	¥ .	1	1	,	/ /	•	<ul> <li>✓</li> </ul>	11	•	۲ ۱	11	•	/	1
		Surveillance and reporting		1											1		1						∢				•	/						1
5.3	Mangement of invasive species																																	
		Removal of water hyacinth and other invasive macrophytes	<b>v</b>	· 🖌	1	~	1	11	<ul> <li>✓</li> </ul>	✓	1	1	· 🗸	✓	1	•	11		< </td <td><ul> <li>I</li> </ul></td> <td><b>√</b> .</td> <td>1</td> <td>1</td> <td>•</td> <td>/ /</td> <td>•</td> <td>✓</td> <td>11</td> <td>· •</td> <td><b>イ</b> ,</td> <td>11</td> <td>•</td> <td>1</td> <td></td>	<ul> <li>I</li> </ul>	<b>√</b> .	1	1	•	/ /	•	✓	11	· •	<b>イ</b> ,	11	•	1	
6	Resource development an	d livelihoods																																
		Sustainable fisheries development	-					• •	<ul> <li>✓</li> </ul>	✓	1		_		✓	<b>v v</b>	11		_				1		-	·	✓	/ /	′ イ	۲	′ イ	•	<u> </u>	_
		Water hyacinth-based enterprise		· •			_	✓			✓		1	✓	1	<b>v</b> v	′ <b>イ</b>		< <	<ul> <li>✓</li> </ul>	•		✓	•	/ /	· .	•	/	1		′ ́		<u> </u>	
		Multi-purpose shelter											_							_										-				_
		Construction of approach roads											_				_		~					•			_	_	1	-				-
7	Monitoring and review																																	
		Monitoring		· 🗸 🖌	•	<b>/</b>	1	<b>1</b> 1	¥ .	✓	1	1	· 🗸	✓	1	<b>v</b> v	/ /		<b>√</b> √	· •	¥ 1	1	1	,	/ 4	•	<b>,</b>	1 1	· 🖌	¥ ,	11		/	1
		Monitoring (Representative Sites)		1			1		$\square$		1		1				-								1		-	1		- H				
		Management plan mid-term review (External)	-	· • •	• •	1	1	11	✓ .	1	1	1	•	1	1	· •	11		11	1	<b>·</b> ·	/	1	,	1 1	•	<b>·</b> ·	11	•	1.	11		/	1
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#### Urban and Peri-Urban Wetlands

Activities to meet the objectives of the urban and peri-urban wetlands management category are proposed under different management interventions namely; institutional set-up, wetlands delineation and demarcation, enhancing hydrological regimes, pollution abatement, species and habitat conservation and wetlands education and interpretation (Table 22).

#### Institutional set-up

- Formation of a multi-stakeholder forum as a wetlands-mitra network is proposed as an effective arrangement for cross-sectoral coordination and multi-stakeholder engagement in wetlands management. Specifically, the network shall:
  - o Support implementation of various management activities on ground.
  - Promote awareness on wetland values and functions within community stakeholders.
  - Articulate community views and suggestions on various management interventions.
  - Support adoption of alternative and new knowledges/skills/technologies aimed at reducing livelihood vulnerabilities and advancing wise use of wetlands.
- Systematic wetlands inventory, assessment and monitoring system is proposed to be established to address the overall information needs of wetland management and support decision making and management.
- To support integrated management of wetlands capacity building of stakeholders needs to be enhanced through professional training workshops on:
  - o Integrated wetlands management
  - Wetlands inventory assessment and monitoring
  - Land use planning for multiple wetlands use
  - Wetlands and climate change mitigation and adaptation
  - o Integrating wetlands wise use in developmental planning
- The site-management plan is to be prepared by the concerned Divisional Forest Officer. After being endorsed by the PCCF-Wildlife (Principal Chief Conservator of Forests-Wildlife), it is subsequently approved by the SWA.
- Signage indicating the wetland as a Ramsar Site, an Important Bird Area or a Biodiversity Hotspot is proposed to be placed at all major entry points of the wetlands complex.
- Workshops and public events are proposed to be organized on the eve of World Wetlands Day (Feb 2), World Environment Day (June 5) and International Day for Biological Diversity (May 22) as a means of reaching out to public on the issues of wetland conservation and wise use.
- Public events on specific issues, as pollution control or water management are also proposed to be organized as a means of engaging with stakeholders.
- Development of resource material on the wetland including posters, brochures, pamphlets, films and education kits and Publication of newsletter.

# Wetlands delineation and demarcation

# Wetlands demarcation

It is proposed to demarcate wetland boundary by placing geo-tagged pillars all along the wetland periphery. Demarcation will be done using geo-tagged boundary pillars. Pillars will be placed at an interval of approximately 100 m or as the case may be. Approval of the demarcated boundary of the wetland will be obtained from the State Wetlands Authority. Activities to be carried out are as follows:

- Completion of field reconnaissance survey. Wherein detailed mapping of wetland extent using Remote Sensing and GIS and ground truthing will be undertaken.
- Removal of encroachments.
- Placement of geo-tagged pillars. These will be concrete cemented pillars.

# Creation of vegetative buffers

Afforestation activities to be promoted to arrest soil erosion. Indigenous soil binding plant species to be planted in consultation with local communities through PRA exercise. For raising plantations and maintenance following activities are proposed:

- Nursery raising through community organizations.
- Preparatory works, including deweeding and making pits for plantation.
- Plantation of saplings into the prepared pits.
- Protection measures (including watch and ward) from fire, cattle etc.
- The plantation shall be maintained for three years after creation, and handed over to the respective village committee for operation as per the approved Forest Working Plan.

# Enhancing hydrological regimes

# Clearing of inlets and outlets

• Identification and cleaning and maintenance of inlets and outlets to identify flow impediments.

## Selective desilting

• Selective desilting of highly silted up wetlands areas to enhance their water holding capacity and overall wetland water regime stability.

# Pollution abatement

Village ponds are the ultimate recipients of untreated sewage and sewerage from the settlements which dot its periphery. Also, intensification of agriculture in adjoining areas has led to increased use of fertilizers and pesticides. Coupled with changes in circulation and mixing pattern, excessive loading of nutrients has promoted growth of macrophytic vegetation. Activities for pollution abatement are as follows:

- Survey of wastewater nallahs that are clogging the channels and increasing waterlogging.
- Manual scouring of scum and other waste material. The waste-collectors will form an integral part of the solid waste management system.
- Applying of in-situ inflowing nallah treatment for efficient control of sewage quantity and quality received within the wetland.

- Construction of sand gravel-beds for inflow filtration.
- Establishment of floating treatment wetlands.
- Relocation of dumping sites. The wetlands may be designated a zero-waste zone. A
  management framework for this purpose, including components on regulation and
  behaviour change may be drawn up, in consultation with stakeholders.
  Screens/mesh are proposed to be placed at all inlets to prevent transport of solidwaste/plastic in the canal system of the wetland.

### Species and habitat conservation

Creation and maintenance of People's Biodiversity Registers

- With support from the State Biodiversity Board (SBB), People's Biodiversity Registers are created at the local level under the guidance of the Biodiversity Management Committee (BMC).
- For creating the Peoples' Biodiversity Register, training by experts should be conducted to prepare document which contains comprehensive information on the landscape, demography of the village and locally available bio-resources. To prepare species inventories training by wildlife experts should be conducted on habitat mapping and identification of local flora and fauna.
- Training on Asian Waterbird Census (AWC) must be conducted annually during winter season. This is a must for wetlands that are known to be frequented by migratory waterbirds of the central Asian flyway.

#### Habitat mapping and surveillance

- Identification of potential areas for restoration and improvement as waterbird habitats.
- Maintenance of different forms of waterbird habitats based on inventorisation and habitat mapping:
  - Open water areas as feeding areas for diving species, such as pochards, grebes and coots, and as open roosting areas for other flocking waterbird species.
  - Reed beds and channels for migratory ducks and geese.
  - Reed beds and open marsh vegetation for nesting species.
  - Trees along wetland edge for tree nesting species.
  - Patches of wet grasslands and open grounds for grazing ducks, geese and shorebirds.
- Community sensitization and formation of bird protection committees to monitor waterbird habitats and to control any human disturbance. Incentives in the form of recognition and training as bird guides could be provided to the committee members.
- In areas important for reed nesting bird species, grazing and harvesting of macrophytes need to be completely banned during breeding season.
- For areas of tree nesting bird species, cutting of trees and tall bushes along the periphery of the wetland to be banned.

Management of invasive species

• Growth of invasive macrophytes to be managed by either manual or mechanical

removal of thick stands of emergent vegetation like Phragmites karka, Ipomoea aquatica, Eichhornia crassipes etc. to improve hydrological connectivity, check eutrophication and increase fish breeding areas.

• Control of invasive macrophytes such as Water Hyacinth can also be done through meshing of inlets.

### Wetlands education and interpretation

#### Interpretation infrastructure

A wetlands interpretation centre is proposed to be constructed. Following facilities are proposed to be developed in the interpretation complex: Exhibits including posters, models, flying patterns hanging from ceiling, wetland birds interactive panel and ecosystem food chain, viewing gallery comprising panels highlighting the ecological, socioeconomic and cultural aspects. Desks fitted with adequate displays, bird identifications books. Children's Play area consisting of open dioramas and floorings with underwater paintings should be developed as a special section to cater to the young visitors. The area should have several innovative environment-oriented games and interactive food chain, fish trap games, jigsaw puzzles etc. Auditorium having audio-visual facilities for screening documentaries and arranging talks/workshops/meetings. Children's Play area consisting of open dioramas and floorings with underwater paintings and interactive food chain, fish trap games, jigsaw puzzles etc. Auditorium having audio-visual facilities for screening documentaries and arranging talks/workshops/meetings. Children's Play area consisting of open dioramas and floorings with underwater paintings should be developed as a special section to cater to the young visitors. The area should have several innovative environment-oriented games and interactive food chain, fish trap games and interactive food chain, fish trap games, jigsaw puzzles.

## Construction of watch towers

Watchtowers may be constructed at vantage points. They should be equipped with binocular and telescope facilities for better viewing.

#### Establishment of walking trails

Walking trails around the wetlands should be established to enable visitors to have a better view of the landscape.

## Monitoring and review

A mid-term review of management plan implementation is proposed to assess the extent to which stipulated objectives have been achieved with a high degree of resource efficiency and in participation with stakeholders. An external committee on wetlands is proposed to be formed by the SWA to carry out the evaluation, specifically looking at the following elements:

- Degree to which wetland ecological character is being maintained as a result of management being applied.
- Implementation quality, timeliness and resourcing of activities.
- Quality and comprehensiveness of wetlands monitoring.
- Effectiveness of management being applied, in terms of design, activities, outcomes and impacts.
- Quality of stakeholder engagement in implementation of various activities and discharging wetland management functions
- Changes in external environment requiring adaptation in management plan.

Table 22: Proposed phase-wise activities under the management category – Urban and Peri-Urban wetlands

weakan	lana	gement Category - Urban ar	nd Peri-Urban wetlands		-			_														ē				_	_	
Instructional Solution of wetshadd mirts network.       I		Wetlands		Fatehpur	Fatehpur MB	Fatehpur MB 2	Fatehpur MB 3	Fatehpur MB 4	Fatehpur MB 5	Sanganv	Chakki	Kannauj	Madharpur	Mausampur Morara	Kanpurnagar	Mama Talab	Shivrajpur-2	Shivrajpur	Sanigvan	Prayagraj	Bela Kchar Talaab	Dhobiyan Basti Talaab Har	Nivari Tal	Varanasi	Chunagir Tal	Chancha Tal	Pandeypur	Kausnambi
Construction of wettod       A <th>1</th> <th>Institutional Set-up</th> <th></th>	1	Institutional Set-up																										
Insue-specie range       Partial solution and indexember of size:       Partial solution and			Constitution of wetland mitra network Training and orientation on wetland management		✓	•	•	•	•	•	•		•	✓		•	✓	•	✓		•	•	✓		•	1	✓	
Signage         Image: Signage			Issue-specific training Finalisation and endorsement of site- management plan		✓	1	1	1	•	•	•		•	✓		•	✓	1	✓		1	✓	✓		•	•	✓	
2 Wetlands definisation & definis & definisation & definisation & definisation &			Signage Outreach programmes		1	1	1	1	1	1	1		1	1		1	1	✓ ✓	•		1	1	1		1	1	•	
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2       Creation of vegetative buffers       Paintation of native species       I <td>2.1</td> <td>Wetland demarcation</td> <td>Placement of geo-tagged boundary pillars Removal of encroachments</td> <td></td> <td>•</td> <td>1</td> <td>•</td> <td>•</td> <td>✓ ✓</td> <td>✓ ✓</td> <td>•</td> <td></td> <td>•</td> <td>•</td> <td></td> <td>↓ ↓</td> <td>1</td> <td>↓ ↓</td> <td><b>√</b></td> <td></td> <td>* *</td> <td>1</td> <td>•</td> <td></td> <td>•</td> <td>•</td> <td>•</td> <td></td>	2.1	Wetland demarcation	Placement of geo-tagged boundary pillars Removal of encroachments		•	1	•	•	✓ ✓	✓ ✓	•		•	•		↓ ↓	1	↓ ↓	<b>√</b>		* *	1	•		•	•	•	
Maintenance       Maintenance       Image: 1	2.2	Creation of vegetative buffers	Plantation of native species		✓	1	✓	1	✓	1	✓		✓	✓		•		1	✓		✓	✓	✓		✓	✓	1	
3.1 Clearing of inlets and outlets			Maintenance		1	1	1	1	1	1	✓		1	✓		✓	_	✓	-		1	1	1		1	1	-	
3.1       Clearing of inlets and outlets       Image: Serie of inlets       Image: Serie of inlets <td>3</td> <td>Enhancing hydrological regi</td> <td>mes</td> <td></td>	3	Enhancing hydrological regi	mes																									
32       Selective desikting       Image: selective desikting <td>3.1</td> <td>Clearing of inlets and outlets</td> <td></td> <td></td> <td></td> <td></td> <td></td> <td></td> <td></td> <td>~</td> <td>~</td> <td></td> <td></td> <td></td> <td></td> <td></td> <td>~</td> <td>~</td> <td></td> <td></td> <td>•</td> <td></td> <td>1</td> <td></td> <td></td> <td></td> <td></td> <td></td>	3.1	Clearing of inlets and outlets								~	~						~	~			•		1					
Pollution abatement       Survey of watewater nallabs  <	3.2	Selective desilting				1	1	1	•		•		1	•		•		•	•		1		1		•	1	1	
Survey of wastewater nallahs <td>4</td> <td>Pollution abatement</td> <td></td>	4	Pollution abatement																										
Manual accouring of scum and other waste meterials       A			Survey of wastewater nallahs		∢		1	✓	∢	∢						<	✓	<	✓		✓	~	✓		∢	✓	✓	
installation of waste sizes at inlets       installation of waste sizes at inlets       i <td></td> <td></td> <td>Manual scouring of scum and other waste materials</td> <td></td> <td>•</td> <td></td> <td>1</td> <td>•</td> <td>1</td> <td>•</td> <td>•</td> <td></td> <td></td> <td></td> <td></td> <td>1</td> <td>•</td> <td>•</td> <td>1</td> <td></td> <td>1</td> <td>•</td> <td>•</td> <td></td> <td>•</td> <td>•</td> <td>1</td> <td></td>			Manual scouring of scum and other waste materials		•		1	•	1	•	•					1	•	•	1		1	•	•		•	•	1	
initration       i			Installation of waste sieves at inlets Construction of sand gravel-beds for inflow						✓	1	✓		✓			•	✓	1			1	•	✓		•	1		
Sepicies and habitat conservation       Creation and Maintenance of       5.1       People's Biodiversity Registers       7 <td></td> <td></td> <td>filtration Establishment of floating treatment wetlands</td> <td></td> <td></td> <td></td> <td>1</td> <td>~</td> <td>1</td> <td></td> <td>1</td> <td></td> <td>_</td> <td>_</td> <td></td> <td>_</td> <td>,</td> <td>•</td> <td>~</td> <td></td> <td>1</td> <td>1</td> <td>1</td> <td></td> <td>1</td> <td>1</td> <td>_</td> <td></td>			filtration Establishment of floating treatment wetlands				1	~	1		1		_	_		_	,	•	~		1	1	1		1	1	_	
Creation and Maintenance of S.I       Fraining       Image: Solution of People's Biodiversity Registers       Image: Solution of People'	5	Species and habitat conserv	Relocation of dumping sites						۲	۷	۷		*	۷		¥	*	¥			*	¥	Ÿ		¥	•	*	
5.1       People's Biodiversity Registers       Image: Similar Component Comp	J	Creation and Maintenance of																										
Image: Antion of People's Biodiversity Registers Image: Antion of People's Biodivers	5.1	People's Biodiversity Registers																										
Asian Waterbird Census Asian Waterbird Census I<			Training Creation of People's Biodiversity Registers		✓ √	* *	* *	✓ ✓	✓ ✓	✓ ✓	✓ ✓		✓ ✓	✓ ✓		✓ ✓	✓ ✓	✓ ✓	✓ ✓		✓ ✓	✓ ✓	✓ ✓			•		
5.2 Mangement of invasive species Removal of water hyacinth and other invasive macrophytes I </td <td></td> <td></td> <td>Asian Waterbird Census</td> <td></td>			Asian Waterbird Census																									
macrophytes       v <th< td=""><td>5.2</td><td>Mangement of invasive species</td><td>Removal of water hyacinth and other invasive</td><td></td><td>1</td><td>1</td><td>1</td><td>1</td><td>1</td><td>1</td><td>1</td><td></td><td>1</td><td>-</td><td></td><td>1</td><td>-</td><td>1</td><td>-</td><td></td><td>1</td><td>1</td><td>1</td><td></td><td>1</td><td>1</td><td>_</td><td></td></th<>	5.2	Mangement of invasive species	Removal of water hyacinth and other invasive		1	1	1	1	1	1	1		1	-		1	-	1	-		1	1	1		1	1	_	
• Wetch Towers       • • • • • • • • • • • • • • • • • • •		Wotland aduction and it to	macrophytes		Ľ	Ľ	Ĺ	Ĺ		Ľ	Ľ		•			·			1		•	<u> </u>	•		Ċ	<u> </u>		
Match Towers       Maling trails         Monitoring and Review       Monitoring (Representative Sites)         Managemet Plan Mid term reiew (External)       Y	6	wedand education and inte	rpretation																									
Monitoring and Review       Monitoring       Monitoring       Image: Constraint of the constraint			Watch Towers Walking trails			✓ ✓	•	1			•							✓ ✓	1		✓ ✓		•			1		
Monitoring       Image: Constraint of the co	7	Monitoring and Review																										
Managemnet Plan Mid term reiew (External)			Monitoring Monitoring (Representative Sites)		1	1	1	√ √	•	1	✓ ✓		✓ ✓	√ √		✓ ✓	✓	1	✓ ✓		•	•	✓ ✓		1	✓ ✓	•	
			Managemnet Plan Mid term reiew (External)		•	•	•	1	•	•	4		1	•		1	•	1	1		•	1	•		•	1	•	

# Wetlands within Protected Area

Activities to meet the objectives of the wetlands within protected area management category are proposed under different management interventions namely; institutional set-up, enhancing of hydrological regimes, species and habitat conservation, sustainable tourism development and monitoring and review (Table 23).

Institutional set-up

- Formation of a multi-stakeholder forum as a wetlands-mitra network is proposed as an effective arrangement for cross-sectoral coordination and multi-stakeholder engagement in wetlands management. Specifically, the network shall:
  - Support implementation of various management activities on ground
  - Promote awareness on wetland values and functions within community stakeholders
  - Articulate community views and suggestions on various management interventions
  - Support adoption of alternative and new knowledges/skills/technologies aimed at reducing livelihood vulnerabilities and advancing wise use of wetlands
- Systematic wetland inventory, assessment and monitoring system is proposed to be established to address the overall information needs of wetland management and support decision making and management.
- To support integrated management of wetlands capacity building of stakeholders needs to be enhanced through professional training workshops on:
  - Integrated wetlands management
  - Wetlands inventory assessment and monitoring
  - Land use planning for multiple wetlands use
  - Wetlands and climate change mitigation and adaptation
  - o Integrating wetlands wise use in developmental planning
- The site-management plan is to be prepared by the concerned Divisional Forest Officer. After being endorsed by the PCCF-Wildlife (Principal Chief Conservator of Forests-Wildlife), it is subsequently approved by the SWA.
- Signage indicating the wetland as a Ramsar Site, an Important Bird Area or a Biodiversity Hotspot is proposed to be placed at all major entry points of the wetlands complex.
- Workshops and public events are proposed to be organized on the eve of World Wetlands Day (Feb 2), World Environment Day (June 5) and International Day for Biological Diversity (May 22) as a means of reaching out to public on the issues of wetland conservation and wise use.
- Public events on specific issues, as pollution control or water management are also proposed to be organized as a means of engaging with stakeholders.
- Development of resource material on the wetland including posters, brochures, pamphlets, films and education kits and Publication of newsletter.

#### Enhancing hydrological regimes

Clearing and maintenance of inlets and outlets

• Identification and cleaning and maintenance of inlets and outlets to identify flow impediments.

### Selective desilting

• Selective desilting of highly silted up wetlands areas to enhance their water holding capacity and overall wetland water regime stability.

#### Species and habitat conservation

Species inventory and population count

- Training by wildlife experts on habitat mapping and inventorisation of wetland species along with an assessment of preferred habitat zones of key wetland species.
- Augmenting surveillance infrastructure including construction of watch towers, procurement of equipment for bird watching and mobile vans and boats for patrolling.
- Training on Asian Waterbird Census (AWC) must be conducted annually during winter season. This is a must for wetlands that are known to be frequented by migratory waterbirds of the central Asian flyway.
- Knowledge of the health of resident and migratory species that inhabit the wetlands is critical to understanding the risk and potential of transmission of avian diseases to other birds and animals, domestic poultry, and people. Specific studies need to be undertaken to establish a baseline of the common and potentially harmful zoonotic diseases.

## Management of invasive species

- Growth of invasive macrophytes to be managed by either manual or mechanical removal of thick stands of emergent vegetation like Phragmites karka, Ipomoea aquatica, Eichhornia crassipes etc. to improve hydrological connectivity, check eutrophication and increase fish breeding areas.
- Control of invasive macrophytes such as Water Hyacinth can also be done through meshing of inlets.

Sustainable tourism development

A wetlands interpretation centre is proposed to be constructed. Following facilities are proposed to be developed in the interpretation complex: Exhibits including posters, models, flying patterns hanging from ceiling, wetland birds interactive panel and ecosystem food chain, viewing gallery comprising panels highlighting the ecological, socioeconomic and cultural aspects. Desks fitted with adequate displays, bird identifications books. Children's Play area consisting of open dioramas and floorings with underwater paintings should be developed as a special section to cater to the young visitors. The area should have several innovative environment-

oriented games and interactive food chain, fish trap games, jigsaw puzzles etc. Auditorium having audio-visual facilities for screening documentaries and arranging talks/workshops/meetings. Children's Play area consisting of open dioramas and floorings with underwater paintings should be developed as a special section to cater to the young visitors. The area should have several innovative environment-oriented games and interactive food chain, fish trap games, jigsaw puzzles.

- To enable visitors to have a better view of the landscape boardwalks around the wetlands should be constructed. Wooden benches may also be established to provide sitting/resting facilities.
- Watchtowers may be constructed at vantage points. They should be equipped with binocular and telescope facilities for better viewing.

# Monitoring and review

A mid-term review of management plan implementation is proposed to assess the extent to which stipulated objectives have been achieved with a high degree of resource efficiency and in participation with stakeholders. An external committee on wetlands is proposed to be formed by the SWA to carry out the evaluation, specifically looking at the following elements:

- Degree to which wetland ecological character is being maintained as a result of management being applied
- Implementation quality, timeliness and resourcing of activities
- Quality and comprehensiveness of wetlands monitoring
- Effectiveness of management being applied, in terms of design, activities, outcomes and impacts
- Quality of stakeholder engagement in implementation of various activities and discharging wetland management functions
- Changes in external environment requiring adaptation in management plan.

Table 23: Proposed phase-wise activities under the management category – Wetlands within Protected Area category

nage	ement category - Wetlands with	in Protected Areas								
	Wetlands		Fatehpur	Manikpur	Mirzapur	Bhokawa Bandha	Lower Khajuri Dam	Tanda Dari Taal	Kanpur	Kanpurnagar
I	Institutional Set-up									
		Workshops for constitution of wetland					./			
		mitra network		¥		v	v	•		v
		Training and orientation workshop on		1		7	1	1		
		wetland management						ľ		
		Issue-specific training workshops		✓		✓	✓	1		
		Finalisation and endorsement of site-		1			1	1		
		management plan					·			
		Signages (Publication and Installation)		✓			✓	1		✓
		Outreach programmes (Publication of		1		7	1	1		1
		field/event brochures)				·	•	ľ		Ľ
2	Enhancing hydrological regimes	5								
2.1	Clearing and maintenance of inlets			1						
	and outlets			_						
2.2	Selective desilting					✓	✓	1		✓
3	Species and habitat conservation	on and a second s								
3.1	Species inventory and population count									
		Training		✓		✓	✓	✓		✓
		Periodic updation		✓		✓	✓	1		√
		Conduct species survey - Asian								
		Waterbird Census		·		ľ	•	•		
		Zoonotic disease surveillance		√		✓	✓	1		✓
3.2	Management of invasive species									
		Removal of water hyacinth and other		~				1		1
		invasive macrophytes								-
		invasive macrophytes								
4	Sustainable tourism developme	invasive macrophytes								
4	Sustainable tourism developme	invasive macrophytes Interpreptation Infrastructure		<b>√</b>				<b>√</b>		<b>√</b>
4	Sustainable tourism developme	invasive macrophytes nt Interpreptation Infrastructure Boardwalks		✓ ✓				✓ ✓		✓ ✓
4	Sustainable tourism developme	invasive macrophytes ent Interpreptation Infrastructure Boardwalks Watch Towers		✓ ✓ ✓				✓ ✓ ✓		✓ ✓ ✓
4	Sustainable tourism developme Monitoring and review	invasive macrophytes ent Interpreptation Infrastructure Boardwalks Watch Towers		✓ ✓ ✓				✓ ✓ ✓		↓ ↓ ↓
4	Sustainable tourism developme Monitoring and review	invasive macrophytes int Interpreptation Infrastructure Boardwalks Watch Towers Management plan mid-term review		✓ ✓ ✓				✓ ✓ ✓		✓ ✓ ✓
4	Sustainable tourism developme Monitoring and review	invasive macrophytes int Interpreptation Infrastructure Boardwalks Watch Towers Management plan mid-term review (External)		✓ ✓ ✓		· · ·	✓	✓ ✓ ✓		√ √ √

# 8 Budget and Financing

# **Budget**

Management plan implementation will entail a budget of ₹ 72.7 crores. Of this, the budget allocated for the sub-basin level actions is ₹ 16.7 crores (22.95 %) and that for the site level actions is about ₹ 56 crores (77.05 %). Out of the total budget, the activities proposed under phase 1 will require ₹ 21.8 crores, phase 2 will require about ₹ 17.9 crores and phase 3 will require ₹ 15.1 crores (Table 24).

Table 24: Summarised budget for management plan implementation at the sub-basin and site levels

	Number of Wetlands	Total Amount	Phase 1	Phase 2	Phase 3
Sub-basin level actions		16,70,00,000	16,70,00,000		
Wetland level actions					
Wetlands within Protected areas	5	20,82,86,960	-	2,32,27,600	69,50,850
Urban and Peri-urban wetlands	20	6,86,83,692	-	4,10,74,875	2,76,08,817
Floodplain agricultural wetlands	47	16,26,50,658	4,79,70,270	6,48,02,568	4,98,77,820
Ponds	34	12,09,95,911	40,28,202	5,02,62,548	6,67,05,161
	106	72,76,17,221	21,89,98,472	17,93,67,591	15,11,42,648

Detail activity wise budget plan for the sub-basin level (Table 25) and site level indicating all four management categories viz., wetland within protected areas (Table 26), urban and peri-urban wetlands (Table 27), floodplain agricultural wetlands (Table 28 and Table 29) and ponds (Table 30) are as follows:

Table 25: Detailed activity	wise budget for sub-basin level activities	

	Wetlands	Rate	Unit	Physical	Amount	Y	ear I	۱	fear 2	ŗ	Year 3	Ye	ear 4	١	'ear 5
						Physical	Financial	Physical	Financial	Physical	Financial	Physical	Financial	Physical	Financial
L.	Institutional Set-up				1,80,00,000		36,00,000		36,00,000		36,00,000		36,00,000		36,00,
	Notification of wetlands under	To be done					ĺ	ĺ							
<u> </u>	Wetland Rules	departmentallly													
2	Notification of district wetland	To be done													
	committees	departmentallly													
3	Infrastructure development-human	75.000	Per person per	20		4	36.00.000	4	36.00.000	4	36.00.000	4	36.00.000	4	36.00
	resources	/3,000	month				50,00,000		50,000	•	50,00,000		50,00,000		50,00,
,	Integrated wetland inventory				10 89 00 000		5 25 00 000		5 16 00 000		16 00 000		16 00 000		16.00
	assessment and monitoring								-,-,-,		,,				,
.1	and research center						5,00,00,000		5,00,00,000						
	Development of database														
.2	management system						10,00,000		1,00,000		1,00,000		1,00,000		1,00,
.3	Wetland monitoring						10,00,000		10,00,000		10,00,000		10,00,000		10,00,
.4	Ecosystem health report						5,00,000		5,00,000		5,00,000		5,00,000		5,00,
5	Research Studies				2,50,00,000		60,00,000		1,30,00,000		60,00,000		-		
.1	Climate Risk Assessment						30,00,000		20,00,000						
.2	Hydrological connectivity assessment						30,00,000		20,00,000						
.2	Inventorization of wetlands biodiversity								30,00,000		20,00,000				
.3	Socio-cultural inventory of wetlands								30,00,000		20,00,000				
.4	Multiple wetland values assessment								30,00,000		20,00,000				
4	Capacity development				62,00,000		20,00,000		8,00,000		13,00,000		8,00,000		13,00,
л.	Training needs assessment						15,00,000				-				
.2	Development of training plan						5,00,000				-				
.3	Capacity development workshops	5,00,000	Per workshop	4				1	5,00,000	1	5,00,000	1	5,00,000	1	5,00,
.4	Post-training handholding support								3,00,000		3,00,000		3,00,000		3,00,
.5	Effectiveness assessment										5,00,000				5,00,
5	Communication and outreach				69,00,000		20,00,000		11,00,000		16,00,000		11,00,000		11,00,0
л.	Webpage				18,00,000		10,00,000		2,00,000		2,00,000		2,00,000		2,00,
.2	Resource material	2,50,000	Per publication	4	10,00,000	2	5,00,000			2	5,00,000				
.3	Newsletter	1,00,000	Per issue	5	5,00,000	1	1,00,000	1	1,00,000	1	1,00,000	1	1,00,000	1	1,00,
.4	Workshop and public events	4,00,000	Per event	9	36,00,000	1	4,00,000	2	8,00,000	2	8,00,000	2	8,00,000	2	8,00,0
6 1	nagement implementation and rev	riew			20.00.000						10.00.000				10.00
.г	Mid-term review										10,00,000				
.2	Annual learning events										-				10,00,0
	•														
					16 70 00 000		( ( ) 00 000		7 01 00 000		1 51 00 000		71.00.000		04 00 0

Table 26: Detailed activity wise bu	idget for wetland level activities in	wetlands within protected areas
Table 20. Detailed activity wise bu	וויז איפנומווט ופיפו מכנויונופט ווו	wellanus within protected areas

Wetlands		Rate	Unit	Physical	Phase 1 Physical	Phase 1 Amount	Phase 2 Physical	Phase 2 Amount	Phase 3 Physical	Phase 3 Amount	Total Amount	Manikpur Reserve Forest	Mirzapur	Bhokawa Bandha	Lower Khajuri Dam	Tanda Dari Taal	Kanpur	Kanpurnagar
	Area (ba)											3.97	,	31.4		154		3.86
	Circumferance (m2)											1450.63		8674.29		40960.88		1421.66
	No. of inlets											1		0	0	1		0
	No. of outlets											0		0	0	1		0
	Choked inlets											0		0	1	0		1
	Choked outlets											0		0	0	0		0
	Sedimentation											0		1	1	0		1
	Pollution as threat											0		1	1	0		0
	Solid-waste dumping											0		0	1	1		0
	Area covered by water hyacinth											0		0	0	1		0
	Existing Fishery											0		1	1	0		0
	Phasing											3		2	2	2		3
1 Institutional Set-up						0		650000	)	2600000	9100000							
	Workshops for constitution of wetland mitra network	100000	Per Workshop	8	0	0	6	600000	2	2 200000	800000	1		2	1	3		1
	Training and orientation workshop on wetland management	100000	Per Workshop	5	0	0	3	300000	2	2 200000	500000	1		1	1	1		1
	Issue-specific training workshops	100000	Per Workshop	15	0	C	9	900000	e	600000	150000			3	3	3		3
	Finalisation and endorsement of site-management	Lumpsum	Per Wetland	1800000	0			1600000		200000	1800000	100000		300000	300000	1000000		100000
	pian	1	De altrada a d	4500000				4400000		400000	4500000	200000		200000	200000	500000		200000
	Signages (Publication and Installation)	Lumpsum	Perwetiand	1500000	0			1100000		400000	1500000	200000		300000	300000	500000		200000
	brochures)	Lumpsum	Per Wetland	3000000	0			2000000		1000000	3000000	500000		500000	500000	1000000		500000
																_		
2 Enhancing hydrological regimes						0		4640100		200850	4840950							
2.1 Clearing and maintenance of inlets and outlets		2	Person days per 25 inlet/outlet @ Rs 204	2	0		1	5100	1	5100	10200	1		0	0	1		0
2.2 Selective desilting		5	0 Per m3	96615	0		92700	4635000	3915	195750	4830750	1985		15700	0	77000		1930
5 Species and habitat conservation						0		500000		100000	600000							
5.1 Species inventory and population count			Per Wetland	6000000				5000000		1000000	6000000	50000	0	1500000	1500000	2000000		50000
	Training	Lumpsum	Per Wetland															
	Periodic updation	Lumpsum	Per Wetland															
	Conduct species survey - Asian Waterbird Census	Lumpsum	Per Wetland															
	Zoonotic disease surveillance	Lumpsum	Per Wetland															
5.2 Management of invasive species																		
	Removal of water hyacinth and other invasive																_	
	macrophytes											C		0	0	30.8	(	2 O
														L		_		
6 Sustainable tourism development	late an an attable a later attached		De a Martíne d	6500000		0		6750000		3000000	9750000	400000		1000000	4000000	2500000		4000000
	Interpreptation Intrastructure	Lumpsum	Per Wetland	6500000		0		4500000		2000000	6500000	1000000		1000000	100000	2500000		100000
	Boardwalks Wateh Toward	Lumpsum	Per Wetland	1625000		0		1125000		500000	1625000	250000		250000	250000	625000		250000
	watch rowers	Lumpsum	rei wetiand	1625000		U		1125000		50000	1625000	250000		250000	250000	625000		250000
7 Monitoring and review								227500		150000	497500	25000	0	250000	250000	625000		25000
A Monitoring and review	Management plan mid term review (Evternal)		Des Matter d			0		53/500		150000	46/500	25000		250000	20000	025000		25000
	VALAPPINPIN DATI THOSE PINT PVPW (Prototati	Lumpsum	Per wetland	48/481		0		337500		15(888)	48/500	/488		75000	75000	187500		/ / / / /
Table 27. Detailed activit	wise hudget for	wetland level activities	in urban and neri-ur	han wetlands														
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Tubic 27. Detailed detivit	y wise budget for		ni u ban ana pen u	barr wettanus														

3.2	3.1	3			2.2			21	2						<u> </u>													
Selective desilting	Clearing of inlets and out	Enhancing hydrologic		butters	Creation of vegetative			demarcation Wetland demarcation	Wetlands delineation						Institutional Set-up												Wetlands	
	ots	al	Maintenance	Plantation of native species		Removal of encroachments	Placement of geo-tagged boundary pillars		£	Outreach programmes	Signage	Finalisation and endorsement of site- management plan	Issue-specific training	manning and orientation on weband		Phasing	Number of rafters needed	Sewage into wetland projected	Possibility of peripheral plantation	Sorid-waste dumping (1,2,3 yes)	Choked outlets	Choked inlets	Number of inlets and outlets	Pollution as a threat	Circumferance	Area		
50	204		20000	100000		To be done at administrative	8000			300000	200000	50000	50000	50000	100000						•						Rate	
Per m3	Person days per inlet/outlet @ Rs 204 per person day		Per ha	Per ha		finaced every	Per pillar			rer wettand	Per wetland	Per wetland	Per wetland	Per wetland	0.1.1												Unit	
40753.50	200.00		8.24	8.24			296			20	20	20	20	20	20												Physical	
0	0		0	0			0			0	0	0	0	0													Phase I Physical	
0	0	0	0	0			0		0	0	0	0	0	0	0												Phase I Amount	
31400.000	100.000		6.946	6.946			210				- 11	П	11	11						-							Phase 2 Physical	
1570000	20400	1590400	138912.4	694562.2			1680000		2513474.581	3300000	2200000	550000	550000	550000	10450000												Phase 2 Amount	
9353.50	100.00		1.30	1.30			86			1	9	9	9	9													Phase 3 Physical	
467675.0	20400.0	488075	25957.0	129785.0			688000		843742.0345	4300000	1800000	450000	450000	450000	8550000												Phase 3 Amount	
2037675	40800	2078475	164869.44	824347.18			2368000	1	3357216.616	1000000	4000000	1000000	1000000	1000000	1900000										m2	ha	Amount	
410 580 1160 1435 1250 3365 10875	0 0 0 0 0 50 0		0 0 0 0 0 0	0 0 0 0 0 0 0		0 / 10 12 11 22 61	6 7 10 12 11 22 41					1 1 1 1 1 1 1				3 3 3 3 3 2 2	0 0 23 29 25 0 0	0.1 0.1 0.2 0.2 0.2 0 0				0 0 0 0 0 1 0	0 0 0 0 0 1 2	1 1 1 1 1 0 0	621 11 1016 161 064 2177 6133	0.82 1.2 2.32 2.87 2.5 6.73 21.75	Fatehpur M8 Fatehpur M8 2 Fatehpur M8 4 Fatehpur M8 4 Fatehpur M8 5 Sangan v Chakki	
																											Kan nauj	
500 80	0 0		0.40109 0.26836	0.40109 0.26836			7 4				1 1	т т	· ·			2 2	0 0	0 0	0 0	1 1	0 0	0 0	0 0	0 0	668.479 147.2658	1 0.16	Madharpur Mausampur Morara	
																											Kanpurnagar	
925	0		0.535395	0.535395		7					1	1	i i			2	0	0.1	0	'	0	0	0	- i - '	892.3257 1	1.85	Mama Talab	
1335 335 132	0 50 50		0 0.348944 0.661	0 0.348944 0.661							1 1 1	і і і				2 2 3	27 0 27	0.2 0.1 0.2	0 0 0	0 1 1	0 1 0	0 0 1	2 2 0	1 1 1	08.272 (81.5738 103.0	2.67 0.67	Shivrajpur-2 Shivrajpur Sanieran	
s			803	803																					005	2.65		
1065	0		0.579638	0.579638		10	10									2	0	0	0	0	0	0	0	1	966.0634	2.13	prayagraj BELA KCHAR TALAB	
1500 9320	50 0		0 3.188373	0 3.188373		12 33	12 53			1 1	1 1	т т	· ·			3 2	0 50	0 0.5	0	I	0 0	I 0	0 2	1 1	195.177 5313.955	3 18.64	DHOBIYAN BASTI TALAB HANDIA Nivari Tal	
																									1		Varanasi	
1300 2300	0 0		0.653902 (0.96992	.653902 ().96992		16	11 12			1 1	1 1	т т	1 1	1 1		2 2	26 46	0.2 0.4	1 1	1 1	0 0	0 0	0 0	1 1	089.837 1616.53	2.6	Orunagir Tal Chancha Tal	
450	0		I 0	0		0	4				1	1	· ·	1		3	0	0.1	0	1	0	0	0	1	642.1441	0.9	Pandeypur	
			0.	0.																					10		Kaushambi	
1243.5	0		.636047	.636047						-	1	1		1		3	25	0.2	0	0	0	0	4	0	060.079	2.487	Sirathu NP	

- 4	Pollution abatement						0		8955000		6960000	15915000																				
		Survey of wastewater nallahs	20000	Per impacted wetland	15.00	0	0	7.000	140000	8.00	160000.0	300000	1	1	1 1	1	0 0		0	0	1	1	1	1	1	1	1	1	1			0
		Manual scouring of scum and other waste	75000	Per impacted wetland	15.00	0	0	7.000	525000	8.00	600000.0	1125000	1	1	i 1	1	0 0		0	0	I.	1	I.	1	1	1		1	1	1		0
		Installation of waste sieves at inlets	250000	Per impacted wetland	15.00	0	0	7.000	1750000	8.00	2000000.0	3750000	1	1	i   i	1	0 0		0	0	1	1	ı.	1		1		1	1	1		0
		Construction of sand gravel-beds for inflow filtration	700000	Per MLD	2.80	0	0	1.500	1050000	1.30	910000.0	1960000	0.1	0.1	0.2 0.3	2 0.2	0 0		0	0	0.1	0.2	0.1	0.2	0	0	0.5	0.2	0.4	0.1		0.2
		Establishment of floating treatment wetlands	10000	Per Rafter	278.00	0	0	149.000	1490000	129.00	1290000.0	2780000	0	0	23 25	25	0 0		0	0	0	27	0	27	0	0	50	26	46	0		25
		Relocation of dumping sites	500000	Per impacted wetland	12.00	0	0	8.000	4000000	4.00	2000000.0	600000	0	0	0 0		1 0			1	ī	0	1	1	0	-	1	1	1	1		0
																		_													-	
5	Species and habitat cons	ervation					0		4066000		3267000	7333000	-																			
	Creation and Maintenance of	(																														
5.1	People's Biodiversity																															
		Training	50000	Per wetland	20.00	0	0	11.000	550000	9.00	450000.0	1000000	1	1	1 1	1	1 1		1.1	1	1	1	1	1		1		- i - '	- 1 - İ	- 1 <sup>- 1</sup>		
		Creation of People's Biodiversity Registers	100000	Per wetland	20.00	0	0	11.000	1100000	9.00	900000.0	2000000	1	1	1 1	1	1 1	_			1	1	1	1		1		1	1			L 1
		Asian Waterbird Census	200000	Per wetland	20.00	0	0	11.000	2200000	9.00	1800000.0	4000000	1	1	1 1	1	1 1	-	1.1	1	1	1	1	1	1	1	1	1	1	1.1		1.1
5.3	Management of invasive species				0.00																											
		Removal of water hyacinth and other invasive macrophytes	50000	per na per impacted werbod	6.66	0	0	4.320	216000	2.34	117000.0	333000	0	0	0 0	0	0 0		0	0	0	0	0	0	0	1.8	0	1.56	2.76	0.54		0
6	Wetland education and i	nterpretation					0		13500000		7500000	21000000																				
		Interpreptation Infrastructure	500000	Per wetland	20.00	0	0	11.000	5500000	9.00	4500000.0	10000000	1	1	1 1	1	1 1		1	1	1		1	1	1	1	1	1	1	1		1 L
		Watch Towers	500000	Per tower	11.00	0	0	8.000	4000000	3.00	1500000.0	5500000	0	0	0 1	0	1 1		1	0	0	- I	0	- I	1	0	1	1	1	0		1.1
		Walking trails	500000	Per wetland	11.00	0	0	8.000	4000000	3.00	1500000.0	5500000	0	0	0 1	0	1 1		1	0	0		0		1	0	1	1	1	0		1.
7	Monitoring and review								8500000		600000	14500000																				
		Monitoring	2,50,000	0 Per wetland	20.00	0	(	11.000	2750000	9.00	2250000	5000000	1	1	1 1	1	1 1	_	1	1	1	1	1	1	1		1	1				
		Monitoring (Representative Sites)	5,00,000	0 Per wetland	9.00	0	(	6.000	3000000	3.00	1500000	4500000	0	0	0 1	0	0 1	_	1	1	1	0	0	1	0	0	1	0	1	0		
		Management plan mid-term review (External)	2,50,000	0 Per wetland	20.00	0		11.000	2750000	9.00	2250000	5000000	1	1	1 1	1	1 1		1	1	1	1	1	1	1		1		1	1		
							0		41074874.58		27608817.03	68683691.62																				

	Wetlands		Rate Unit	Physical	Phase I Physical	Phase I Amount	Phase 2 Physical	Phase 2 Amount	Phase 3 Physical	Phase 3 Amount	Amount	Hardoi Terwakulli	Arwal Paschim	Murwa Shahabud	Fatehour	Audhara	Baschani	Paliya Bujurg I	Paliya Bujurg 2	Bhalewa-2 Kan nau j	kmilpur Dígan	Gangdharapur Kanburnagar	Saibasi Pond	Katri Jaisamau	Katri bajidpur	Prataparh Benti pA	Ramdas Patti	Devar Patti	Prayagraj	Bada Talab (rura	Upardaha (Rural	Bhiti Talula Tala	N umaiya Dahi Jh eel Kh eduva Tal (Rural)
		Area									na	6.47	12.82	15.29		80.69	10.37	20.24	34.68	14.19	12	12	5.81	6.16	15.03	427.07	5.	5 34.53		6.9	120	65	578.9
		Circumferance									m2	2108.998	3781.264	4431.736		21654.76	3136.059 5	735.3138 9	538.0733 4142	052	3565.32 35	65.318	1935.188	2027.36	4363.2655	112873.59	1853.5495	9498.57		2222.238	32007.01	17522.82	52860.4996
		No. of inlets and outlets										0	2	2		2	2	0	0	0	0	0	0	0	- I.	2	0	0		1	1	3	5
		Choked inlets										0	1	1		0	0	0	0	0	1	0	- I.	1	0	0	0	0		0	0	0	0
		Choked outlets										0	1	1		0	0	0	0	0	0	0	- I.	0	0	0	0	0		0	0	0	0
		Pollution as a threat										0	0	0		0	0	0	0	0	0	0	- I.	1	- I.	0	1	- I.		1	1	1	
		Solid-waste dumping										0	0	0		1	1	- I	- I	0	1	1	0	0	0	0	0	0		0	1	1	0
		Area covered by water hyacinth										0	0	0		0	0	0	0	0	0	0	0	0	0	0		0 0		1		0	
		Wetland agriculture										0	0	0		1	1	1	1	1	1	0	1	1	1	0	1	1		1	i	1	
		Existing Fishery										0	0	0	-	0	0	0	0	0	0	0	0	L.	1	0	0	0		0	1	1	
		Phasing										2	2	2		3	3	3	3	2	3	2	2	1	2	3	3	3 3		1	1	2	
1	Institution al Set-up					36800	00	962000	0	6220000	19520000																						
		Constitution of wetland mitra network	100000 Per network		59 1	11 110000	10 2	9 290000	0 19	9 1900000	5900000	1	I.	1		2	1	Т	1	1	- 1	Т	1	Т	1	4	1	1		- 1	2	1	5
		Training and orientation on wetland management	50000 Per network		59	11 55000	10 3	145000	0 19	950000	2950000	1	I.	1		2	1	1	1	1	- 1	1	1	Т	1	4	1	1		1	,	1	
		Issue-specific training	50000 Per network		59	11 55000	10 7	9 145000	0 19	950000	2950000	1	1	1		2	1	1	1			1	1	1	1	4	1				2	1	
		Finalisation and endorsement of site-management plan	f 50000 Per wedand		47	6 30000	10 2	135000	0 14	700000	2350000	1	I	1		1	1	Т	1	1	1	1	1	I.	Т	1	1	1		1	1	1	1
		Signage	15000 Per signage	1	18 2	22 33000	10 5	8 87000	0 38	570000	1770000	2	2	2		4	2	2	2	2	2	2	2	2	2	8	2	2		2	4	2	10
		Outreach programmes	50000 Per programm per 50 ha	2	72	17 8500	00	160000	10 23	3 1150000	3600000	1	1	1		2	Т	1	1	1	1	1	1	T	T.	8	1	1		1	2	2	10
2	Wetlands d	elineation & demarcation				191200	00	1634400	10	17136000	52600000																						
2.1	Wetland demarcation																																
		Placement of geo-tagged boundary pillars	8000 Per pillar (placed every	65	575 239	90 1912000	20-	1634400	0 2142	17136000	52600000	21	38	44	-	217	31	57	95	41	36	36	19	20	44	1129	19	95		22	320	175	1529
_		Removal of encroachments	To be done at administrative level												-																		
3	Enhancing I	hydrological regimes				714	00	17340	10	71400	316200														_								
		,	Person days pe	r																													
3.1	Clearing inlets and outlets		25 inlet/outlet @ Rs 204 per person day		62	14 7140	00 3	84 17340	10 14	4 71400	316200	0	2	2		2	2	0	0	0	0	0	0	0	1	2	0	0		T	T	3	5
_																									_								
4	Pollution a	batement				5000	00	200000	10	1000000	350000																						
		Constructed wetlands	Per impacted 500000 wetland with identified inflow	vs	7	I 50000	00	4 200000	10 2	2 100000	350000	0	I	0		0	0	0	0	0	I	0	I	0	0	0	0	0		0	0	0	0

# Table 28: Detailed activity wise budget for wetland level activities in floodplain agriculture wetlands

5 5	Species and h	habitat conservation					6998870		7065168.064		4650420	18714458.06																					
5.1 c F	Creation and Maintenance of People's Biodiversity Registers																																
	т	Fraining	5000	Per Gram	59	п	550000	29	1450000	19	950000	2950000	1	1	1	2	1	1	1	1	1	1	1	1	L.	4	1	i – 1		1	2	I.	5
	c	Creation of People's Biodiversity	10000	0 Per Gram Panchayat	59		1100000	29	2900000	19	1900000	5900000	1	1	1	2	1	1	I.	1	1	1	1	1	1	4	1	1 1		Т	2	I.	5
5.2	Habitat		Lump sum				1550000		2275000		1725000	5550000	75000	75000	75000	150000	75000	75000	75000	75000	75000	75000	75000	75000	75000	600000	75000	) 75000	-	75000	250000	75000	750000
		Mapping of key habitat areas		-											_								_			_							
	1	Papping of fish breeding and											_								_		_										
		proving to monitor habitats																															
		Community renzitiration																					_										
53	Mangement	community sense action													_					_						_							
	F	Removal of water hyacinth and other invasive macrophytes	1000	10 Per ha	431.4458064	379.887	3798870	44.0168064	440168.064	7.542	75420	4314458.064	0	0	0	0	0	0	0	0	0	0	0	0	0	0	C	) O	-	2.07	84	0	231.564
6	Resource de	velopment and livelihoods					13100000		16100000		7800000	37000000			_					_													
6.1	Sustainable fish	neries development	Lump sum				6100000		3600000		300000	10000000				0	0	0	0	0	0	0	0	100000	100000	0	C	0 د		0	1000000	500000	5000000
	F	Formation of user groups and si	etting up rules and re	egulation s																													
	1	Microcredit support																															
	1	Training on sustainable fisheries	s development																														
	/	Assistance for craft and gear																															
	0	Construction and upgradation o	of jetties																														
6.3	Promoting sustainable		Lump sum				7000000		12500000		7500000	27000000				1000000	500000	500000	500000	500000	500000	0	500000	500000	500000	0	500000	500000		500000	1500000	000000	3000000
	1	Training through KVKs on sustainable wetland agriculture																															0
	1	Microcredit support to farmers																															1
_	1	Wetland agro-product based																															1
7	Monitoring a	and review					4500000		13500000		13000000	31000000	400000	400000	400000	800000	400000	400000	400000	400000	400000	400000	400000	400000	400000	1500000	400000	400000		400000	1200000	800000	2000000
	1	Monitoring	2,50,00	0 Per wetland	47	6	1500000	27	6750000	14	3500000	11750000	1	1 1	1	1	1	1	1 1	1	1	1	1	1 1	1	1	1	( T		1	1	1	1
		- Monitoring (Representative	5,00,00	0 Per wetland	15	3	1500000	0	0	12	6000000	7500000	0	0	0	1	1	1	1	0	1	0	0	0	0	1	1	<u> </u>		0	0	0	1
		Management plan mid-term	2,50,00	0 Per wetland	47	6	1500000	27	6750000	14	3500000	11750000	1	1	1	1	1	1	1	T.	1	1	1	1	1	1	1	( T		1	1	1	1
				-	-																						-	-					

w	etlands		Rate	Unit	Physical	Phase I Physical	Phase I Amount	Phase 2 Physical	Phase 2 Amount	Phase 3 Physical	Phase 3 Amount	Amount	Rae Bareli	Baraila įhil	Gangsari Tal	Baburta Tal	Raipur Thappa H	Bara Tal	Osraia pie Bakulahi Rver	Bakwa Tal	lamoli al	Maraut Tal	Dudhwan Tal	K ondra Jhil	Jasodi Tal	Paul Tal	Bara Sawayaya H	Unnao Mela Ramkunwa	Maraunda	Dhanuhikh eda 1a	Chaterapur lake	sant Ravidas N	Gonda Shubans	Samdha Tal	Kurauna Tal	Pura Rasai La Misengur	Belwan	jogiya Dari Nala	Kamawati nah
		Area												16.57	26.89 1	1.01 2	9.59 9	5.4 5.	11 168.55	15.63	3 11.71	1 12.87	34.91	12.72	38.11	8.83	15.1	10.24269	63.27	11.42	5.95 12	9	13.09	123.15	5.57 13.	72	49.51	45.22 8	33.6
	-	Circumferance										- 1		4768.823 748	6.585 3304	602 8197	627 25528	.62 1750.8	43 44792.6	4521.275	5 3488.947	3794.432	9598.644	3754.929	10441.36	2730.502	4381.7	3102.532	17067.22	3412.576 19	2.057 3802.3	32	3852.368	32836.56 18	/1.984 4018.2	.78	13443.54	12313.77 2243	39.54
		No. of inlets and outlets												1	4	2	1	2	5 4	6	0 1	<u> </u>	0	1	1	1	0	0	1	0	2	0	2	6		2	1	1	
_	-	Choked inlets												1	0	0	0	0	0 0	0 0	0 0	0 0	0	0	0	0	0	0	0	1	1	0	0	0	0	•	1	1	
_		Choked outlets											-	0	0	0	0	0	0 0	0 0	0 0	0 0	0 0	0	0	0	0	0	0	0	1	0	0	0	0	<u> </u>	0	0	
_	-	Pollution as a threat							_				-	0	0	1	-	0	0 1	1	1 1	1 1	1	1	0	0	- 1	0	0	1	1	0	1		0	<u>•</u>	- 1		
_		Area covered by water													1	0	0	0	0 1				1	1	0	0		1	0	0	0	0	0	0	0	_	1		_
		Wetland agriculture													0															-	0	- -				÷			
	_	Existing Fishery													0		1	0	1 1						0			0		1		1		0	0				
		Phasing												2	2	3	3	3	2 2	2 3	2 2	2 1	2 2	2	2	2	2	2		3	2	2	2		1	3	2	2	
l Ins	titution Set-up						368000	0	962000	0	6220000	19520000		-																	-		-			i i	-		
	¢	Constitution of wetland mitra network	1 0000	00 Per network	5	9 1	1 10000	0	29 290000	0 19	1 900000	5900000						2							1				1	1		1			1	1		1	
	,	Training and orientation on wetland management	500	00 Per network	5	59	11 55000	00	29 145000	d 19	950000	2950000						2	1 3						1							1				1			
		Issue-specific training	500	00 Per network	5	59	11 55000	00	29 145000	d 19	950000	2950000		1	- 1	1	1	2	1 3		1 1	<u> </u>	1	1	1	1	1	1	1	1	1	1	1			1	1	1	
		Finalisation and endorsement o site-management plan	500	00 Per wetland	4	17	6 30000	00	27 135000	c 14	700000	2350000		(	-		-										1				1	1	1	1		1	- 1	1	
	Sg	gnage	1 5000	Per signage	118	22	330000	51	8 870000	38	570000	1770000		2	2	2	2	4	2 4	2	2 2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	
	c	utreach programmes	50000	per 50 ha	7	2 1	85000	0	32 160000	0 23	1150000	3600000			-	-	-	1	-	•							_	_	3							_! _!	_		
2 ₩ 6	etlands de	lineation & demarcation					1912000	10	1634400	0	17136000	52600000																											
2.1 We	idand narcation																																						
	1	Placement of geo-tagged boundary pillars	80	00 Per pillar (placed every	657	5 235	1912000	0 20	43 1634400	0 2142	17136000	52600000		48	75	33	82	255	18 44	ε 4	45 3.	6 3	E 96	6 31	10-	27	44	3	17	3/1	20	38	3)	328	19	40	13	1 123	2
		Removal of encroachments	To be done at administrative level																																				
1 5-1		advertised as shown					71.47		173.00		71.400	21/200															_									- 1	_		
3 Enr	nancing hy	yorological regimes		Person days	e		/140	10	1/340		/1400	316200																								-			
3.1 inle out	aring its and dets		:	25 Rs 204 per person day	6	·2 I	14 7140	10	34 17340	0 14	71400	316200		I	•	2	1	2	5		¢	1		0 I			o	(		0	2	o	3	5	1	2		1	
4 Po	ulution ab	atement					50000	10	200000	0	1000000	3500000																											
		Constructed wetlands	5000	Per impacted		7	1 50000	10	4 200000	0 2	1000000	3500000		۵	c	c	c	e	c			c		o 0	0 O	0	o				0	0	0		,	0		<b>,</b> ,	

# Table 29 : Detailed activity wise budget for wetland level activities in floodplain agriculture wetlands

4 Pc	ollution al	patement				500000		2000000		1000000	3500000																													
		Constructed wetlands	Per impacted 500000 wetland with identified infi	ws	7	500000	4	2000000	2	1000000	3500000		o	o	o	٥	٥	o	1	o	a	c	c	c	¢	¢	o		c	c	I	¢	0				• •	¢.	1	
100						(000070		70/71/0 0/4		4150420	1071 4470 04																_										_			
s sp	pecies and	nabitat conservation				6998870		7065168.064		4650420	18/14458.06	-																					_							
Cri Ma S.1 of I Bio Rej	reation and aintenance People's odiversity agisters																																							
		Training	50000 Per Gram	55		550000	29	1450000	19	950000	2950000		1	1	1	1	2	1	2	1	1	1	1			1	1		1		1		1		1					1
			Panchayat						10																								_						$\rightarrow$	
		Creation of People's Biodiversity	Panchavat	31	, II	1100000	29	2900000	19	1900000	5900000		1	- 1	- 1		2	-	2	- 1						1			-		-	-	1	_				-	_	1
5.2 Hat	abitat		Lump sum			1550000		2275000		1725000	5550000		75000	75000	75000	75000	50000	75000	250000	75000	75000	75000	75000	75000	75000	75000	75000	750	00 150	000 75	000 7	5000 7	5000	7500	250000	75000	75000	75000	75000	150000
		Mapping of key habitat areas										_																_		_	_		_							
		mapping of tish breeding and		_														-	-								_				_	_	_							
		Formation of community																																						
		groups to monitor habitats										_						_		-								_				_	_	_						
5.2 Ma	10.00000	Community sensitization										_															_				_		_							
3.3 114	angement	Removal of votor buacieth and										_						-									_				_		_							
		other invasive macrophytes	10000 Per ha	431.4458064	379.887	3798870	44.0168064	440168.064	7.542	75420	4314458.064		4.971	0	0	0	0	0	0	0	0	0	0	٥	c	٥	0	3.0728	06 25.	308 3.	426 1	1.785	5.16	3.92	36.945		4.116	¢	c	25.10
														_				_	_	_									-	_										
6 Re	esource de	velopment and livelihoods				13100000		16100000		7800000	37000000																													
6.1 Sus	istainable fis	heries development	Lump sum			6100000		3600000		300000	10000000		100000	0	100000	100000	0 11	00000	500000	0	0	0	o	100000	d	a	100000		d	c 100	000 10	0000 10	0000		i é		0	200000	200000	500000
		Formation of user groups and se	atting up rules and regulations																																					
		Microcredit support																																						
		Training on sustainable fisheries	development																																					
		Assistance for craft and gear																									_													
		Construction and upgradation o	of jetties																																					
6.3 Pi	romoting		Lump sum			7000000		12500000		7500000	27000000	51	00000	0 5	00000 5	10	500	20	000000 5	00000 9	500000	500000	500000	500000	500000	500000	500000	0	0	5000	00 0	500	000	500000	1500000	500000	500000	500000	500000	1000000
	ustainable	Training through KVKs on										_						_	_					_								_	_							
		sustainable wetland agriculture																																						
		Microcredit support to farmers																																						
		Wedand agro-product based																																						
7 M a	onitoring a	and review				4500000		13500000		13000000	31000000		400000	400000	400000	400000	00000 4	00000	200000	400000	400000	400000	400000	400000	400000	400000	400000	4000	00 800	000 400	000 40	0000 40	0000	40000	1200000	40000	400000	400000	400000	80000
		Monitoring	2,50,000 Per wedand	43	6	1 500000	27	6750000	14	3500000	11750000		1	1			1	- 1	1	1	1	1	1	1		1	1		1	1	1	_			!					
		Monitoring (Representative	5,00,000 Per wedand	15	3	1 500000	0	0	12	6000000	7500000		0	0	1	1	1	0	0	0	0	٥	0	0	d	٥	0		0	1	1	c	0				0	6	c	
		Management plan mid-term	2,50,000 Per wedand	43	6	1 500000	27	6750000	14	3500000	11750000		1	1		- 1	1	- 1	1	1	1	1	1	1		1	1	_	-	1	1	_								
			I		1																																			

# Table 30: Detailed activity wise budget for wetland level activities in ponds

Wetlands		Rate Unit	Physical	Phase I	Phase I Amount	Phase 2	Phase 2 Amount	Phase 3	Phase 3 Amount	Amount	rdoi nj Nan eriya kihera kihera nsála tdar ampur	ewa-l lewa-l dara arpur sawan Pilihini	rau ra Gram maj	<b>urnagar</b> ara Rai man as Talab dupur	hambi hambi ktpur shur uspur sara	aparh suli kuri athpur ychandra k Tihaj k Tihaj	ragraj 3 (Rural)	Bareli pur Tal da Tal	pur pond aon Pond Ljheel Lpeel Lpond S Pond	anasi
				Physical		Physical		Physical			Alga Ha Sani Rh Ra Ra Ra Ra Ra Ra Ra Ra Ra Ra Ra Ra Ra	Fath Kury Kury Haron	a span	Kanpa Mad G. Rehn	Para Para Para Para Para Para Para Para	Prat Dashi Dashi Dashi Dashi Dashi Saray ja (Mala Nars	TALA	Bhai	Kushraj Undig Undig Rawe Rawe Rawe	Var
	Area			_						ha	3.35 2.28 0.98 1.73 0.86	2.97 4.5 4.18 2.86 4.49	5	1.87 2.7 1.17	1.28 1.0914 0.9 5.26	1.3 2.27 2 3	.2 2.14	4.46 4.77	3.095 2.3 2.74 4.921 1.2 2.2	<u>a</u>
	Gircumferance									m	1287 1006 664 861 631.6	1187.3 1590 1505.9 1158 1587.57	1721.875	897.59 ### 713.2	743 692.55 641 1790	742 1002.9 931.828 1195.177 721.	5 969	1580 1661	1220 998 1127 1701 722 987	1
	No. of inlets and outlets										0 0 2 3 0	2 0 2 0 2	0	0 0 2	2 2 2 2	2 0 0 0 0	0	1 0	1 2 0 1 1 0	- 1
	Pollution as a threat											0 1 1 1 1	0	1 1 0	1 1 0 0			<u> </u>	1 1 1 1 0 0	- 1
	Choked milets											0 0 0 0	1	1 1 0	1 0 0 0		0	0 0		- 7
	Solid-waste dumping			-								0 0 0 0 0		1 0 0	1 0 0 0			0 0		17
	(presence and absence)		-								0 1 0 1 0	1 0 0 0 0	1	0 0 0	0 0 0 0	0 0 0 0 0	0	0 1	2 0 0 0 1 0	- 1
	hyacinth (>10%)										0 0 1 1 1	1 I I I I I	1	1 1 1	1 1 1 1	1 1 1 1 1	1.1	1.1	1 1 1 1 1 1	
	Existing Fishery( based on master sheet data sertion 5.3																			
	a and b)										0 1 1 0 1	0 0 0 1	0	0 0 0	0 0 1 1	1 0 0 1 0	0	0 0	1 1 1 0 1 1	
	Increased sediment deposition																			
	Phasing (priortization as per												0	1 0 0	0 0 0 0					
	action plan)										2 2 3 2 3	3 3 2 3 2	3	3 2 3	2 2 3 3	3 3 3 3 3	3	2 2	1 3 2 2 3 2	
tutional Set-up	•				8,00,00	2	1,12,00,000	)	1,52,00,000	2,72,00,000										
	Constitution of wetland mitra	1.00.000 Per werland	1 34	1	1 00 00	14	14 00 000	19	19.00.000	34.00.000										1
	network Training and origonation on				.,							1 1 1 1 1	1		1 1 1 1		- 1	1 1		-
	wedand management	50,000 Per wedanc	34	1	50,00	14	7,00,000	19	9,50,000	17,00,000			1				1.1	1 1	1 1 1 1 1 1 I	
	Issue-specific training	50,000 Per wedand	1 34	1	50,00	14	7,00,000	19	9,50,000	17,00,000			1	1 1 1	1 1 1 1		1	1 1	1 1 1 1 1 1	1
	Finalisation and endorsement	50,000 Per wetland	34	1	50,000	14	7,00,000	19	9,50,000	17,00,000										
	Signage	50,000 Per wetland	34	1	50,000	14	7,00,000	19	9,50,000	17,00,000							- <u>-</u>			
	Outreach programmes	5,00,000 Per wetland	34	1	5,00,000	14	70,00,000	19	95,00,000	1,70,00,000	1 1 1 1	1 1 1 1 1	1	1 1 1	1 1 1 1	1 1 1 1 1	1	1 1	1 1 1 1 1	1
																				1
ids ition &					96,000		15,68,277		19,65,711	36,29,989										
d demarcation																				1
	Placement of geo-tagged	Per pase	. 197	12	96.000	166	13 28 000	215	17 20 000	21.44.000										
	boundary pillars	intervention (praced every			70,000	100	13,20,000	113	17,10,000	51,44,000	13 10 7 9 6	12 16 15 12 16	17	9 11 7	7 7 6 18	7 10 9 12 7	10	16 17	12 10 11 17 7 10	-
		To be done at																		
	Removal of encroachments	the																		
		level																		
on of vegetative																				-
	Plantation of native species	1,00,000 Per ha	4.0499067	0		2.002	2,00,231	2.05	2,04,759	4,04,991	0.405 0.28	0.375 0.4706 0.37		0.2881				0.493	0.36	4
	Maintenance	20,000 Per ha	4.0499067	0		2.002	40,046	2.05	40,952	80,998	0.405 0.28	0.375 0.4706 0.37		0.2881				0.493	0.36	-
ing																				
logical					82,467		10,98,213		14,02,217	25,82,897										
																				4
ring inless and		Person days																		
ng mes ans		25 @ Rs 204 per	r 30	1	5,100	13.000	66,300	16.00	81,600	1,53,000										
		person day									0 0 2 3 0	2 0 2 0 2	0	0 0 2	, , , , ,	2 0 0 0 0	0		1 2 0 1 1 0	
e desilting		50 Per m3	48597.940	1547.344	77.367	20638.263	10.31.913	26412.3	13.20.617	24.29.897										
										- 11-11-1	1675 1140 492 865 430	1485 2250 2090 1430 2245	2500	935 ### 585	642 545.71 449 2630	640 1135 1000 1500 600	1070	2230 2385	1547 ::::::: 370 2461 602 1105	-
n abatemen	t				7,45,000		50,85,000		50,85,000	1,09,15,000										
	Survey of wastewater nallahs	20,000 Per impacted	27	1	20,000	13.000	2,60,000	13	2,60,000	5,40,000		0 1 1 1 1			1 1 0 0					1
	Manual scouring of scum and other waste materials	75,000 Per impacted werland	27	1	75,000	13.000	9,75,000	13	9,75,000	20,25,000										1
	In-situ inflowing nallah	2,50,000 Per impacted	27	1	2,50.000	13.000	32,50.000	13	32,50.000	67,50.000										1
	treatment	wedand Per impacted		- i - i - i - i - i - i - i - i - i - i								0 1 1 1 1	0	1 1 0	1 1 0 0			1 1	1 1 1 1 0 0	-
	Relocation of dumping sites	2,00,000 wedand	8	2	4,00,000	3.000	6,00,000	3	6,00,000	16,00,000	0 1 0 1 0	1 0 0 0 0	1	0 0 0	0 0 0 0		0	0 1	2 0 0 0 1 0	

5	Species and habitat conservation						3,50,000		45,00,000		64,50,000	1,13,00,000										
5.1 M B	Creation and Maintenance of People Biodiversity Registers																					
		Training	50,000	Per wedand	34	1	50,000	14.000	7,00,000	19	9,50,000	17,00,000			1					1 1		1
		Creation of People's Biodiversity Registers	1,00,000	Per wedand	34	1	1,00,000	14.000	14,00,000	19	19,00,000	34,00,000			1					1 1		1
5.2 s	labitat mapping and surveillance																					
		Mapping of key habitat areas																				
		Formation of community																				
		Community sensitization																				
		Surveillance and reporting																				
5.3	Mangement of invasive																					
	pecies	Removal of water hyacinth and other invasive	2,00,000	Per impacted wetland	31	Т	2,00,000	12.000	24,00,000	18	36,00,000	62,00,000	0 0 1 1 1	1 1 1 1 1		1 1 1	1 1 1 1			1 1		
																						_
6 d	Resource development and ivelihoods						16,54,734		2,11,11,058		2,99,02,233	5,26,68,025										
		Sustainable fisheries development	50,000	per ha per impacted wetland	53.36	3.094688	1,54,734	22.221	11,11,058	28.0	14,02,233	26,68,025	0 2.28 0.98 0 0.86	0 0 0 0 4.49	0	0 0 0	0 0 0.9 5.26	1.3 0 0 3 1.2	0	4.46 0	3.095 2.3 2.79 4.92 1.2 2.21	1.12 11
		Water hyacinth-based enterprise	5,00,000	l group per wetland	32	1	5,00,000	12.000	60,00,000	19.0	95,00,000	1,60,00,000	0 0 1 1 1									
		Multi-purpose shelter	5,00,000	Per wetland	34	1	5,00,000	14.000	70,00,000	19.0	95,00,000	1,70,00,000			1			1 1 1 1	1	1 1		1
		construction of approach roads	5,00,000	Per wetland	34	1	5,00,000	14.000	70,00,000	19.0	95,00,000	1,70,00,000	<u> </u>	<u> </u>	1.1	1 1 1	1 1 1 1		1	1 1		1
												_			_							_
7	review						3,00,000		57,00,000		67,00,000	1,27,00,000										
		Monitoring Monitoring (Representative	2,50,000	Per wetland Selected	34	1	2,50,000	14.000	35,00,000	19	47,50,000	85,00,000			- 1				1	1 1		
		Sites)	5,00,000	wetland	5	0		3.000	15,00,000	2	10,00,000	25,00,000	0 1 0 0 0	1 0 0 0 0	1	0 1 0	0 0 0 0	0 0 0 0 0	0	1 0	0 0 0 0 0	0 0
		Management plan mid-term review (External)	50,000	Per wedand	34	1	50,000	14.000	7,00,000	19	9,50,000	17,00,000				- i i i	1 1 1 1		1	1 1		

### Financing

The management plan may be financed under the National Mission of Clean Ganga (NMCG) under the relevant scheme guidelines. Conservation of village ponds may be financed under Amrut Sarovar Scheme. For wetlands within the protected area network, it is recommended that the management interventions and actions are linked with protected area plan implementation. Additional sources of funds may be sourced from National Plan for Conservation of Aquatic systems (wherein 40% State funds will have to be provided as State share).

# 9. Reference

- Brinson, M.M. 1993. A hydrogeomorphic classification for wetlands, Technical Report WRP–DE–4, U.S. Army Corps of Engineers Engineer Waterways Experiment Station, Vicksburg, MS. http://el.erdc.usace.army.mil/wetlands/pdfs/wrpde4.p
- Butchart, H. M. et. al. (+ 44 authors). (2010). Global Biodiversity: Indicators of Recent Declines. Science. Vol 328, Issue 5982. Pp. 1164-1168.
- Central Pollution Control Board. (2013). Pollution Assessment: River Ganga, 206. <u>http://cpcb.nic.in/upload/NewItems/NewItem\_203\_Ganga\_report.pdf</u>. Accessed 1 Apr 2019.
- Finlayson, C Max, Nick Davidson, Dave Pritchard, G Randy Milton, and Heather Mackay. 2011. "The Ramsar Convention and Ecosystem-Based Approaches to the Wise Use and Sustainable Development of Wetlands." Journal of International Wildlife Law & Policy 14 (3–4): 176–98.
- Finlayson, C Max. 2012. "Forty Years of Wetland Conservation and Wise Use: EDITORIAL." Aquatic Conservation: Marine and Freshwater Ecosystems 22 (2): 139–43. https://doi.org/10.1002/aqc.2233
- Kanaujia, A and Kumar, A. (2013). Amphibians of Uttar Pradesh and their ecological importance. *In* Water & Biodiversity. Souvenir (2013) published by the Uttar Pradesh State Biodiversity Board.
- Mao, H., Kathuria, D., Duffield, N., & Mohanty, B. P. (2019). Gap filling of highresolution soil moisture for SMAP/sentinel-1: a two-layer machine learningbased framework. Water Resources Research, 55(8), 6986-7009.
- McFeeters, S.K. (1996). The use of the Normalized Difference Water Index (NDWI) in the delineation of open water features, International Journal of Remote Sensing, 17:7, 1425-1432.
- McInnes and Everard 2017. Rapid Assessment of Wetland Ecosystem Services (RAWES): An example from Colombo, Sri Lanka. Ecosystem Services. Volume 25, June 2017, Pages 89-105
- Millennium Ecosystem Assessment (2005). (*Ed.*): Rashid Hassan, Robert Scholes and Neville Ash. Published by Island Press, 1718 Connecticut Avenue, Suite 300, NW, Washington, DC 20009.
- Pekel, J.-F & Cottam, Andrew & Gorelick, Noel & Belward, Alan. (2016). Highresolution mapping of global surface water and its long-term changes. Nature. 540. 10.1038/nature20584.
- Rahmani, A.R., Kumar, B., Ahmad, S., Mehta, P. & Rahman, F. (2019). Sarus Crane in North Uttar Pradesh: Status survey of Sarus and mapping of its wetland habitats. Bombay Natural History Society, Mumbai, pp 1 - 109.
- Ramsar Convention on Wetlands. (2018). Global Wetland Outlook: State of the World's Wetlands and their Services to People. Gland, Switzerland: Ramsar Convention Secretariat.

- Ramsar Convention Secretariat. (2010): Laws and institutions: Reviewing laws and institutions to promote the conservation and wise use of wetlands. Ramsar handbooks for the wise use of wetlands, 4th edition, vol. 3. Ramsar Convention Secretariat, Gland, Switzerland
- Reed, P.B. Jr. (1988). National list of plant species that occur in wetlands: national summary. U.S Fish Wildl. Serv. Biol. Rep. 88 (24). 244 pp.
- Rouse, J.W., Haas, R.W., Schell, J.A., Deering, D.W., Harlan, J.C., 1974. Monitoring 915 the vernal advancement and retrogradation (Greenwave effect) of natural vegetation. 916 NASA/GSFCT Type III Final Report. Greenbelt, MD, USA: NASA/GSFCT.
- Sarkar, U. K., S.C Rebello., G.E Khan., V.K Dubey., A.K Pathak and S.P Singh. (2013). Patterns of fish biodiversity in Uttar Pradesh: current status and challenges for sustainable management of resources. *In* Water & Biodiversity. Souvenir (2013) published by the Uttar Pradesh State Biodiversity Board.
- Shi, Z., Lamb, H. F., & Collin, R. L. (1995). Geomorphic change of saltmarsh tidal creek networks in the Dyfi Estuary, Wales. Marine Geology, 128(1-2), 73-83.
- Singh, S., Basu, D., Tripathi, A., Singh, R and Singh, Ram. (2009). An evaluation of distribution, status and abundance of freshwater turtles in Uttar Pradesh. In book: Freshwater Turtle and Tortoises of India- WII ENVIS Bulletin 2009 (pp.81-89). Published by Wildlife Institute of India, Dehradun.
- Sinha, Rajiv, Shivika Saxena, and Manudeo Singh. "Protocols for Riverine Wetland Mapping and Classification Using Remote Sensing and GIS." *Current Science* 112, no. 7 (2017): 1544–52.
- Sundar, K.S Gopi and Choudhury, B.C. (2006). Conservation of the Sarus Crane (*Grus antigone*) in Uttar Pradesh, India. Journal of the Bombay Natural History Society. 103.

# Annexes

#### Annex 1

# List of wetland plant species

Family	Scientific name	Common english name	Туре
Alismataceae	Sagittaria latifolia	Arrow head	Emergent hydrophytes
Amaranthaceae	Alternanthera philoxeroides	Alligator weed	Moist loving hydrophytes
Amaranthaceae	Alternanthera sessilis	Sessile joy weed	Moist loving hydrophytes
Apiaceae	Centella asiatica	Indian coinwort	Moist loving hydrophytes
Apiaceae	Bacopa monenieri	Pennywort	Moist loving hydrophytes
Araceae	Pistia stratiotes	Water lettuce	Free floating hydrophytes
Asteraceae	Xanthium strumarium	Rough cockleburr	Emergent hydrophytes
Cannabaceae	Cannabis sativa	Hemp	Emergent hydrophytes
Ceratophyllaceae	Ceratophyllum demersum	Horn wort	Submerged hydrophytes
Convolvulaceae	lpomoea spp.	lpomoea spp.	Emergent hydrophytes
Fabaceae	Oxalis tetraphylla	Four leaf clover	Free floating hydrophytes
Hydrocharitaceae	Hydrilla verticillata	Water thyme	Submerged hydrophytes
Lemnaceae	Lemna minor	Duck weed	Free floating hydrophytes
Menyanthaceae	Nymphoides hydrophylla	Crested floating heart	Submerged hydrophytes
Nelumbonaceae	Nelumbo nucifera	Lotus	Emergent hydrophytes
Nymphaeaceae	Nymphaea caerulea	Blue water lily	Emergent hydrophytes
Oxalidaceae	Oxalis acetosella	Wood sorrel	Emergent hydrophytes
Plantaginaceae	Veronica anagallis-aquatica	Water speedwell	Emergent hydrophytes
Poaceae	Phragmites spp.	Common reed	Moist loving hydrophytes
Polygonaceae	Polygonum plebeium	Knot weed	Moist loving hydrophytes
Polygonaceae	Persicaria hydropiper	Water pepper	Moist loving hydrophytes
Pontederiaceae	Eichhornia crassipes	Water hyacinth	Free floating hydrophytes
Potamogetonaceae	Potamogeton nodosus	Long leaf pond weed	Submerged hydrophytes
Ranunculaceae	Ranunculus sceleratus	Cursed buttercup	Emergent hydrophytes
Trapaceae	Trapa natans	Water chestnut	Free floating hydrophytes
Typhaceae	Typha spp.	Cattail	Moist loving hydrophytes
Zosteraceae	Zostera marina	Eel grass	Submerged hydrophytes

Family	Common name	Scientific name
Cyprinidae	Hamilton's barila	Barilius bendelisis
Bagridae	Gangetic mystus	Mystus mystus
Clariidae	Walking catfish / Magur	Clarias batrachus
Cyprinidae	Rohu	Labeo rohita
Cyprinidae	Spotfin swamp barb	Puntius sophore
Cyprinidae	Common carp	Labeo catla
Cyprinidae	Ticto barb	Pethia ticto
Cyprinidae	Silver carp	Hypophthalmichthys molitrix
Cyprinidae	Carp	Catla catla
Cyprinidae	Mrigal carp / White carp	Cirrhinus mrigala
Cyprinidae	Orangefin labeo	Labeo calbasu
Cyprinidae	Ticto barb	Puntius ticto
Bagridae	Striped dwarf catfish	Mystus tengra
Siluridae	Helicopter catfish	Wallago attu
Mastacembelidae	Zig-zag eel	Mastacembelus armatus
Channidae	Snakehead	Channa marulius
Channidae	Spotted snakehead	Channa punctatus
Channidae	Striped snakehead / Mudfish	Channa striatus
Channidae	Dwarf snakehead	Channa gachua

# Annex 3

# List of amphibian species

Family	Common name	Scientific name
Bufonidae	Common Indian Toad	Duttaphrynus melanostictus
Dicroglossidae	Indian Bullfrog	Hoplobatrachus tigerinus
Ranidae	Common frog / Grass frog	Rana temporaria
Chamaeleonidae	Indian chameleon	Chamaeleon zeylanicus

### List of reptilian species

Family	Common name	Scientific name
Agamidae	Garden Lizard	Calotes versicolor
Colubridae	Checkered Keelback	Xenochrophis piscator
Colubridae	Indian Ratsnake/Dhaman	Ptyas Mucosus
Elapidae	Black Cobra	Naja naja
Scincidae	Indian Skink	Sphenomorphus indicus
Trionychidae	Indian Flapshell Turtle	Lissemys punctata
Gavialidae	Gharial	Gavialis gangeticus
<u>Crocodylidae</u>	Muggar	Crocodylus palustris

Annex 5

#### List of mammalian species Scientific name Family Common name Bovidae Blue bull Boselaphus tragocamelus Canidae Golden Jackal Canis aureus Leporidae Indian Hare Lepus nigricollis Sciuridae Five-striped Squirrel Funambulus pennantii Herpestidae Common Mongoose Herpestes edwardsii Mustelidae Smooth-coated Otter Lutra perspicillata <u>Cervidae</u> Hog deer Axis porcinus <u>Cervidae</u> Swamp deer Rucervus duvaucelii Viverridae Indian Civet Cat Viverricula indica <u>Hystricidae</u> Indian crested porcupine Hystrix indica

# List of bird species

Family	Common name	Scientific name
Podicipedia	e: Grebes	
	Little Grebe	Tachybaptus ruficollis
Phalacrocor	acidae: Cormorants	
	Indian Cormorant or Indian Shag	Phalacrocorax fuscicollis
	Little Cormorant	Phalacrocorax niger
Anhingidae:	Darter	
	Darter or Snake Bird	Anhinga malanogaster
Ardeidae: He	erons, Egrets, Bitterns	
	Cattle Egret	Bubulcus ibis
	Grey Heron	Ardea cinereal
	Indian Pond Heron	Ardeola grayii
	Large Egret	Casmerodius albus
	Little Egret	Egretta garzetta
	Purple Heron	Ardea purpurea
Family Cico	niidae: Storks	
	Asian Openbill	Anastomus oscitans
	Black-necked Stork	Ephippiorhynchus asiaticus
	Painted Stork	Mycteria leucocephala
Family Thre	skiornithidae: Ibises, Spoonbills	
	Black Ibis	Pseudibis papillosa
	Eurasian Spoonbill	Platalea leucorodia
	Oriental-white Ibis	Threskiornis melanocephalus
Family Anat	idae: Ducks, Geese	
	Bar-headed Goose	Anser indicus
	Brahmini Shelduck	Tadorna ferruginea
	Comb Duck	Sarkidiornis melanotos
	Common Pochard	Aythya ferina
	Common Teal	Anas crecca
	Eurasian Wigeon	Anas penelope
	Gadwall	Anas Strepera
	Gargany	Anas querquedela
	Greylag Goose	Anser anser
	Mallard	Anas platyrhynchos
	Northern Pintail	Anas acuta
	Northern Shoveller	Anas clypeata
	Red-crested Pochard	Rhodonessa rufina
	Spot-billed Duck	Anas poecilorhyncha
Family Acci	pitridae: Kites, Eagles, Vultures etc.	
	Black Kite	Milvus migrans
	Egyptian Vulture	Neophron percnopterus
	Greater Spotted Eagle	Aquila hastata
	Pallid Harrier	Circus macrourus

	Shikra	Accipiter badius
	Steppe Eagle	Aquila nipalensis
	Western Marsh-Harrier	Circus aeruginosus
Family Fa	Iconidae: Falcons	·
	Eurasian Hobby	Falco subbuteo
Family Ph	asianidae: Pheasants, Partridges	
	Black Francolin	Francolinus francolinus
	Grey Francolin	Francolinus pondicerianus
	Indian Peafowl	Pavo cristatus
Family Gr	uidae: Cranes	
	Sarus Crane	Grus antigone
	Common Crane	Grus grus
Family Ra	llidae: Rails, Coots	
	Common Coot	Fulica atra
	Common Moorhen	Gallinula chloropus
	Purple Moorhen	Porphyrio porphyrio
	White-breasted Waterhen	Amaurornis phoenicurus
	Watercock	Gallicrex cinerea
Family Jac	canidae: Jacanas	1
	Bronze-winged Jacana	Metopidius indicus
	Pheasant-tailed Jacana	Hydrophasianus chirurgus
Family Ros	stratulidae: Painted Snipe	1
	Greater Painted Snipe	Rostratula benghalensis
Family Cha	aradridae: Plovers, Lapwings	I
	Little-ringed Plover	Charadrius dubius
	Northern Lapwing	Vanellus vanellus
	Red-wattled Lapwing	Vanellus indicus
	White-tailed Lapwing	Vanellus leucurus
Family Sco	olopacidae: Sandpipers, Snipes etc.	· ·
	Black-tailed Godwit	Limosa limosa
	Common Greenshank	Tringa nebularia
	Common Redshank	Tringa totanus
	Common Sandpiper	Actitis hypoleucos
	Common Snipe	Gallinago gallinago
	Green Sandpiper	Tringa ochropus
	Little Stint	Calidris minuta
	Marsh Sandpiper	Tringa stagnatilis
	Pintail Snipe	Gallinago stenura
	Ruff	Philomachus pugnax
	Spotted Redshank	Tringa erythropus
	Wood Sandpiper	Tringa glareola
Family Red	curvirostridae: Stilts, Avocet	
	Black-Winged Stilt	Himantopus himantopus
	Pied Avocet	Recurvirostra avosetta

Family Burhinidae: Stone	curlew	
Stone-Curle	ew	Burhinus oedicnemus
Family Columbidae: Pigeons, Doves		
Blue Rock F	Pigeon	Columba livia
Eurasian C	ollared-Dove	Streptopelia dacaocta
Little Brown	n Dove	Streptopelia senegalensis
Red Collare	ed-Dove	Streptopelia tranquebarica
Yellow-legg	ged Green-Pigeon	Treron phoenicoptera
Family Psittacidae: Parak	keets	
Rose-ringe	d Parakeet	Psittacula krameri
Family Cuclidae: Cuckoo	s, Crow Pheasants	
Asian Koel		Eudynamys scolopacea
Brain Fever	Bird	Hierococcyx varius
Greater Co	ucal	Centropus sinensis
Eurasian C	uckoo	Cuculus canorus
Family Tytonidae: Barn O	WIS	
Barn Owl		Tyto alba
Family Strigidae: Owls, O	wlets	
Dusky Eagl	e Owl	Bubu coromandus
Family Alcedinidae: King	fishers	
White-brea	sted Kingfisher	Halcyon smyrnensis
Pied Kingfi	sher	Ceryle rudis
Small Blue	Kingfisher	Alcedo atthis
Family Meropidae: Bee-e	aters	
Blue-tailed	Bee-eater	Merops philippinus
Small Bee-e	eater	Merops orientalis
Family Coraciidae: Roller	S	
Indian Rolle	er	Coracias benghalensis
Family Upupidae: Hoopo	es	
Ноорое		Upupa epops
Family Bucerotidae: Horr	nbills	
Indian Grey	/ Hornbill	Ocyceros birostris
Family Picidae: Woodpec	ckers, Wrynecks	
Lesser Gold	den-backed	Dinopium benghalense
Woodpecke	er weblerk	
Family Alaudidae. Lark, B		Colorido orietato
Common C		Galerida Cristata
Family Hirundinidae: Mar	tins and Swallows	l linuada mustia -
	wallow	
	Curelleur	Riparia paludicola
	Swallow	HII UNAO SMITNII
Family Motacillidae: Wag	italis, Pipits	Matacilla citracia
Citrine Wag	Jian Mantail	
Large-pied	vvagtall	iviotacilia maderaspatensis
Paddy-field	I Pipit	Anthus rufulus

Yellow Wagtail	Motacilla flava	
Family Campephagidae: Minivets		
Small Minivet	Pericrocotus cinnamomeus	
Family Pycnonotidae: Bullbulls		
Red-vented Bulbull	Pycnonotus cafer	
Family Laniidae: Shrikes	I	
Rufous-backed Shrike	Lanius schach	
Family Musicapidae: Redstarts, Chats, Robir	ns l	
Black Redstart	Phoenicurus ochruros	
Blue-throat	Luscinia svecica	
Common Stonechat	Saxicola torquata	
Indian Chat	Cercomela fusca	
Indian Robin	Saxicoloides fulicata	
Oriental Magpie Robin	Copsychus saularis	
Pied Bushchat	Saxicola caprata	
Common Babbler	Turdoides caudatus	
Jungle Babbler	Turdoides striatus	
Large Grey Babbler	Turdoides malcolmi	
Striated Babbler	Turdoides earlei	
Ashy Prinia	Prinia socialis	
Common Chiffchaff	Phylloscopus collybita	
Common Tailorbird	Orthotomus sutorius	
Plain Prinia	Prinia inornata	
Rufous-fronted Prinia	Prinia buchanani	
Streaked Fantail-Warbler	Cisticola juncidis	
Red-throated Flycatcher	Ficedula parva	
Asian Brown Flycatcher	Muscicapa dauurica	
Family Nectariniidae: Sunbirds		
Purple Sunbird	Nectarinia asiatica	
Family Estrildidae: Munias	· · · ·	
Black-headed Munia	Lonchura malacca	
Red Munia	Amandava amandava	
Spotted Munia	Lonchura punctulata	
White-throated Munia	Lonchura malabarica	
Family Passeridae: Sparrows		
House Sparrow	Passer domesticus	
Baya Weaver	Ploceus philippinus	
Black-breasted Weaver	Ploceus benghalensis	
Streaked Weaver	Ploceus manyar	
Family Sturnidae: Mynas, Starlings	· · · ·	
Asian-pied Starling	Sturnus contra	
Bank Myna	Acridotheres ginginianus	
Brahminy Myna	Sturnia pagodarum	
Common Myna	Acridotheres tristis	

	Common Starling	Sturnus vulgaris
Family Orioli	dae: Orioles	-
	Eurasian Golden	Oriolus oriolus
Family Dicru	ridae: Drongos	-
	Black Drongo	Dicrurus macrocercus
Family Corvidae: Crows, Treepies		
	House Crow	Corvus splendens
	Indian Treepie	Dendrocitta vagabunda
	Jungle Crow	Corvus macrorhynchos

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# Conserving and Sustainably Managing Gangetic Floodplain Wetlands of Uttar Pradesh

Management Plan for Ghaghra Confluence to Gomti Confluence Sub-basin, Uttar Pradesh



2023

Funded By National Mission for Clean Ganga, Government of India Ministry of Jal Shakti



#### **Uttar Pradesh State Wetland Authority**

The Uttar Pradesh State Wetland Authority (UPSWA) is the apex body in the state for conservation and management of wetlands present within the state of Uttar Pradesh. Constituted as per provisions of the Wetlands (Conservation and Management) Rules, 2017 as the nodal policy and regulatory institution within the state, It is entrusted with a plethora of functions like preparing list of wetlands of the State and those to be notified; Recommending identified wetlands for regulation; Preparing and updating comprehensive digital inventory of all wetlands; Developing a comprehensive list of activities to be regulated and permitted within the notified wetlands and their zone of influence; Defining strategies for conservation and wise use of wetlands; Reviewing Integrated Management Plan for each of the notified wetlands; Recommending mechanisms for maintenance of ecological character; Identifying mechanisms for convergence of implementation of the management plan with the existing State development plans and programs; Ensuring enforcement of the Wetlands (Conservation and Management) Rules and other relevant Acts; Reporting and coordinating activities. The Authority is headed by the state's environment minister.



#### Wetlands International South Asia

Wetlands International South Asia Wetlands International South Asia is a non-government organisation working for sustaining and restoring wetlands, their resources and biodiversity in the South Asia region. Its office in New Delhi (India) was established in 1996 as a part of Wetlands International network. Wetlands International is a global, independent, non-profit organisation dedicated to conservation and restoration of wetlands, and presently works in over 100 countries through a network of 18 regional and national offices and expert networks headquartered in The Netherlands. Wetlands International is also one of the five International Organization Partners of the Ramsar Convention. In 2005, Wetlands International South Asia was registered under the Societies Registration Act of Government of India (retaining remit of South Asia region), consequently gaining an Indian legal entity while subscribing to the goals and targets of the Wetlands International network. The organisation endeavours to use a mix of approaches including technical knowledge, policy dialogue and field demonstrations for addressing various issues related to wetland management. To leverage change, the organisation works with national and state governments, knowledge centres, civil society as well as the private sector, often acting as catalysts to enable joined up actions. Given that securing a positive change in the status of wetlands and linked livelihoods takes considerable time, the organisation works for long-term engagement, forging strategic and innovative partnerships.

# Conserving and Sustainably Managing Gangetic Floodplain Wetlands of Uttar Pradesh

Management Plan for Ghaghra Confluence to Gomti Confluence Sub-basin Uttar Pradesh





Uttar Pradesh Forest Department





Funded By National Mission for Clean Ganga, Government of India Ministry of Jal Shakti

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# Acronyms

ARC	Above Ramganga Confluence
BAPS	Basin Assessment and Planning System
BMTPC	Building Materials and Technology Promotion Council
BSI	Botanical Survey of India
CEPA	Communication Education Participation and Awareness
CIFRI	Central Inland Fisheries Research Institute
CPCB	Central Pollution Control Board
DDMA	District Disaster Management Authority
DGPC	District Ganga Protection Committee
DWC	District Wetlands Committee
DRR	Disaster Risk Reduction
GOI	Government of India
HGM	Hydrogeomorphic classification system
HWLS	Hastinapur Wildlife Sanctuary
India-WRIS	India Water Resource Information System
KVKs	Krishi Vigyan Kendras
mbgl	below ground level
mg/l	milligrams-per-liter
MoEFCC	Ministry of Environment, Forest and Climate Change
NBSSLUP	National Bureau of Soil Survey and Land Use Planning
NCC	National Cadet Corps
NDMA	National Disaster Management Authority
NMCG	National Mission for Clean Ganga
NPCA	National Plan for Conservation of Aquatic Ecosystems
NSS	National Service Scheme
OA	Overall accuracy
PA	Producer accuracy
RGB	River Ganga Basin
RAWES	Rapid Assessment of Wetland Ecosystem Services
SAC	Space Application Centre
SMCG-UP	State Mission for Clean Ganga-Uttar Pradesh
SWaRDAC	State Water Resources Data Analysis Center
SwaRA	State Water Resources Agency
SWaRDAC	State Water Resources Data Analysis Center
SOI	Survey of India
UA	User accuracy
UPSBB	Uttar Pradesh State Biodiversity Board
UPSDMA	Uttar Pradesh State Disaster Management Authority
UPSWA	Uttar Pradesh State Wetlands Authority
UPWaMReC	Uttar Pradesh Water Management and Regulatory Commission
WWF – India	World Wildlife Fund – India
ZSI	Zoological Survey of India

# 1. Introduction

### Background

River Ganga flows through 27 Districts of Uttar Pradesh covering 1180 km, entering the state at Kotwali in Bijnor District and exiting at Dokti in Ballia District. The floodplains flanking the main channel provide an ecological and hydrological continuum rendering vital ecosystem services and biodiversity habitats. Effective management of these wetlands is crucial for achieving river integrity, and food and water security for the dependent communities.

The 'Vision Ganga' under the National Mission for Clean Ganga (NMCG) is an integrated conservation mission, approved as the 'Flagship Programme' by the Union Government of India. The mission is structured along four dimensions of the river system, namely: a) Aviral Dhara (uninterrupted flow), b) Nirmal Dhara (unpolluted flow), c) Geological entity, and d) Ecological entity. The main objectives of the Ganga River Management have been articulated to be: a) maintenance of environmental flows in rivers and tributaries to fulfill their geological, ecological, socio-economic, and cultural functions; b) ensuring that water quality in all rivers and tributaries is consistent with their governing geological, ecological, socioeconomic and cultural functions; c) judicial use of water and other aquatic resources to enable sustainable development in the entire basin; and d) transparent and inclusive review of all existing, ongoing and planned anthropogenic activities in the basin. Action programmes to realize the objectives have been organized around eight missions, namely: a) aviral dhara, b) nirmal dhara, c) ecological restoration, d) sustainable agriculture, e) geological safeguarding, f) disaster protection, g) river hazards management, and h) environmental knowledge building and sensitization.



Bakwatal wetland provides immense ecological subsidies

Within any basin, including the River Ganga Basin (RGB), management of hydrological regimes and linked ecosystem processes, services, and biodiversity values needs to be based on complementarity and interactions between lentic ecosystems (i.e., the wetlands) and lotic systems (i.e., the river). Floodplains, especially the active part, harbour significant riverine wetlands, which are unique, highly productive, and perform a wide range of functions such as flood control, water purification, carbon storage, groundwater recharge, and water storage. In terms of biodiversity, these wetlands provide refuges for fauna in times of flooding, are food reservoirs and breeding sites, and participate in the dispersion of plant and animal species. Owing to the variability of the geomorphological, physicochemical, and hydrogeological contexts in which they are created, riverine wetlands offer a unique diversity of ecological situations that has no equivalent in other wetlands on similar scales.

Conservation and wise use of wetlands, recognition of their role, and wide-ranging ecosystem services are essential aspects of river basin planning and management. Degradation and loss of wetlands, and rapid changes in the river basins of which these wetlands are integral elements, which lead to the disruption of natural hydrological cycles, often leading to enhanced frequency and severity of flooding, drought and pollution, and imposing significant economic and social losses and costs to the human populations within these river basins. Proper consideration of the role and importance of wetlands in river basin management can significantly assist in securing safe, reliable sources of water and meeting development objectives identified within the Ganga Vision.

The Government of Uttar Pradesh constituted the Uttar Pradesh State Wetlands Authority as the nodal policy-making, regulation, and management organization at the state level. The NMCG, with an objective of supporting conservation and sustainable management of Gangetic wetlands of Uttar Pradesh, sanctioned a technical assistance project to UPSWA. The project has an overall objective of 'effective management of floodplain wetlands in River Ganga Districts' to ensure sustained provision of wide-ranging ecosystem services naturally provided by these ecosystems and securing diverse habitats. The specific objectives were to:

- Define and characterize floodplain wetlands regimes within the Ganga Districts.
- Put in place institutional arrangements for managing floodplain wetlands by notifying under Wetlands (Conservation and Management) Rules, 2017.
- Develop stakeholder-led integrated management plans for securing ecosystem services and biodiversity values.
- Design and implement a monitoring regime to enable periodic assessment of wetland ecosystem health and effectiveness of management.
- Creating and developing the available infrastructure, capacity building and generation of awareness of the stakeholders.

This management plan has been prepared under the aegis of the NMCG funded project and reflects the commitment of the Government of Uttar Pradesh for ensuring the conservation of floodplain wetlands of the state. The Gangetic floodplain wetlands in Uttar Pradesh fall within three sub-basins of the River Ganga: a) Above Ramganga Confluence, b) Gomti Confluence to Muzaffarnagar and c) Ghaghra Confluence to Gomti Confluence (Map 1). In line with this, the wetland management plans have been prepared at the sub-basin level, articulating description and evaluation of the ecological character, identification of threats and management needs, management objectives and outcomes, and actions. It is envisaged that a basin sub-level wetland plan will provide better synergies with water resource planning and implementation, as well as with districtlevel developmental planning. The current management plan provides a framework for action for conservation and wise use of floodplain wetlands located within the Ghaghara Confluence to Gomti Confluence sub-basin.

#### Management planning purpose and objectives

India, as a signatory to the Ramsar Convention, is committed to achieving wise use of all wetlands in her territory. Wise use of wetlands is defined in the text of the Ramsar Convention as 'the maintenance of their ecological character, achieved through the implementation of ecosystem approaches, within the context of sustainable development.' Ecological character is 'the combination of ecosystem components, processes, and services that characterize a wetland.' Ecosystem management of wetlands thus seeks to achieve the goal of 'maintenance of ecological character' or 'wetland wise use'.

Wise use is the longest established example amongst inter-governmental processes, implementation of which have become known as ecosystem approaches for conservation and sustainable development of natural resources, including wetlands (Finlayson et al. 2011). The approach recognizes the human interdependency with wetland functioning and accommodates sustainable utilization of these ecosystems for the benefit of humankind in a way compatible with the maintenance of natural properties of the ecosystem. Wise use encourages stakeholder engagement and transparency in negotiating trade-offs and determining equitable outcomes for wetland conservation while promoting maintenance of environmental, economic, and social sustainability (Finlayson 2012). The purpose of management planning is to outline the pathway through which wetland wise use can be achieved (Ramsar 2010).

The term 'wise use' is often misinterpreted to indicate that the Ramsar Convention promotes the human use of all wetlands. However, wise use as a wetland management approach is much wider than the use of a wetland. The phrase 'in the context of sustainable development' recognizes that development, which may be inevitable in some cases, is not an objective for every wetland. Whenever development is to take place, it has to be facilitated in sustainable ways by approaches elaborated in the Ramsar Convention. 'Ecosystem approaches include the elements elaborated by the Convention on Biological Diversity – integrated management, stakeholder's participation in the decision-making process, transparency about trade-offs, and equitability of the outcomes. In totality, wise use is about 'maintaining the capability of the wetland' to support human well-being at present and in the future, rather than 'use' or 'development' at present.



Map 1: River Ganga and her three sub-basins in Uttar Pradesh

The wetland management plan aims at putting in place effective management arrangements which enable integration of biological diversity and ecosystem service values of these wetlands in river basin conservation and developmental planning. The following are specific objectives:

- Describe the wetlands in terms of their ecological character and their governing factors.
- Assess the risk of adverse change in wetlands and their underpinning reasons.
- Define monitoring requirements for detecting changes in ecological character.
- Define management objectives and strategies for achieving these objectives.
- Support resource mobilization.
- Enable communication within and between sites, organizations, and stakeholders.
- Ensuring compliance with local, national, and international policies and regulatory frameworks.

### Management planning approach and method

Wetlands under the Gangetic floodplains evolve and function within physical templates, characteristics of which are determined primarily by the interaction between water and sediments. The ecological components, processes, and services are influenced by land and water management practices within the immediate as well as indirect catchments of the wetland complex. Management planning, therefore, calls for an approach that recognizes the interconnectedness of wetland biological diversity and ecosystem services with land and water management in the river basin taking into account the external, natural, and induced factors. The approach also needs to address climate change which has direct as well as indirect implications for wetland features as well as factors governing these features. The wise use principle encourages stakeholder engagement and transparency in negotiating trade-offs and determining equitable outcomes for wetland conservation while promoting maintenance of environmental, economic, and social sustainability.

The National Environment Policy (2006), Government of India, recommends the integration of conservation and wise use of wetlands into river basin management involving all relevant stakeholders, in particular local communities, to ensure maintenance of hydrological regimes and conservation of biodiversity. It further recommends the integration of wetland conservation into sectoral development plans for poverty alleviation and livelihood improvement, and link efforts for conservation and sustainable use of wetlands with all ongoing rural infrastructure development and employment generation programmes. If considered as a natural infrastructure capable of providing water and food security, buffering extreme events, and supporting adaptation to climate change, the ecosystem services of Ganga floodplain wetlands can support achieving outcomes for several sectoral development, and disaster risk reduction. The Wetlands (Conservation and Management) Rules,

2017; The River Ganga (Rejuvenation, Protection and Management) Authorities Order, 2016 (amended 2019), and the minimum environmental flows notification of 2018 provides the regulatory framework to prevent any fragmentation of hydrological regimes through hydraulic structures, diversions, encroachments, or impeding flow pathways.

Much of the region along the 10-kilometer buffer of the Ganga River channel is constituted by river floodplains (Map 2). The uniqueness of floodplain ecosystems lies within their near-linear form, the high dynamism of their geomorphology, and the ability to processes large fluxes of energy and material from upstream areas. Several conceptual models and frameworks have emphasized upstreamdownstream linkages along the river corridor, the influence of river basin form and climate on downstream areas, their horizontal linkage across the floodplain between the river channel and the floodplain, the vertical interconnection within the floodplain between overbank flooding, groundwater, and rainfall. Amongst several factors, hydrological inputs to floodplains play a significant role through a) their influence on the arrangement of landforms and vegetation communities, and b) the impact of flooding regimes on the regeneration and turnover time of floodplain vegetation.

River floodplains are specific areas typical of grid dynamics of natural, especially fluvial processes co-existing within anthropogenic influences and intensive use. There are several basic definitions to delimit the floodplains corresponding to the scientific disciplines concerned. From a geomorphological perspective, floodplains are accumulation plains along a watercourse constituted by unconsolidated sediment, transported by and deposited in this stream, usually partially or fully flooded during high floods. The geomorphological view of the floodplains emphasizes its genesis and relief morphology, bringing to focus two systems of fluvial processes i.e., erosional fluvial processes with predominant removal of material and accumulation fluvial processes, with predominant sedimentation. Geological definitions describe the floodplain as "flat valley floor activated during the flooding of a stream"; the floodplain is composed of horizontal young (Holocene), gravel, sandy, loamy, or clay sediment, often displaying irregularities caused by braiding of a stream, origin of islands, meanders, alluvial fans, and delta plains, debris, landslides, etc. (Shi et al., 1995). Hydrological definition views floodplains as natural inundation areas suitable for water retention in the landscape during floods. In times of such high flood discharges, water is over-burdened with suspension loads, depositing in the inundation area. Floodplain regions are also characterized by the occurrence of fluvisols and glevsols. Ecological boundaries of floodplains are defined on the basis of the regionalization of floodplains, biochores, ecosystems, and plant and animal communities. Floodplains are indispensable ecological corridors for plant and animal migration and have other vital ecological functions in the landscape (such as climate moderation, water retention, and others).


Map 2: Wetlands within the active floodplain boundary on the either side of River Ganga in the Ghaghara Confluence to Gomti Confluence Sub basin

Floodplains apparently exist in two alternating phases. For most of the time, these ecosystems exist in a dry phase during which, at least superficially, is not substantively different from surrounding terrestrial ecosystems. However, during monsoons, these ecosystems are inundated wherein large, shallow floods driven by rainfall top up moisture in the soil, recharge the groundwater aquifers, and fill up depressions. This recharge provides the reservoir of water upon which the biota depends until the next flood event. These ecosystems have evolved to cope with these phase changes. Many aquatic plants have long-lived seeds that can withstand extended periods of drought. Similarly, many animals possess drought-resistant stages in the life-cycle or the physiological capacity for diapause or, like waterbirds, adopt highly mobile strategies in order to track scarce resources.

The gradients of flooding frequency, soil moisture, and vegetation create conducive environments for wetlands within these floodplains. Located at the interface of terrestrial and aquatic ecosystems, combining features of both, wetlands arise when inundation by water produces soils dominated by anaerobic processes, which in turn, forces the biota, particularly rooted plants to adapt to flooding. Ramsar Convention, an inter-governmental treaty defines wetlands broadly as 'areas of marsh, fen, peatland or water, whether natural or artificial, permanent or temporary with water that is static or flowing, fresh, brackish or salt, including areas of marine water the depth of which at low tides does not exceed six metres. All wetlands exhibit certain common indicators such as the presence of water permanently or seasonally, saturated soils, and hydrophytic vegetation. Hydrology, in particular, serves as a driving force for these ecosystems through its disproportionate impact on abiotic and biotic characteristics of wetlands. Abiotic characteristics such as soil texture and colour, water quality depend on the distribution and movement of water as do the abundance, diversity, and productivity of the range of species that use the wetlands as habitats.

The variable water regime in floodplains plays an important role in the structure and function of floodplain wetlands. Intermittent or seasonal floods transport organic matter and biota, triggering the life cycles of many aquatic and terrestrial organisms inhabiting wetlands. Wetting and drying are vital to the functioning of these ecosystems. During dry phases, eggs, and seeds of diapausing animals and plants remain in dry floodplain soils. Nutrients and energy to floodplain soils are also added by decomposing organic matter from leaf litter and stranded aquatic plants and animals. During floods, these organic reservoirs support emerging aquatic organisms and biota which colonise the newly inundated habitats. Heterotrophic organisms, in particular, assimilate these resources into the food webs, linking detritus to higher trophic levels. The temporal dynamics of water drive this complexity. Species like waterbirds and fishes depend on floodplain river connections to complete their life cycles.

The analysis of floodplain processes tends to be dominated by discussions of geomorphological, hydrological, and hydraulic processes which provide the physical background to the evolution of floodplain areas. However, floodplains are also subjected to a high degree of development and often urbanization which tend to significantly modify their natural properties and functions. A basic differentiator

of the impact of human activities is whether these occur on or off the floodplain. Development on the floodplain such as the intensification of agriculture can greatly alter the morphology of the region. The effect of the development of the floodplain can be just as significant in that they can have "downstream effects" on floodplain areas lower down the catchment. The urbanization that is not planned with in-built local storage for flood flows tends to increase both the volume of runoff and the speed of concentration. This means that the flood severity can increase in the floodplain storage areas downstream, while at the same time the lead time before the floodwater arrives decreased. Again, the flood damage potential is increased and the opportunities for ameliorative action during flood events are reduced.

Conservation of floodplain wetlands needs to be based on maintaining the carbon and biotic balance through appropriate water regimes and land management practices. The concentration of carbon, organic matter, dissolved oxygen, density, and diversity of micro-invertebrates as well as recruitment in fish, plants, and water birds can serve as key indicators of floodplain wetland ecosystem health. Wise use of floodplain wetlands entails that the underpinning ecological and hydrological processes, particularly the flood pulse are maintained in line with natural regimes. From this perspective, the management of floodplain wetlands is closely interlinked with the management of river systems within their basin and linked developmental planning.

Conservation and sustainable development of floodplain wetlands of Ganga require integrated planning and resource management at the river basin level recognizing the interconnectedness of the wetland system with its catchments. River basinlevel planning requires an understanding of the carrying capacity of the basin to produce desired outputs (goods and services) from a limited resource base and achieve an equitable quality of life while maintaining desired environmental quality in the region. The planning for management calls for trade-offs between desired production and consumption levels. It also emphasizes the development of supportive mechanisms within the generative capacity while maintaining the environmental quality. The challenge, therefore, is to conserve the ecological character and full range of ecosystem services of floodplain wetlands of Ganga while providing sustained benefits to the communities dependent upon the wetland for their sustenance.

The methodology for management planning is based on the New Guidelines for Management Planning for Ramsar Sites and Other Wetlands as adopted by the Contracting Parties to the Ramsar Convention on Wetlands in 2002. These guidelines also form the basis of the wetlands management planning guidelines of the MoEFCC's National Plan for Conservation of Aquatic Ecosystems (NPCA). In 2022, the Ministry also notified the Sahbhagita Guidelines – wherein a participatory and inclusive framework for wetland management has been outlined clarifying roles and responsibilities at various levels of administration.



Figure 1: Framework for integrated management planning

The NPCA guidelines recommend following a diagnostic approach – wherein the selection of management interventions is guided by knowledge of wetlands features and factors governing these features, and their relationship with broader societal conservation and development goals that wetland wise use is contributing to (Figure 1). Wetlands features are its ecological, social, and institutional attributes, which collectively characterize a wetland. Wetlands are dynamic systems, and thus their features undergo cyclical and temporal changes.

Factors (natural as well as anthropogenic) cause the wetland to move along a specific trajectory. The afore-mentioned wetland management planning method was implemented in the following steps in accordance to the NMCG project (implemented over 2020 – 2022):

a) Mapping and inventory of wetlands within 10km buffer along either side of the Ganga River channel: Inventory of 285 wetlands (of which 137 wetlands were in the Ghaghara Confluence to Gomti Confluence sub-basin) (Map 3), identified on the basis of 2020 land use and land cover map of the 10-km buffer region was undertake with the help of a rapid assessment tool. For each wetland, the following information was generated

**Wetland settings:** Official and vernacular names, geographical location, extent, wetland type, and features of the surrounding area.

**Description of wetland features:** Catchment, hydrology (topography, geology, geomorphology, soil, land use, and land cover, climate, major sources of water, number and status of inlets and outlets, water depth, connectivity, inundation regime, water flow direction, water permanence, and usage), Species and habitats (habitat types, availability of bird counts, invasive species status, macrophytes, fish, reptiles, birds, amphibians, and mammals), and Communities (permanent and temporary settlements present on the shoreline, population, and percentage of community dependence).



Map 3: Location of surveyed wetlands within 10 km buffer zone for the Ghaghara Confluence to Gomti Confluence Sub-basin

Values and benefits: provisioning services (freshwater - drinking, washing & domestic use, agriculture and livestock; food – fish and edible aquatic plants; fuel; fiber and fodder; natural medicines; ornamental resources; clay, sand, and mineral harvesting), regulatory(air quality regulation, local climate regulation, water regulation, flood hazard regulation, water during droughts, pest regulation, disease regulation – human and livestock, erosion regulation, water purification, pollination, salinity regulation, fire regulation, and noise and visual buffering), supporting services (soil formation, primary production, nutrient cycling, water recycling, and provision of habitat), and cultural services(cultural heritage, recreation and tourism, aesthetic value, spiritual and religious value, inspiration value, social relations, educational and research, and transportation).

**Threats:** adverse changes faced in the ten years, major direct threats, and major indirect threats.

**Management:** Pattern of land ownership within the wetland, the pattern of land ownership in the area surrounding the wetland, and pre-existing rights and privileges in the wetland.

The inventory data of 285 wetlands was uploaded into an electronic database of the Uttar Pradesh Forest Department (upforest.org/wetland.aspx).

**b) Preparation of wetlands health cards:** For each wetland, the inventory information was used to develop an ecosystem health report card on the basis of nine indicators related to wetland extent, hydrology and catchments, biodiversity, ecosystem services, and governance.

**c)** Hydrogeomorphic classification and prioritisation: Wetlands were prioritised on the basis of scores generated for threats, and a cumulative score of ecosystem service index and hydro-geomorphic function score.

A systematic classification of wetlands is a necessary step for their management and conservation. The current classification system used for mapping wetlands by Space Application Centre (SAC) are based on a three-tier system wherein at the first level, the wetlands are classed into inland and coastal categories, at the second level into natural and human-made categories and at the third level, the wetlands are placed either of the twenty categories (thirteen natural and seven humanmade). This classification system is largely based on ecosystem structure attributes (such as hydrology or plant communities) and does not readily lend itself to attribution of ecosystem functions (such as groundwater recharge, flood buffering and water purification). The latter is of critical importance for integrating wetlands in management of River Ganga. The project, therefore, uses a hydrogeomorphic (HGM) classification system to enable focus on wetland functions within a given landscape.

The hydrogeomorphic (HGM) classification of wetlands emphasizes the wetland hydrological processes and functions and their ecological significance within a generalized landscape context (Semeniuk et al., 2016). The HGM classification

renders the wetlands classes which have distinctive ecological character as they represent the hydrogeomorphic functions of wetlands. The classification system used in the project has been modified from those applied in Australia, South Africa and other countries and uses landform and water characteristics as the dominant features and wetland size and vegetation as descriptors.

d) Stakeholder Consultations: Significant data was generated based on preliminary consultations with relevant stakeholder groups, Government department(s), and/or agencies from varied relevant sectors for wetlands conservation and management planning. The varied sectors considered for consultation and their corresponding stakeholder groups included wetlands management (State Wetlands Authority, District Ganga Committees, Nodal departments entrusted for management of wetlands), Biodiversity conservation (State Biodiversity Board, Forest Department), Water resources (Water resources department, State Pollution Control Board), Agriculture (State Agriculture Department), Fisheries & Animal Husbandry (State Fisheries and Animal Husbandry Department), Climate Change (Science and Technology Council), Planning (Department of Planning), Disaster Management (State Disaster Management Authority, District administration), Culture & Tourism (Department of Culture & Tourism, Religious bodies present around wetlands, Tour Operators (public and private), Hoteliers and Hotel Associations), Research and Academia (College, Universities and research institutes conducting research & monitoring on wetlands), State governance (Elected political representatives, District Administration), Civil society (NGOs engaged in developmental and conservation activities around wetlands) and Resource users (Fishing communities and others which depend directly on wetlands) respectively.

#### **Management Plan Structure**

The management plan follows the format prescribed by the MoEFCC and is organized in three sections with eight chapters. Following the introduction, Section one of the plan (comprising Chapters 2, 3, and 4) contains a description and evaluation of the wetlands. Chapter 4 includes an analysis of current institutional arrangements in terms of the capability of addressing the risk of adverse change identified in Chapter 2 and 3 and ensuring wetlands wise use. Section 2 of the plan (containing chapters 5 and 6) discusses the management framework (management goal, purpose, strategy and objectives, and monitoring arrangements thereof. Section 3 (comprising chapters 7 and 8) includes the detailed action plan, budget for five years and possible financing arrangements.

# 2. Description of Wetlands Features

#### Wetland location, and extent

The Ghaghara Confluence to Gomti confluence sub-basin is situated between 81.59° E and 84.75° E longitudes and 24.54° N and 26.86° N latitudes and spans ~27,552 km<sup>2</sup>, encompassing about 3.25 % of the Ganga basin area. The 10 km buffer zone on either side of the Ganga River channel falls within 83.03° E and 84.63° E and 25.12° N to 25.79° N in three districts (Ballia, Chandauli, Ghazipur) and spans 3172 km<sup>2</sup>.

The Ganga River floodplain was delineated using the Global Surface Water data for 1984-2020 (Pekel et al., 2016). The data provides occurrence, change, recurrence, transitions, seasonality for 35 years and maximum extent at 30m resolution. The maximum extent of inundation was used as the active floodplain boundary. This was digitized using visual interpretation, and rectified at a constant scale of 1:1000 to ensure accuracy in capturing the landscape details (Rozo et al., 2014).

Wetlands dynamics in the 10-km buffer was assessed using cloud-free postmonsoon (October) Landsat images (30 m resolution) of 2000 and 2020. This spatial resolution is suitable for 1:50,000 scale mapping. Satellite images downloaded from USGS Earth Explorer were radiometrically and atmospherically corrected. The river channel was extracted from satellite imagery using a binary mask generated by a decision tree based on spectral band reflectance (SWIR 1; 1.57–1.65 m), Normalized Difference Vegetation Index (NDVI) (Rouse et al., 1974) and the Normalized Difference Water Index (NDWI) (Mcfeeters, 1996).

The wetland mapping method used herein has been adapted from National Wetland Atlas (SAC, 2011) and Sinha et al., (2017)) and is presented in Figure 2. Water-dominated areas (including wetlands, river channel, river bed, and aquatic vegetation) were extracted from the current LULC map (i.e., the Year 2020) in the GIS environment. Additional information pertaining to the wetland types mapped were derived from satellite imagery-based spectral indices including Normalized difference vegetation index (NDVI) (which indicates the extent of aquatic vegetation) and Normalized Difference Water Index (NDWI) (which depicts the open water extent within the wetland) (Map 4). Proximity to linear infrastructure was used to segregate the human-made waterlogged areas. To improve the accuracy of the land use and land cover classification, 2837 ground truth points were used, evenly dispersed across the study region. The overall accuracy of the land use and land cover maps was 98.49% (2020) and 98.2% (2000).



Figure 2: Classification approach used in the study

In 2020, riparian wetlands constituted a majority of the overall wetland area (77%), followed by isolated sumplands (23%) in the Ganga basin in Uttar Pradesh. For Ghaghara Confluence to Gomti Confluence basin active floodplain area in 2020 was 47,600 ha (15% of the 10-km buffer area), and the total wetland area in 2020 was 8,529 ha, of which 73.45% is within the active floodplain area and the rest outside.

The wetland area in Ghaghara Confluence to Gomti Confluence shrunk by 71% during 2000–2020 (from 28,988 ha to 8,529 ha). From the Ghaghara Confluence to Gomti Confluence, an area of 4,824 ha of riparian wetlands was converted to agricultural land. Similarly, isolated sumplands have added 12,755 ha to the agricultural class over the past 20 years. From 2000 to 2020, isolated sumplands experienced a more significant conversion of wetland area to terrestrial vegetation than riparian wetland areas (5558 ha vs. 436 ha, respectively). Similarly, isolated sumplands (709 ha) experienced a greater rate of urbanization than riparian wetlands (144 ha). Reference (Figure 3)



Figure 3: Comparative distribution of wetland area conversion in Ghaghara Confluence to Gomti Confluence



Map 4: Wetland extent in the 10km buffer zone on either side of the River Ganga in the Ghaghara Confluence to Gomti Confluence sub basin during the years 2000 (left) and 2020 (right)

#### Wetland Catchments

Wetlands in the 10 km buffer zone receive inflows from the Ghaghara confluence to Gomti Confluence sub basin. The sub basin covers 18 districts namely Bara Banki, Faizabad, Sultanpur, Ambedkar Nagar, Azamgarh, Mau, Ghazipur, Chandauli, Bhabua, Mirzapur, Varanasi, Jaunpur, Ghazipur, Buxar, Rohtas, Bhojpur, Sonbhadra, Ballia, Saran.

#### Drainage

The sub basin is flanked by the Gomti River on its west margins and the Ghaghara River basin on the east. The Ghaghra river originates at an elevation of 4,800 m near Manasarowar Lake. The river is also known as Karnali in Nepal. It flows through a length of 1080 km. In this stretch the Ganga flows in a north easterly direction after changing course near Chunar. Several streams having their origin in the Vindhyans join the Ganges after flowing northwards and westwards. Karamnasa River originates in Kaimur plateau, and marks the interstate boundary between Uttar Pradesh and Bihar. The Kathal Nala flows in Ballia district and connects the Surha Tal to River Ganga. Tamas River flows in Ballia district. Some of the other rivers are Belan Nadi, Beso River, Mangal River, Gangi River, Dhansoi Nadi in Ghazipur district, Varuna and Jargo Nadi in Varanasi district. Surha Tal canal system is used for irrigating Reoti, Bansdih and Beruarbari blocks in Ballia district. Total length of the main canal is 11.8 km (CGWB, 2008). The Sharda Shayak Project caters to the irrigation needs of the sub basin districts as Sultanpur, Ambedkar Nagar, Azamgarh, Ghazipur, Jaunpur, Varanasi.

## Topography

The alluvial tract of the sub basin is long and narrow. Excluding river courses, relief on a cross-interfluve traverse is only a few meters. The Vindhyan ranges in the south- eastern part of the basin presents a stark contrast to the gentle relief of the plains. The Vindhyans border the southern bank of the Ganges in the districts of Mirzapur and Varanasi at a distance of 15 -80 km but reaching up to the river bank at Chunar. The maximum elevation rises abruptly from 100 m to 200-300 m (Map 5). The Vindhyans tablelands extend to Kaimur hills in the east. The landscape is dotted with abruptly rising scarp of low hills, tablelands, waterfalls and rivers. Steep slopes are observed. The soil is inferior and is broken in to ravines (Map 6).



Map 5: Elevation profile of the Ghaghara Confluence to Gomti Confluence sub-basin



Map 6: Topography map of the Ghaghara Confluence to Gomti Confluence sub-basin

## **Geology and Geomorphology**

The sub basin borders the southern cratonic region. Hence while the alluvial plains comprise 82 % of the sub basin, central highlands occupy 18 % of the basin. As compared to the foreland basin this region is more stable and experiences less or little earthquake activity but the Faizabad ridge considered to be an extension of the Bundelkhand craton is one of the faults that extends through the sub basin (Demudu Babu et al. 2020).

In Ghaghara basin, the Himalayan foredeep comprises of nearly 4000 m of sedimentary materials deposited over Bundelkhand granite gneisses of Archaean age (Map 7). The lower segment of the Ghaghara River basin shows sinuous river valley showing 10 to 12 m deep incision on the Ganga Plain that is mostly resulting from impact of tectonics and monsoon controlled fluvial dynamics (Ghaghara basin plan Vol. I 2020). The fluctuation in monsoon intensity is marked and probably exercises an overwhelming influence that is bared in historical artifacts and landforms present in the region.

The floodplain comprises coarse to fine sand, silt, clay, and gravel. Sand bar, abandoned channels, levies land form are very common in the floodplains. Fluvial landforms, like paleo-channels meander scar, back swamps etc. are found in the newer alluvial plains and meander lakes, marshy and swampy lands are very common in the older alluvial plains (CGWB, 2008).



Map 7: Geomorphology map of the Ghaghara to Gomti Confluence sub-basin

#### Soil characteristics and soil erosion

Stratified fluviatile, marine and lacustrine sediments containing fluvisols that are associated with water bodies are found in a narrow strip in the floodplains in Buxar and Arrah districts. Orthic Luvisols cover the districts of Chandauli, Bhabua and Sasaram (Table 1 and Map 8).

Soils with moderate profile development, Cambisols dominate the mid sub basin in the districts of Faizabad, Ambedkar Nagar, Sultanpur, Azamgarh, Jaunpur. In wetlands, Cambisols are associated with Fluvisols. The transitional nature of soils indicates a situation of free internal and external drainage where slow and continuous erosion is in equilibrium with weathering processes. The Ganga – Brahmaputra alluvial plains and terraces have large continuous surfaces of Cambsiols in the tropics. The soils are loamy and sandy loam, fertile and widely used for agriculture (

## Table 2).

Ferric luvisols are also encountered in south eastern parts of the sub basin. Sedimentary rock formations dominate this landscape. Mixed red and black soils are found in these parts (Map 9).

Soil is loamy in nature. Younger and older alluvium form good cultivable soils. Soil fertility gets impacted due to erosion. 31.37% catchment affected by severe soil erosion by water (> 15-20 t/ha/yr). Soils majorly have no or little soil profile differentiation. The worst affected districts in the sub basin are Ambedkar Nagar, Sultanpur, Faizabad, Sonbhadra, Barabanki.

Class Name	Texture	Texture Class	% GRAVEL	% SAND	% SILT	% CLAY	Hydraulic conductivity (m/s)
Eutric							
Cambisols	Medium	Loam	9	42	36	22	6.94E -06
Calcaric							
Fluvisols	Medium	Loam	10	35	47	18	6.94E-06
Orthic							
Luvisols	Medium	Loam	4	47	32	21	6.94E -06

Table 1: Soil characteristics of the Ghaghara Confluence to Gomti Confluence subbasin (Source: NBSSLUP, Mao, 2019)

Districts	% Area within the sub basin facing severe soil erosion (>15-20 t/ha/yr)
Ambedkar Nagar	92.31
Sultanpur	91.43
Faizabad	70.24
Sonbhadra	64.47
Barabanki	44.44
Bhabua	39.19
Chandauli	35.13
Azamgarh	33.18
Mirzapur	27.08
Ballia	24.85
Ghazipur	24.06
Rohtas	12.92
Mau	6.45
Jaunpur	5.49
Buxar	4.98
Bhojpur	4.61
Saran	0.00
Varanasi	0.00

Table 2: District wise area under erosion in the Ghaghara Confluence to Gomti Confluence sub basin

Source: Based on analysis of NBSS&LUP Data.



Map 8: Soil map of the Ghaghara to Gomti Confluence sub-basin



Map 9: Soil erosion map of the Ghaghara Confluence to Gomti Confluence sub-basin

#### **Climatic set-up**

The Ghaghara Confluence to Gomti Confluence sub basin has a moderate subtropical climate. The average annual rainfall is about 1027 mm, out of which the main part is received during the monsoons in July - August (IMD 2020).

May is the warmest month of the year. The temperature in May averages 32.92°C (as observed during the time period 1901-2021). In January, the average temperature is 16.27°C. It is the lowest average temperature of the whole year. Map 10 and Figure 4.

Recognizing Uttar Pradesh's climate vulnerability, rapid urbanisation, rising poverty, and increased drought and flood make this densely populated, agriculturally dominated state a very vulnerable landscape (Saxena, 2020). The anticipated increase by 20% in rainfall and rise in maximum temperature to 2°C by 2050's is alarming for water security (UP-SAPCC, 2014). The frequency of extreme temperature and rainfall events are constantly on the rise along with annual variation in rainfall (Tripathi, 2016).

Climate change exacerbates water-related risks. Climate change exacerbates water insecurity by limiting per-capita supplies, water guality, consumption disputes, and deterioration of wetlands ecosystems. Climate change in the region has altered the precipitation regime, intensity rates, and indirectly impacting the flux and storage of water in wetlands (UP-SAPCC, 2014). Wetlands dynamics is impacted most by the changing climate, increasing temperatures and changing climatic patterns have led to drying up of wetlands in Uttar Pradesh. To combat the impacts of climate change, Uttar Pradesh has formulated action plan for seven missions (1) Sustainable agriculture mission (2) Solar Mission (3) Energy Efficiency Mission (4) Green UP Forestry Mission (5) Jal Mission (6) Strategic Knowledge Mission (7) Sustainable Habitat Mission (UP-SAPCC, 2014). The Jal Mission is of profound importance in this context as 70% of agriculture in the state is dependent on irrigation. Semi-arid and arid regions in the state are especially vulnerable to climate change and are anticipated to suffer decline in water resources. The expected annual precipitation variance would result in frequent and prolonged waterlogging, as well as saline intrusion into aquifers (UP-SAPCC, 2014).



Map 10: Spatial variation in annual precipitation during 2020 for the Ghaghara Confluence to Gomti Confluence sub-basin



Figure 4: Correlation between precipitation and temperature for Ghaghara Confluence to Gomti Confluence sub-basin during 1901-2021

## Hydrological Set-Up

The Ghaghara Confluence to Gomti confluence sub basin encompasses 58634.18 km2 of area encompassing 3.25% drainage area of the Ganga basin. There are 36 watersheds in the sub-basin The size of the watershed ranges from 372.40 - 1761.77 km2 (India-WRIS).

The river Ganga in this stretch receives inflows from Gomti river and Ghaghara River that has a significant Himalayan component and has high discharges and significant sediment load. Ghaghara has sediment load of 125 MT/year.

The flow of Ganges River is regulated by dams and barrages in this sub basin. There are 12 dams, 7 weirs and 7 lift irrigation schemes operational in the sub basin. Mostly the dams have been constructed in the Vindhyan highlands in Mughalsarai and Bhabua districts. This includes irrigation dams as Naugarh, Deori, Nagwa dams and Ahraura dams. Important lift irrigation schemes exist at Gaynpur, Larma and Karamnasa and includes the Dohrighat pump canal and the Dohrighat Sahayak schemes that cater to Azamgarh, Ballia and Mau districts. The gauge, discharge, sediment, water quality is measured at Hydro-observation stations and flood levels at flood forecasting stations of the CWC (Central Water Commission) present in the sub-basin, as shown in Map 11 (India-WRIS).



Map 11: Hydrological monitoring stations and drainage map of the Ghaghara Confluence to Gomti Confluence sub-basin

#### Flow direction and inundation regime

The major geomorphic elements in this region consist of lentic (wetlands, lakes) and lotic (streams) water bodies. The inundation regime in the Ghaghara Confluence to Gomti Confluence sub-basin is governed by the extent of river channels in different seasons, water logging due to the seepage through canals and embankments and the depressions formed due to geographical and topographic features. The wetlands in the surveyed 10 km buffer zone on either side of the river Ganga have different extent of inundation at various months of the year. Wetlands water regimes from a sample of 32 wetlands indicates that 25 % wetlands remain permanently inundated while rest are seasonally inundated (Map 12).

The connectivity approach has the potential to be applied extensively to the Gangetic floodplain for understanding the complexity of its wetlands and to design effective management protocols. Of the 32 wetlands analyzed, only 9 % were perennially connected with the river and streams throughout the year while 3 % were connected seasonally i.e., during monsoons only. Rest 88 % wetlands remain completely isolated (Map 13).

A snapshot of how flooding occurs in river cross-sections having embankments and not having embankments are shown in Figure 5. The maximum extent of inundation is shown in, prepared using 35 years of inundation data by Peckel et. al. 2016 (Map 14). Map 15 presents the flood risk hazard zone of Ghaghara Confluence to Gomti Confluence sub-basin as per the vulnerability map of Uttar Pradesh made by BMTPC, Sol and Gol.

Geographically isolated wetlands or wetlands that are completely surrounded by uplands might normally lack surface water connections, they can be hydrologically connected to downstream waters through intermittent surface flow or groundwater. Horizontal flow reflects connection between rivers and wetlands or between wetlands through flood pulses or inundation. Vertical flow reflects water flow between wetlands holding surface water to groundwater. 81 % of the surveyed wetlands are losing water to vertical flow 10 % exhibit horizontal flow in the surface and 9 % have both vertical and horizontal flows.

The study by Peckel et al., 2016 highlights the transition of water from one form to another in terms of inundation. Within the 10km buffer zone on either side of the river Ganga, it is assessed that over the past 3 decades only six percent has remained permanent and unchanged. (Map 16).



Map 12: Seasonality of water in the 10km buffer zone on either side of the River Ganga in Ghaghara Confluence to Gomti Confluence sub-basin



Map 13: Connectivity and inundation regime of the surveyed wetlands





Figure 5: Rising surface water levels in relation to water logging in the neighboring areas (Bonsor et al., 2016)



Map 14: Maximum water extent within the surveyed wetlands in the 10km buffer zone on either side of the River Ganga in the Ghaghara Confluence to Gomti Confluence sub basin



Map 15: Flood hazard zone in the Ghaghara Confluence to Gomti Confluence sub basin



Map 16: Transitions of Water

Monitoring of water quality parameters is important to understand the interactions between parameters and its effect on aquatic life, their growth and health. Each water parameter individually may not cause alarming situation, but several parameters together can reveal dynamic processes taking place in the wetland.

One time sampling was conducted in 2020 following standard protocols. Water sample was collected from 32 wetlands (Map 17). Water quality analysis was carried out at the respective regional laboratory, Uttar Pradesh Pollution Control Board. Samples were tested for DO, pH and nutrient load.

The results indicate that DO in the sampled wetlands (N = 32) situated in the 10 km buffer on either side of River Ganges in the Ghaghara Confluence to Gomti confluence sub -basin, ranged from 0.5 to 7.1 mg/l. Majority (79.3%) wetlands have DO ranging above 4 mg/l. Of the sample of 32 wetlands, 21.8 % wetlands were recorded to be eutrophic (Figure 6 and Figure 7). pH ranged from 7.22 to 8.79. Wetlands of Chandauli district showed higher alkalinity, with pH > 8 as compared to the rest.



Demonstration of water quality testing



Map 17: Variation in DO, pH and nutrient load for surveyed wetlands in the Ghaghara Confluence to Gomti confluence sub-basin



Figure 6: DO in the surveyed wetlands in different districts within 10 km buffer in the Ghaghara Confluence to Gomti confluence sub-basin



Figure 7: Trophic status of surveyed wetlands in different districts within 10 km buffer in Ghaghara Confluence to Gomti confluence sub basin

#### **Groundwater levels**

From 1984 to 2015, spatial distribution of groundwater shows an overall decrease of 35.67% in groundwater level in Gomti River Basin (Sharma et.al 2020). The groundwater has steadily declined in parts of Uttar Pradesh over the past decade as seen in Map 18. Groundwater which was once available at ground level to 3

metres below subsurface at majority of the catchment has been pushed to 10-20 meters in a decade. This can be attributed to the rising abstraction of groundwater for catering to the needs of growing population and the ease of abstraction. As groundwater is a readily available pollution free water there is a stark shift from the use of surface water to groundwater. This has led to the drawdown of groundwater way more than the recharge that is consistently leading to the decline in groundwater levels.

## **Species and Habitats**

Many plant and animal species live in the wetlands, including a number of rare and endangered species. Such species are characteristic to their environment and often described as indicator species that are used to monitor environmental changes, assess the efficacy of management, and provide warning signals for impending ecological shifts. Reed (1988) first described the indicator status of a species (floral or faunal) through its expected occurrence in the wetland as follows:

Obligate wetland species	Occur almost always (estimated probability >99%) under natural conditions in wetland habitat
Facultative wetland species	Usually occur in wetlands (estimated probability 67%–99%), but occasionally found in non-wetlands habitat
Facultative	Equally likely to occur in wetlands or non-wetland habitat (estimated probability 34%–66%)
Facultative upland	Usually occur in non-wetland habitat (estimated probability 67%–99%), but occasionally found in wetlands (estimated probability 1%–33%)
Obligate upland	Occur almost always (estimated probability >99%), under natural conditions in the non-wetland habitat

## **Plant species occurrence**

The Gangetic ecosystem forms a unique environment for hydrophytic, semihydrophytic, and submerged floral association. The vegetation pattern in the Ganga basin varies according to seasonal changes, hydrology, flood level, and different soil types. These factors have a sharp influence on plant species distribution and composition.

The present study was conducted in the Ghagra Confluence to Gomti Confluence sub-basin. 32 wetlands across the three districts were sampled. 27 wetland plant species representing 25 families were identified (Annex 1). Family Amaranthaceae and Apiaceae were recorded as dominant. The plant species were grouped as; emergent, free-floating, moisture-loving, and submerged (Figure 8). The occurrence of free-floating hydrophytes was recorded maximum (63%). Water hyacinth *Eichhornia crassipes*, Hornwort *Ceratophyllum demersum*, and Hemp *Cannabis sativa* were recorded as major invasive wetland plant species.



Map 18: Groundwater levels in different parts of Uttar Pradesh over the past decade



Figure 8: Hydrophytic plant species recorded in the Ghagra Confluence to Gomti Confluence sub-basin

Vetiver grass was recorded only from wetlands within the river channel which were also dominated with *Phragmites* sp. *Typha* sp. dominated the isolated wetlands. Herbs like *Ipomea* sp. were recorded from the isolated wetlands.

Wetland vegetation, despite offering high resource availability is often affected by habitat loss and fragmentation. In the present study, it was recorded that wetlands are being converted for permanent farming. Overuse of resource extraction was also recorded. It has brought about adverse impacts giving the rise to spread of invasive species like water hyacinth, leading to eutrophication indicating a non-conducive ecological regime.

Comprehensive information on the aquatic biodiversity and various ecological aspects of the river Ganga has been documented but the status of wetlands faunal elements in Uttar Pradesh state remains feebly documented. Studies have largely been conducted to document the distribution, habitat use, and breeding of the Sarus Crane *Grus antigone*, a globally vulnerable species and India's only resident



Flora species occurrence
breeding crane (Rahmani et. al. 2019; Sundar 2006). Few other noteworthy studies include patterns of fish diversity (Jha and Das, 2019); amphibians and their ecological importance (Kanaujia and Kumar, 2013), and, the status and abundance of freshwater turtles in Uttar Pradesh (Singh et. al. 2009).

In the present study, the occurrence of fauna was documented based on direct sightings during field visits and secondary data in the form of peer-reviewed published articles was also referred to. Species conservation status was described following the IUCN Red List. A total of 23 species of fish (Annex 2), three species of amphibians (Annex 3), four species of reptiles (Annex 4), five species of mammals (Annex 5), and 66 species of birds were recorded (Annex 6). Five species of high global conservation significance were recorded from this sub-basin (Figure 9). The floodplain wetlands are an important habitat for over 60 bird species, including at least 25 water birds (Figure 10).

Rich in fish diversity (~36% fish species of the Ganga river system) have been recorded from this sub-basin. A study conducted at Surahatal revealed presence of forty-one species of fishes belonging to six orders, sixteen families and twenty-five genera (Singh et al. 2009). The walking catfish *Clarias batrachus* was recorded as a dominant fish species. It is a freshwater fish species that require wetlands as spawning grounds and as nursery areas for their young ones.

Pond Turtle Actinemys marmorata and the Indian Flap Shell Turtle Lissemys punctata commonly occur in isolated ponds. Riverine turtle species such as the vulnerable Ganges softshell turtle Nilssonia gangetica often move between rivers and wetlands to find suitable foraging, mating, nesting, rearing, and overwintering habitat throughout the year.

Floodplain wetlands are effective in improving habitat quality by mitigating the effects of fragmentation. Suraha Tal in Ballia District of eastern Uttar Pradesh is the largest floodplain lake. It is a perennial meander of the river Ganga with an area of 26km<sup>2</sup>. The Tal is connected with River Ganga through a 32.6 km long Katehar nullah (Map 19). This continuum of riverine-wetlands complex serves as a suitable corridor linking habitats for free movement and recolonization of species. Also, due to the availability of good nesting and feeding habitats, the Tal offers refuge for a variety of avifauna. During field surveys between August 2002 and July 2004, Srivastava and Srivastava (2012) recorded a total of 91 species of birds representing 33 families and 13 orders. Of these, 62 species were resident, 24 winter migrant and 20 local migrants. Availability of food and suitable habitat support resident and local migrant bird species to visit the wetland throughout the year.



Figure 9: Species of high global conservation significance recorded in floodplain wetlands in Upstream Gomti Confluence to Muzaffarnagar sub-basin



Figure 10: Status of wetlands bird species recorded (n = 66)



Map 19: Surha Tal in Ballia District is a proposed Ramsar Site

### Wetlands Ecosystem Services and Livelihoods

#### Demographic features

The landscape in the flood buffer zone of Ghaghara confluence to Gomati confluence presents a mosaic of largely clustered settlements interspersed with agricultural fields. Predominantly mixed in population character, the region houses many known historical and industrial centers like Ballia and Ghazipur. Number of households are around 5,56,737 with an approximate population of 3,99,4011 inhabiting targeted 10km area from the main stream of the Ganges. Male to Female ratio is 53:50 with literacy rate of approximately 48%.

#### **Regulating services**

A key indirect value of floodplain wetlands to the communities living in the vicinity is their ability to buffer extreme events like floods, droughts and heatwaves. Gangetic floodplains are some of the most susceptible areas in India prone to flooding and experience frequent loss of life and property. The target districts of Ballia, Ghazipur and Chandauli are highly vulnerable to flood incidences with reported losses of life and property. With climate change, there is a possibility of an increased occurrence of these extreme hydrometeorological events increasing the risk of natural hazards. The role of wetlands as buffers, therefore, becomes more critical and of urgent nature. It was recorded that around 56.25% of surveyed wetlands and their complexes provide a buffer to bank inundations by absorbing the flows and thereby reducing the risk of damages within the settlements around the complex. Wetlands like Bhogwar and Birna in Chandauli district and Dahtal Reoti in Ballia district exemplify such buffering function of wetlands. Lack of understanding of the role of wetlands as nature-based solutions in disaster management and more focus on structural engineering has led to fragmentation of natural regimes of these wetlands (Figure 11).



Figure 11: Number of surveyed wetlands utilized for regulating services by communities

#### **Provisioning services**

The survey zone across the 3 districts lies in the highly fertile floodplains of the River Ganges with agriculture and animal husbandry being the key economic activities. Primary survey brought to fore that almost 28.1% of sampled wetlands were utilized for sourcing fresh water for irrigation purposes, while a considerable percentage of 37.5 were utilized for supporting population of livestock by providing water for rearing activities.

Capture fisheries within the sub-basin essentially form the base of livelihoods of around 50% of respondent households. It was also observed that village ponds are generally leased out by Gram Panchayats on a time-bound basis for pisciculture activities. This provides additional employment opportunities to locals. Also, culture fishery is practiced in almost 18% of surveyed wetlands. *Mallahs* constitute an exclusive caste of occupation fishers. However, locals living near wetlands also resort to occasional fishing. Changes in inundation patterns and decline in connectivity with riverine environments also impact fishing practices as witnessed in Surha Tal located in district Ballia. Major fishing in the wetland coincided with decreasing water levels from February to May, with monsoons witnessing a declining fishing activity. The deeper areas are used for net fishing, whereas traps are used in the marsh areas located in the margins.

Locals also reported that fisheries have transformed from a high-value mix of Indian Major Carps to low economic value air-breathing fishes like Magur (*Clarias batrachus*) and Snakehead fish (*Channa* spp.). The use of very small mesh (mosquito size nets) and traps has further impacted species recruitment. Also, construction of barriers affecting riverine connectivity also impacts auto stocking from rivers as witnessed in the case of Surha Tal, where construction of barrier on the Katehar nalluh has impacted such auto stocking of Indian Major Carps from the River Ganges.

For the villages adjacent to the wetlands most predominant human use of aquatic vegetation is that of macrophytes mainly as food, fodder for the cattle, fuel and raw material of herbal medicines. Almost 34% of wetlands are used for harvesting aquatic plants. Plant of Lotus (*Nelumbo nucifera*), leaves, and stem of Water Spinach (*Ipomoea aquatica*) locally called Nari ka saag are harvested from the wetland complex and used as vegetables. *Sparaganium erectum*, reported along Pakaria tal in Ballia district is used for sourcing of seeds for preparation of "Tilwa". Also, its stem is used for weaving indigenous mats, locally known as "Gonar". *Typha angustifolia* and Narkul (*Phragmites karka*) are extensively used for thatching, making ropes and mats. Respondents also reported declining growth of once abundant and culturally significant wild- semi aquatic rice locally known as "Teeni", which is used in local festival of Jaitua (Figure 12).



Figure 12: Number of surveyed wetlands utilized for provisioning services by communities

## Supporting services

Supporting high avian diversity is one of the prominent features of the Gangetic floodplain wetlands. Wintering population of waterbirds, have been recorded in good numbers from the Surha tal wetland in Ballia district, which is also one of the largest floodplain wetlands in eastern Uttar Pradesh and have been declared as a bird sanctuary. It is also considered as a potential Ramsar site due to presence of high diversity of waterbirds. Though no consistent records are available on the number of waterbirds at many wetland sites, in terms of habitat preference wetlands of the region serve as a safe refuge for birds, especially those migrating along the Central Asian Flyway. Hydrological and ecological connectivity between the river channel, riparian zone, and floodplain wetlands. Sampled wetlands of Danapur in Chandauli district and Sansar Toal Bhagad are also known for supporting significant biodiversity.

The importance of cyclic inundation for the biodiversity of Gangetic floodplain wetlands is apparent. The exchange of fish brooders and juveniles between the river channel and the floodplains helps to sustain high fish biodiversity and productivity of the entire Indo-Gangetic plains. Besides, species of conservation significance like *Wallago attu*, *Cirrhinus cirrhosis*, *Chitala chitala* etc. also find refuge in these wetlands making their conservation, a priority (Figure 13).

## Cultural, educational and recreational services

The Ganges is the most sacred freshwater ecosystem in India. The aesthetics, mythological connotations, and spiritual appeal have made it the popular world over. Two major ancient sites of pilgrimage, Ballia and Ghazipur are located within the sub basin. Wetlands here too are interlinked with socio-cultural lifestyle of the Gangetic communities. Many wetland sites like *"Durga Kunda" in* Naugarh Chandauli district is considered sacred and used for ritualistic bathing. Besides, Since, ancient times, socio-cultural ceremonies are held at banks of these

waterbodies which are continued by tradition. *Chatt Puja*, a famous and sacred festival is celebrated on the banks of a number of wetlands on the auspicious Karthik Shukla Shasthi by a large number of inhabitants of the region. Also, local festival of *Satuan* celebrated during April in the region also involves ritualistic bathing and donating food to the needy. Wild rice "Teeni" found growing in wetlands is also considered culturally significant and used during festival of Jaitua. Of the total sampled wetlands, around 28% were found to have spiritual and cultural significance and around 25% still considered significant owing to their social values (Figure 14).



Figure 13: Number of surveyed wetlands providing supporting services



Figure 14: Number of surveyed wetlands providing Cultural, educational and recreational services

# 3. Evaluation of Wetland Features

# **Ecological character**

Wetlands are managed for their wise use which is the maintenance of their ecological character, achieved through the implementation of ecosystem approaches, within the context of sustainable development. Ecological character description is one of the key elements of the definition of 'wise use', incorporating the combination of the ecosystem components, processes, and services that characterise the wetland at a given point in time. Ecological character is the maintenance of wetland values and functions, while at the same time delivering ecological services and benefits now and into the future, for human well-being. Wise use, in promoting maintenance of environmental, economic, and social sustainability, encourages compromise (or trade-offs) between individual and collective interests. To achieve sound decisions on wetland, use, and management, decision-makers at local, regional, and national levels need to enable participation by relevant stakeholders and to balance a variety of objectives and perspectives.

Ecological character definition allows identification of critical components, processes and services, and identifies changes thereof, which require management intervention. Ecological character is an indicator of health of the wetland ecosystem, and thereby is an important benchmark for management. Changes to ecological character of the wetlands, outside natural variation may signal that uses of the site are unsustainable, and may lead to the breakdown of the ecological, biological and hydrological functioning of the wetland system (Ramsar Convention 1996, Resolution VI.1).

The framework used for describing ecological character for Ganga floodplain wetlands build on the Ramsar Framework (Resolution X.15) modified to suit the local context. The following definitions have been used:

**Ecosystem components** include the living (biotic) and non-living (abiotic) constituents of wetland ecosystem.

- Geomorphic setting (landscape, catchment, river basin)
- Climate (precipitation, temperature)
- Physical setting (area, boundaries, topography, shape, bathymetry, habitat type and connectivity)
- Water regime (inflow, outflow, balance, surface groundwater interactions, inundation regime, quality)
- Wetlands Soil (Texture, Colour)
- Biota (Plant and animal communities)

**Ecosystem processes** comprise of processes that occur between organisms and within and between populations and communities, including interactions with non-living environment that result in existing ecosystem state and bring about changes in ecosystems over time. These are:

- Physical processes (water stratification, mixing, sedimentation, erosion)
- Energy nutrient dynamics (primary production, nutrient cycling, carbon cycling, decomposition, oxidation reduction)
- Processes that maintain animal and plant population (recruitment, migration)
- Species interaction (Competition, predation, succession, herbivory)

**Ecosystem services** are benefits obtained by humans from wetland ecosystems. These are:

- Provisioning (fisheries, use of aquatic vegetation for economic purpose, wetland agriculture, biochemical products)
- Regulating (maintenance of hydrological regimes)
- Cultural (recreation and tourism, spiritual, scientific and educational value)
- Supporting (Soil formation, Primary production, Nutrient cycling, Water recycling, Provision of habitat).

The 32 surveyed wetlands of the Ghaghara Confluence to Gomti confluence subbasin based on their local and hydrological characteristics can be placed under the two categories (Table 3):

- Riparian wetlands (sampled number of wetlands equals 3): which are located within the active floodplains and are directly or indirectly connected with the flood pulse of the river Ganga.
- Others/Isolated wetlands (sampled number of wetlands equals 29): which are located in depressions in the landscape with their hydrology sustained largely by catchment flows. It also includes a few wetlands that are seasonally connected with the Ganges through a channel but are not situated within active floodplains.

Wetland	Landforms	Hydrology &	Vegetation	Soil	Function	Representat
Category		hydrodynamics				ive
						examples
Riparian	Oxbows and	Precipitation and	Macrophyte	Predomi	Significan	Bahkata,
wetlands	paleochannels.	river fed, connected	s largely on	nantly	ce as flood	District
	Predominantly	with the river at	the margin,	loam.	buffer and	Ballia
	flats aligned	least during	open water		ground	
	with the	monsoon,	up to 80%.		water	
	channels.	horizontal water			recharge.	
		flow, mostly				
		inundated for less				
		than 6 months.				
Other/Isol	Shallow	Fed by precipitation	Heavy	Mix of	Significan	Talwal,
ated	depressions,	and basin flows,	infestation	clay and	ce for	District
wetlands	mostly isolated	isolated patches,	of	loam.	ground	Ghazipur,
		predominantly	macrophyte		water	Surha Tal
		vertical flows,	s, open		recharge	District
		seasonally	water up to			Ballia
		inundated	20 - 30 %.			
		wetlands.				

Table 3: Categories of wetlands in the 10-km buffer around River Ganga

The ability of riparian wetlands to sustain its ecosystem services and biodiversity values is dependent on the following ecosystem processes:

- Connectivity of the wetland (lateral, horizontal and vertical) with the riparian environment enabling exchange of sediments, water, nutrients and aquatic organisms.
- Ecological integrity of the migratory corridors to suit the life-cycle requirements of migratory species.
- Landscape aesthetics which supports its touristic and recreational value.
- Cultural, spiritual, and religious values reflected in local practices like offering of libations to the gods, ritual bathing and others.

Sustaining the aforementioned ecosystem services and biodiversity values require:

- Prevention of floodplain fragmentation.
- Protection of species breeding, feeding, spawning grounds, and dispersal routes.
- Responsible tourism aligned with the ecosystem fragility restricting adverse anthropogenic footprint into the wetland.
- To promote relational values that communities hold with the river and its floodplains.
- Governance regimes that enable mainstreaming full range of ecosystem services and biodiversity values within developmental plans, programmes and investments.

The ability of the Others/Isolated wetlands to sustain its ecosystem services and biodiversity values is dependent on:

- Hydrological connectivity with the catchments.
- Pollution loading.
- An optimal balance between open water and macrophyte dominated areas.
- Landscape aesthetics and recreational value.

Sustaining the aforementioned ecosystem services and biodiversity values require:

- Maintenance of the inlets and outlets as per natural gradient.
- Abatement of pollution within the catchment.
- Maintenance and enhancement of recreational and educational values of the wetland.

A description of ecological character in terms of key wetland features is presented in Table 4.

Table 4: Status and trends in ecological character of surveyed wetlands with reference to them in the 10km buffer zone on either side of the river Ganga in the sub-basin Ghaghara Confluence to Gomti Confluence

Wetlands	Descriptors	Data	Current condition of management categories		
Features		Source	Within river channel	Others/Isolated (N=	
			(N=3)	29)	
Physical regime	Types	Sampled Data	Predominated by floodplain wetlands (100%).	Predominated by floodplains (48.3%), followed by sumplands (34.5%), ponds (10.3%) lakes (6.9%)	
	Area (ha) (Range and Average)	Sampled Data	6.2 – 20.32 ha; 10.12 ha (Median)	0.38 - 34329 ha; 3.7 ha (Median)	
	Depth (m) (Range and Average)	Sampled Data	2 - 3 m; 2m (median)	0.8 -30 m; 3 m (median)	
	Loss (Decline in area and numbers since 2000)	Basin Wide	Wetland area shrunk fro (71%) during 2000–2020	m 28,988 ha to 8,529 ha )	
Hydrological regime	Water regimes	Sampled Data	Predominated by seasonally inundated wetlands (100%)	Seasonally inundated (75.9%), Permanently inundated (24.1%);	
	Connectivity	Sampled Data Sampled Data	67 % wetlands connect to The Ganges. 67 % wetlands have inlets and outlets. Majority house flowing water (67%) with majorly horizontal flow direction while the rest house static water (33%) with vertical flow direction.	13.8 % wetlands get seasonally connected to River Ganga during monsoons. Remaining are left as isolated. 20.7 % have both inlets and outlets whereas 20.7 % have only inlets with no outlets. Majority house static water (79.3%) with vertical flow direction while the rest house flowing water (13.8%), or a combination of flowing and static water (6.9%) depending on the month with horizontal flow direction.	
	Water chemistry (Range and Average)	Sampled Data	Alkaline pH ranging from 7.49 to 8.52. DO value ranges from 4.5 to 5.7 mg/l. 67 % showing mesotrophic nutrient concentration.	pH ranges from 7.22 to 8.8 and all wetlands have alkaline pH. DO values range from 0.5 – 7.1 mg/l. The wetlands are majorly mesotrophic (72.4%)	
	Climate Details	Sampled Data, IMD and	Catchments have a moderate subtropical climate. Major parts of the		

Wetlands	Descriptors	Data	Current condition of management categories		
Features		Source	Within river channel	Others/Isolated (N=	
			(N=3)	29)	
		secondary	sub basin receive a		
		sources	rainfall of 850-900		
			mm., mainly during		
			the south west		
			monsoons. A		
			variation in rainfall		
			across the sub		
			basin can be seen		
			with areas around		
			Mughalsarai and		
			Mau receiving lesser		
			rainfall (550-650		
			mm) Rainfall is		
			higher along the		
			Kaimur range (950-		
			1050 mm) (IMD		
			2020). Average		
			temperatures over		
			the basin ranges		
			from 16.3°C in		
			January to 32.9°C		
			in May.		
Catchmonte	Coology and	Domoto	92 % of the sub		
Catonnents	Geomorphology	Sonoing	basin is part of the		
	e control priology	and GIS	Ganga alluvial plaine		
		data	with elevations of		
		Sampled	50 -100 m 18 % of		
		data	the sub basin falls		
		dutu	under the central		
			highlands		
			comprising the		
			Kaimur range that		
			are the eastern		
			extension of the		
			Vindhyans. Steep		
			slopes (>12%) are		
			encountered at the		
			edge of the plateau		
			region. A maximum		
			elevation of 650 m		
			is encountered here.		
			The alluvial plains		
			are dominated by		
			Cambisols whereas		
			the Ferric Luvisols		

Wetlands	Descriptors	Data	Current condition of management categories		
Features		Source	Within river channel	Others/Isolated (N=	
			(N=3)	29)	
			are found in the		
			plateau region. The		
			parts of the sub		
			basin falling under		
			Ambedkar Nagar,		
			Sultanpur, Faizabad		
			and Sonbhadra		
			districts face very		
			severe soil erosion		
			problems. parts.		
	Land use and	Basin Wide	Major Land Use Land Co	over classes recorded in	
	Land-cover of	(Remote	the drainage basin is Ag	riculture, Barren land,	
	drainage basin	Sensing and GIS	Vegetation, Wetland, Riv	er and Built Up.	
		data)	During 2000-2020 decre	ase was recorded in	
			agricultural land by 1	4% and Wetland	
			extent by 6.5%. Howe	ever, vegetation, bare	
			soil, and built-up incr	eased by 14.14%,	
			5.98%, and 1.79% res	spectively.	
Species and	Species	Sampled	100% wetlands house	0% of wetlands house	
Habitats	occurrence	Data	dominant obligate	flagship obligate faunal	
			floral species like	species while 80%	
			Dhragmitae quatralia	wetlands nouse	
			etc	floral species like	
				Nymphaea caerulea	
				Zostera spp.,	
				Lemnoideae spp., etc.	
	Species	Sampled	6% house vulnerable	0 % of wetlands house	
	conservation	Data	faunal species (Naja	critically endangered	
	status		melanoleuca, Nilssonia	faunal species and	
			gangetica, etc.) while	endangered animal	
			45% house hear	species while 40%	
			(Python sp)	faunal species (Naia	
				melanoleuca, Lissemys	
				punctata, Grus	
				antigone, etc.) and	
				30.16% house near	
				threatened species	
				(Anhinga melanogaster,	
		Samplad	75% of wotlands	Fyinon sp. etc.).	
	mvasive species	Data	house invasive	invasive species like	
		23.0	species like Cvprinus	Cyprinus carpio. etc.	
			carpio, etc. while 100%	while 100% house	
			house invasive floral	invasive floral species	
			species (Eichhornia	(Eichhornia crassipes,	
			crassipes).		

Wetlands	Descriptors	Data	Current condition of management categori			
Features		Source	Within river channel (N=3)	Others/Isolated (N= 29)		
				Ipomea spp., Cannabis sativa ssp., etc.).		
Livelihoods and Ecosystem Services	Livelihoods	Sampled Data	All wetlands have minimal dependency <i>i.e.</i> , < 20% of total village population was dependent on wetland.	72.41% of wetlands have minimal dependency <i>i.e.</i> , < 20% of total village population is dependent on wetland while in 17.24 % wetlands, 20-40% of village population were dependent on the wetlands.		
	Provisioning Services	Sampled Data	Majorly serves as freshwater for agriculture (100 %), freshwater for livestock (67%), food - fish (33%).	Primarily provides freshwater for livestock (34.5%), freshwater for food- fish (27.6%), agriculture (20.7%), fresh water for drinking, washing & domestic use (10.3%), and fiber and fodder (6.9%).		
	Regulatory Services	Sampled Data	The regulatory services attributed to wetlands are local pest regulation (100%), local flood hazard regulation (67%), salinity regulation (67%), water during droughts (67%), fire regulation (67%), regional pollination (33%) and noise and visual buffering (67%). The wetlands were perceived to increase risk of human diseases (100 %) as well as	Primarily aids in water during pest regulation (89.7%), droughts (70%), water regulation (62.1%) and flood hazard regulation (55.2%), salinity regulation (51.7%), erosion control (44.8%). Positive water purification benefits perceived for 31% wetlands. 69% were said to increase risk of human diseases and 65.5% livestock diseases. Fire regulation (38%),		

Wetlands	Descriptors	Data	Current condition of management categories		
Features		Source	Within river channel	Others/Isolated (N=	
			(N=3)	29)	
			livestock diseases (100%).	pollination (31%) and noise and visual buffering (21%), local climate regulation (27.6%), air quality regulation (20.7%) were seen as minor benefits	
	Cultural Services	Sampled	No cultural services were attributed to the wetland.	Primarily aids in adding to the aesthetic value (21%), social relations (27.8%), spiritual and religious value (24 %), The wetlands have little recreation and tourism and educational and research values	
	Services	Sampled Data	Primarily helps in nutrient cycling (100%), primary production (67%) and soil formation (67%), water recycling (33%) and serves as biodiversity habitat (33%) in the region.	Primarily helps in soil formation (41.4%), nutrient cycling (41.4%), water recycling (17.2%) and primary production (38%), soil formation (38%)	
	Pre-existing rights and privileges in the wetland	Sampled Data	Primarily wetlands are used and can be used for bathing or wallowing of domestic animals (100%), withdrawal of water for agriculture and fisheries (100%), withdrawal of water for domestic purposes (100%). Religious practices (100%), grazing (100%). Fishing and harvest of aquatic plants without lease	Primarily used for grazing (93%), bathing or wallowing of domestic animals (86.2%), religious practices (48.3%), Fishing without lease (41%), fishing under lease from government department (20.7%), community harvest of plants (without any lease) (21%), withdrawal of water for agriculture or fisheries (38%),	

Wetlands	Descriptors	Data	Current condition of management categories		
Features		Source	Within river channel	Others/Isolated (N=	
			(N=3)	29)	
Institutions	Land tenure and	Sampled	from the government department (100%) are some other rights being availed by the communities. Agriculture within the wetland (33 %) and harvest of aquatic plants (33%) are minor uses.	withdrawal of water for domestic use (27.6%). Agriculture or horticulture within wetland (6.8%), plying of boats (6.8%).	
and	administration:	Data	Government Gram	Government Gram	
Governance	Pattern of land ownership within the wetland		Panchayats-Full (35.71%) and Partial (35.71%), followed by Government Revenue Land-Partial (28.57%) and Full (21.43%), Government Revenue Land-Full 1(4.29%), Government Irrigation DeptPartial (7.15%), and finally Government Forest Department-Partial (7.14%).	Panchayat-Full (60.32%), followed by Government Revenue Land-Full (12.70%), Government Gram Panchayat-Partial (7.94%), Private-Full (6.35%), Government Revenue Land-Partial (4.76%), and Private- Partial (3.17%). A significant portion is Not Clear (12.70%).	
	administration: Pattern of land ownership outside the wetland	Data	Full (50%), followed by Private-Partial (21.43%), Government Revenue Land-Partial (14.29%), Government Revenue Land-Full (7.14%), Government Gram Panchayat-Full (7.14%), Government Gram Panchayat- Partial (7.14%), and Government Forest Department-Full (7.14%).	Full (69.84%), followed by Private-Partial (14.29%), Government Gram Panchayat- Partial (11.11%), Government Gram Panchayat-Full (6.35%), and Government Revenue Land-Partial (3.17%). A small fragment is not clear (11.11%).	
	Management Plans	Sampled Data	Managed primarily under the Village Development Plan (42.86%), followed by Village Development Plan, Irrigation Water Management Plan (21.43%), Forest Working Plan + Village	Largely managed by the Village Development Plan (95.24%), followed by Irrigation Water Management Plan (57.14%) and the Forest Working Plan (44.44%).	

Wetlands	Descriptors	Data	Current condition of management categories		
Features		Source	Within river channel	Others/Isolated (N=	
			(N=3)	29)	
			Development Plan +		
			Irrigation Water		
			(14.20%) Forget		
			(14.29%), FOIESt Working Plan + Villago		
			Development Plan		
			(14,29%), and		
			Irrigation Water		
			Management Plan		
			(7.14%).		
	Laws and	Sampled	Equally governed by Dist	trict Administration and	
	Regulation	Data	Forest and Wildlife Prote	ection Act.	
	Monitoring programmes	Sampled Data	Monitored by the Distric	t Ganga Committee.	
	Formal and	Sampled	Networks include	Networks include	
	informal	Data	District Administration	District Administration	
	institutions and		(100%), Elected	(100%), Elected	
	networks		political	political	
			(100%) Local Forget	Local Forget	
			(100%), LOCALFOREST	Department	
			Panchavati Rai	(100%) State	
			Institutions	Agriculture Department	
			(100%), State	(100%), State	
			Agriculture	Biodiversity Board	
			Department	(100%), State Culture &	
			(100%), State	Tourism Department	
			Biodiversity Board	(100%), State Fisheries	
			(100%), State Culture	and Animal Husbandry	
			& Tourism Department	Department (100%),	
			(100%), State Fishenes	State Pollution Control	
			Department (100%)	Panchavati Rai	
			State Pollution Control	Institutions (85 71%)	
			Board (100%).	Irrigation Department	
			Followed by	(65.08%),	
			Accademia/Colleges,	Accademia/Colleges,	
			Universities and	Universities and	
			Research Institutes	Research Institutes	
			992.86%), NGOs	(61.90%), NGOs	
			(57.14%), Irrigation	(42.86%), Hoteliers and	
			Department (50%),	Hotel Association	
			Hotellers and Hotel	(14.29%), and Religious	
			and religious bodies	area near to wetlands	
			nresent in the area	(1.59%)	
			near to wetlands	(1.0970).	
			(21.43%).		

# Functional assessment and ecosystem services potential mapping

The 10–km buffer region around River Ganga channel has primarily the following three landform types which serve as host to the wetlands and determine its size and shape:

- River and irrigation channels linear, though not necessarily straight open depression formed by River Ganga, its tributaries and linked irrigation channels.
- Flats flat or slightly undulating terrain adjoining the channels which also serve as the floodplains.
- Basins contained, closed depressions in the landscape forming a trough.

Water distinguishes wetland habitats from other terrestrial habitats and influences biological response by its presence, depth, chemistry and movement. The period of water availability in the wetland also termed as 'hydro-period' usually characterized in terms of its permanence or intermittence, reflects the balance between precipitation and evaporation, recharge and discharge, permeability of underlying sediments and shape of the wetland. Generally, a mix of two hydrological conditions is seen in the landscape: inundated (free standing water over soils with soil below the surface being saturated), and waterlogged (soils that are saturated with water yet water does not inundate the soil surface). Therefore, three types of water permanence can be discerned in the landscape:

- Permanently inundated water covers the land surface throughout the year.
- Seasonally inundated surface water is present for extended periods especially post monsoon but gradually recedes by the end of winters or early summers.
- Seasonally waterlogged substrate is saturated for extended periods with surface water being seldom present.

Combining the various type of landforms with various types of water permanence provides five major wetland types, which are shown in the Table 5.

Hydrology Landform	Permanently inundated	Seasonally inundated	Seasonally waterlogged
Basin	Lake/Swamp/Marsh	Sumpland	Dampland
Flat		Floodplain	Palusplain
Channel	River	River / Irrigation Canal	River / Irrigation Canal

Table 5: Hydro-geomorphic classes of wetlands in River Ganga floodplains

Wetlands were further classed on the basis of macrophytic vegetation / tree cover as sparsely vegetated (<20 %), moderately vegetated (20 – 40%), and abundantly vegetated (>40 %). The latter two categories are termed as 'marsh' or 'swamp' depending on whether the predominant vegetation is herbaceous or woody. All wetlands having area  $\leq$ 5ha and with emergent vegetation cover of up to 30% in the study landscape have been classed as ponds (Richardson et al., 2022). The category of river and canal are mentioned with reference to Ramsar classification system; however, these were not included within the current project. A wetland function score was derived for functions like flood buffering, groundwater recharge and water purification for each of the wetlands surveyed in this sub basin. The classification scheme was based on 7 components (a) geomorphology (b) water source (c) water permanence (d) hydrodynamics (e) soil type (f) vegetation cover (g) wetland area. The properties of these following components were given weights with respect to the significance of their delivery to the function as shown in the Table 6. Wetlands were classified as per the properties of each component and the properties were rated as per their significance of the property to deliver the respective functions. The ratings are as shown in the Table 7. The functional score was estimated using the equation given below

$$FS = \sum W_C \times R_C$$

In terms of water purification, flood buffering and groundwater recharge performed by the wetlands, the following assumptions have been used:

- Depressions and flats offer a certain degree of water storage as per the depth. Deeper the depression, more will be the water stored in the wetland.
- Wetlands that a greater ability to store precipitation and surface run off offer better groundwater recharge.
- Wetlands having a horizontal mobility of water offer better water purification due to exposure to sunlight and horizontal flushing.
- Soil with high permeability have more hydraulic conductivity, thereby storing and transporting more groundwater. High permeability also allows water to flow through a porous media which act as a filtration unit. It can also help in storing excess water during flooding event.
- Vegetation along wetlands trap excess sediments and heavy metals thereby helping in flood buffering and purification of water. However, a lesser vegetation cover facilitates greater groundwater recharge owing to the fact that vegetation cover is inversely proportional to the surface area of water in the wetland. The influence gradient for each category on the functions has been listed in Figure 15.

<b>Components/Functions</b>	Flood Groundwater		Water	
	buffering	recharge	purification	
Geomorphology	0.6	0.6	0	
Water source	0	0.6	0	
Water permanence	0.6	0	0.6	
Hydrodynamics	0.6	0.6	0.3	
Soil type	0.3	1	0.6	
Vegetation Cover	0	1	1	
Wetland Area	1	0.6	1	

Table 6: Weights of the components to deliver the respective wetland function



Figure 15: Functional score gradient of major identified functions based on its characteristics features

<b>Components/Functions</b>	Properties	Flood	Groundwater	Water
		buffering	recharge	purification
Geomorphology	Flat	5	5	5
	Depression	10	10	10
Water source	Only			
	precipitation	10	10	10
	Precipitation			
	and surface			
	runoff	5	5	5
	Groundwater	1	1	1
	Surface water			
	and			
	groundwater	8	8	8
Water permanence	Seasonal	1	1	1
	Intermittent	5	5	5
	Permanent	10	10	10
Hydrodynamics	Horizontal	10	5	10
	Vertical	5	10	5
Soil type	Soil with high			
	permeability	10	10	10
	Soil with low			
	permeability	5	5	5
Vegetation Cover	Total	10	1	10
	Partial	8	5	8
	Peripheral	5	8	5
	No Vegetation	1	10	1
Wetland Area	<1 ha	1	1	1
	1 to 5 ha	3	3	3
	5 to 10 ha	5	5	5
	10 to 20 ha	7	7	7
	20 to 30 ha	8	8	8
	>30 ha	10	10	10

Table 7: Ratings of the properties of components to deliver the respective wetland function

The functional scores for each function of all wetland classes are shown in Figure 16



Figure 16: Functional scores for each function of all wetland classes

An assessment of the ecosystem services of the 32 studied wetlands was undertaken using the Rapid Assessment of Wetland Ecosystem Services (RAWES) approach (Ramsar Convention 2018; RRC-EA in press). RAWES was developed to support ecosystem service assessment of wetlands recognizing practical time and resource limitations faced by operational staff, providing a simple, user-friendly, cost-effective approach supporting systemic assessment of the full range of wetland ecosystem services (McInnes and Everard 2017). RAWES addresses the four ecosystem service categories (provisioning, regulatory, cultural and supporting services) defined by the Millennium Ecosystem Assessment (2005).

Expert assessors interacted with numerous local stakeholders, community groups, government officials, and non-governmental organisations. Consent to use anonymized feedback from interviewees was sought prior to interviews and meetings.

Semi-quantitative importance of each service is scored on a scale from 'significantly positive' (+) through 'neutral' (0) to 'significantly negative' (-) or 'unknown' (?). Data captured in hand-written RAWES field assessment sheets were transposed into spreadsheet format, with some modification in dialogue amongst assessors and other experts where more information became available. Groups of ecosystem services (all 36 assessed services or within Millennium Assessment categories) were summed and divided by the number of services in that category (up to provisioning n=9, regulating n=14, cultural n =7, supporting n=6 but reduced where services were not relevant) to derive a single comparable ecosystem services index (ESI) (based on similar index methods by Butchart et al. (2010), calculated using Eq. 1. The potential ESI range is from +1 to -1 when calculated for each of the four ecosystem service categories, though compound values for all services can exceed these limits where benefits are realised at multiple geographical scales.

$$ESI = \frac{\sum (n_{+1.0} + n_{+0.5}) + \sum (n_{-1.0} + n_{-0.5})}{\sum n_{TOTAL}}$$

Based on the range of ESI scores for each of the services, the Figure 17 below was constructed illustrating the combined ESI scores for all ecosystem services under each category i.e., within river channel wetlands and Others/Isolated wetlands for all 106 wetland sites, as well as a breakdown of ESI for each service category (provisioning, regulating, cultural, supporting). As revealed from the data analysis, riparian wetlands reported higher ESI scores as compared to the Others/Isolated wetlands.



Figure 17: ESI scores of the services

## **Ecosystem health assessment**

Wetland Health Cards for the surveyed wetlands were prepared to help identify immediate threats and identify priority areas for future conservation works. The scores assess wetlands using nine indicators across four broad categories - Area, Hydrology, Biodiversity and Governance. The wetland health scores were categorized from A+ to E as per Table 8. The wetlands have very poor to worse health scores. (Figure 18 and Map 20).

	Excellent	0.96-1.00	A+
	Very Good	0.91-0.95	А
	Good	0.86-0.90	B+
Health Score	Moderate	0.81-0.85	В
	Fair	0.76-0.80	C+
	Bad	0.71-0.75	С
	Very Bad	0.61-0.70	D
	Worse	0.51-0.60	E

Table 8: Categorization of health score based on the ecosystem health assessment

Wetlands within the protected area like the Surha Taal and Kawleshwar Taal show poor health scores because of high eutrophication, loss of hydrological connectivity and inadequacy of present governance measures. The floodplains are situated within a densely populated landscape with numerous rural and urban centers. The districts of Ghazipur, Ballia, and Chandauli have high population densities and lack adequate sewage treatment capacities. The majority of wetlands are eutrophicated as they are isolated and receive runoff rich in nutrients from the surrounding areas.



Figure 18: Health scores of surveyed wetlands

### **Risk of Adverse Change**

Gangetic floodplain wetlands in Uttar Pradesh have been subjected to a wide range of anthropogenic disturbances accentuated by rapid and unregulated development along with an increase in use of chemicals in agricultural inputs since advent of green revolution. As an offshoot of the same, the region saw an increase in population due to rapid economic activities with repercussions for natural ecosystems including wetlands.

Assessments of change in land use and land cover has brought to fore the loss of wetlands to the tune of 50,000 ha amounting to 50% for the landscape, assessed for the period of 2000-2019. The primary causes underpin conversion to non-wetland uses like agriculture and plantation activities, pollution, declining groundwater levels and unsustainable harvest as major stressors that have contributed to this loss of wetlands. Also, embankments constructed as a response to annual flood inundation regime of River Ganga which covers an area of 310 km (With over ~60%) in the state, has caused a significant reduction in riverine connectivity and have adversely influenced hydrodynamics of floodplain wetlands.

Requirements of water intensive crops introduced by green revolution has also added to non-judicious abstraction of groundwater often influencing the local hydrodynamics of the region. Also, indiscriminate use of chemical inputs like pesticides and fertilizers, required for achieving higher agricultural productivity of such crops, have increased the risk of their leaching into wetlands with consequences like excessive nutrient loading, proliferation of invasive floral species and eutrophication of the ecosystem with implications for population of native species and ecosystem's life sustaining functions.

Increasing upstream demand for water for agriculture and fragmentation of hydrological regimes through the construction of dykes and channels have caused an overall reduction in water availability, Increase in sedimentation, and shrinkage in the wetland floodplain area. It was also observed during baseline survey that overall vulnerability of wetlands was also increased due to a general lack of awareness about values and functions of wetlands amongst shoreline communities that at many places consider them as mere "wastelands". This attitude of apathy amalgamated with broader governance and management issues has led to overall deterioration in condition and functions of wetlands in the landscape.

Identification of direct drivers of adverse change in wetlands is an important step in designing of efficient and cost-effective strategies for management of such threats. For the wetlands located within landscape, 25 direct drivers of threat (parameters) were identified, based on secondary research and field data collected on the same by means of semiqualitative primary survey. These parameters were further classified under 4 broad classes and 9 sub-classes based on the schematic threat analysis provided by "Global Wetlands Outlook" 2018, as shown below in Table 9.

Threat data obtained through survey was graded on a scale of 0-3, with 0 signifying none to 3 indicating high level of threat faced by wetlands. Scoring was done by considering highest score in respective sub class and then calculating percentile score based on sum of highest score attained and a grading system generated for the same based on following criteria.

Score Range	Assigned grade	Threat level
14 and above	А+	Very High
11	A	Very High
9	В+	High
7	В	High
4	C+	Moderate
3	С	Moderate
2	D	Low
1	E	Very Low

Table 9: Threat levels ascertained based on the score range and consequent threat grade



Map 20: Surveyed wetlands under different categories of health score in the 10km buffer zone on either side of the River Ganga in the subbasin Ghaghara Confluence to Gomti confluence

All 32 sampled wetlands were assigned grades based on the threat scores and further analyzed for selection of corrective management interventions required for checking identified drivers of adverse change. Baseline survey showed that extent of risk of adverse change was determined by the location of wetlands that influenced socio-economic, hydrological and developmental factors. Wetlands sited within river channel are found to be comparatively less threatened than those that are sited as isolated systems within the landscape. Although the nature of anthropogenic threats was found to be somewhat similar across the three categories, the extent of vulnerability varied. A brief description of major threats, based on sample survey of 32 wetlands has been provided below:

Wetlands sited within river channel are found to be threatened most by introduction of pollutants majorly due to discharge of nutrient rich run-off from agriculture and discharge of untreated sewage. More than 60% of wetlands were found to be affected with wastewater discharge. Wetlands like Rampur kodahara dhab and Sansar toal sited in Ballia district witness moderate pollution load due to wastewater discharge and solid waste disposal, while others like Ramgarh wetland in Chandauli district have reported higher loads owing to leaching of cattle waste. Over abstraction of water for irrigation from shoreline & agricultural run-off were other threats that these wetlands are reported to be exposed to. Most of these wetlands have agriculture as preeminent land use in surrounding region that makes them susceptible to such trends of water abstraction. Excessive sediment deposition has also been reported as a threat in almost all sampled riverine wetlands with Sansar toal in Ballia district reporting very high levels of siltation. This trend adversely affects the water holding capacity, wetlands productivity, degrades biodiversity and can eventually lead to filling up of the entire system.

Introduction of pollutants by discharge of wastewater, toilet sewage and solid waste disposal from the settlements present on the shoreline is reported to be the most dominant threat being faced by wetlands categorized under others category, which are mostly represented by isolated ponds. Of the surveyed wetlands that lie in this category, around 65% were found at risk due to such introduction. It is also a major factor behind deterioration of water quality and has perilous impact on ecosystem services rendered by these ecosystems. New Baheri and Quazipura wetlands in Ballia, Saresar wetland in Chandauli and Dhari dheeh in Ghazipur district exemplify such vulnerable wetlands.

Over exploitation of water and conversion to non-wetland uses was also found to be comparatively high in this category owing to illegal encroachments and filling of wetlands for personal use by members of shoreline communities as seen in Behkata and Mithwar wetlands in Ballia, Godhana and Urwa wetlands in Chandauli district. More than 20% of surveyed wetlands were found to be encroached within the landscape. Owing to their proximity to human settlements, dependency on these wetlands for resources like water, edible aquatic plants, fodder, fuel, soil etc. were found to be much higher, leading to risk of their over-exploitation. Overharvesting of biota was reported from around 82.7% of the sampled wetlands. Introduction of invasive plant species like Eichhornia crassipes was also found to be a major threat in more than 60% of surveyed wetlands (Figure 19).



Figure 19: Analysis of major risks of adverse change in sampled wetlands

# 4. Institutional Arrangements

Institutions play an important role in governing and coordinating relationships between various wetland stakeholders, and thereby their fit with ecological character has an important influence on wise use outcomes. Institutional requirements for conservation and sustainable management of the wetland complex are defined by the ability to ensure integration of site management within broad-scale environmental management and development programming including river basin management, and enabling participatory management, particularly ensuring involvement of local communities whose livelihoods are linked to wetland ecosystem.

This section of the management plan presents an analysis of existing institutions and governance settings with the intent of arriving at recommendations for the management of Ganga floodplain wetlands of Uttar Pradesh. The chapter includes an overview of existing settings and emerging lessons and gaps, and recommendations for enhancing the effectiveness of the regimes to secure wise use of floodplain wetlands.

### Existing institutional and governance arrangements

#### Policy and regulatory frameworks

The National Environment Policy of 2006 articulated the core policy elements of wetlands: including their inclusion in poverty alleviation and rural development strategies, and taking into account explicit impact of developmental projects on wetlands. The National Water Policy of 2012 (currently under revision) recommends adoption of a basin approach for water resources management and identifies conservation of river corridors, water bodies and associated ecosystems as an essential action area. The National Action Plan for Climate Change includes wetland conservation and sustainable management in the National Water Mission and the Green India Mission. The National Disaster Management Plan takes into account several non-structural measures for flood and cyclone risk reduction measures and makes direct reference to wetlands.

Provisions of the Indian Forest Act, 1927, the Forest (Conservation) Act, 1980 and the Indian Wild Life (Protection) Act, 1972 define the regulatory framework for wetlands located within forests and designated protected areas. The Indian Fisheries Act, 1897, The Water (Prevention and Control of Pollution) Act, 1974, and The Biological Diversity Act, 2002 provide instruments for regulating various development threats on wetlands. Further, under the Biological Diversity Act, 2002, the Central Government can issue directives to State Governments to take immediate ameliorative measures to conserve any area rich in biological diversity, biological resources and their habitats especially when the area is being threatened by overuse, abuse or neglect. The said Act also gives State Governments the powers to notify areas of biodiversity importance as biodiversity heritage sites. In 2017, the Ministry notified the Wetlands (Conservation and Management) Rules under The Environment (Protection) Act, 1986. The MoEFCC issued an Office Memorandum on March 8, 2022, reiterating that the 2,01,503 wetlands (>2.25 ha) as per the National Wetland Inventory and Assessment (NWIA), 2011 should be protected as per Rule 4 of the Wetlands (Conservation and Management) Rules, 2017. This regulation thus protects wetlands from development threats by prohibiting a range of activities such as discharge of untreated sewage, and construction within 50 meters of high flood lines. The Environment (Protection) Rules, 1986, empowers the Central government to prohibit or restrict the location of industries and carrying on of processes and operations in different areas including wetlands.

The Ministry of Water Resources, River Development, and Ganga Rejuvenation Notification of October 7, 2016, namely the River Ganga (Rejuvenation, Protection and Management) Authorities Order, 2016 sets the overarching regulation and management framework for the Ganga River System, including tributaries, floodplains and connected surface and groundwater regimes. The order defines floodplains as 'areas of River Ganga or its tributaries which comes under water on either side of it due to floods corresponding to its greatest flow or with a flood of frequency once in hundred years'. Rule 4 (ix) provides that the entire floodplain zone to be construction free zone to reduce pollution sources, pressures and to maintain its natural ground water recharge functions.

Several statutes of the Government of India and the Uttar Pradesh state government directly or indirectly support wetland conservation in Uttar Pradesh. These are described below in Table 10.

Regulation	Purpose	Scope	Key implications for management of Ganga floodplain wetlands
Wetlands (Conservation and Management) Rules, 2017 under Environment (Protection) Act, 1986	Provides the regulatory framework for conservation and management of wetlands in the country	All wetlands >2.25 ha except those covered under the Indian Forest Act, 1927, the Wild life (Protection) Act, 1972, the Forest (Conservation) Act, 1980	Prohibits: Conversion for non-wetland uses solid waste dumping discharge of untreated waste and effluents from cities and towns poaching
The River Ganga (Rejuvenation, Protection and Management) Authorities Order, 2016, amended 2019	Constitutes authorities at central, state and district levels to take measures for prevention, control and abatement of environmental pollution in River Ganga and to ensure continuous adequate flow of water	Applies to the states comprising River Ganga Basin including Uttar Pradesh	National Mission for Clean Ganga, authority is constituted under the Act. It has administrative, appraisal and approval powers and duties, functions and powers to identify specific threats to River Ganga and remedial actions, make the River Ganga Basin

Table 10: Key regulatory frameworks relevant for Ganga floodplain wetlands

Regulation	Purpose	Scope	Key implications for
			management of Ganga
			floodplain wetlands
	so as to rejuvenate the River Ganga to its natural and pristine condition		Management Plan to maintain adequate ecological flows in the River Ganga and tributaries and prevention, control and abatement of environmental pollution.
The Indian Wildlife (Protection) Act, 1972 and The State Wildlife Protection Rules, 2020	Protection of wild animals, birds and plants and for matters connected in addition to that	Applies to all wild habitats, protected areas, wild animals, specified plants, wildlife trade and related matters	Regulatory framework for management of all protected areas like National Parks, Wildlife Sanctuaries and Critically Endangered and Endangered Species.
Environment Protection Act, 1986	Umbrella law to provide for the protection and improvement of the environment, and for matters connected therewith	Covers all forms of pollution and empowers the central government to take any all measures for improving environment quality and lay down standards for emissions and discharges throughout the country	The Environment Protection Act, 1986 and related Acts as the Water Act, 1974, the Water Cess Act 1977, the Wetland (Conservation and Management) Rules 2017 lay the framework of regulatory tools to deal with pollution from industries, towns and settlements located along the Ganges and wetland management. The provision of the Act can be invoked to make new statutes. The NMCG was constituted under the provisions of EPA,1986. The Act has been used to designate Ecological Zones and to specify the land uses that are permitted around Protected Areas.
The Water (Prevention and Control of Pollution) Act of 1974	Aims to prevent and control water pollution and to maintain/restore wholesomeness of water by establishing central and state pollution control board to monitor and enforce the regulations	National (Rules pertain to the State of Uttar Pradesh)	Lays down effluent discharge standards of sewage and sullage Provides for the constitution of State Level Boards for enforcement of various provisions of the Act.
The Indian Forest Act, 1927	An Act to consolidate the law relating to forests the transit of forest-produce and the duty leviable on timber and other forest produce.	Applicable to whole of India. Wetlands lying within notified forest areas are regulated as per the provisions of the Indian Forest Act of 1927, Forest Conservation Act of 1980	Reserved/Protected status is accorded to the wetlands. Acts that are detrimental to forest (wetlands included) health are prohibited and punishable. It applies to all protected areas.

Regulation	Purpose	Scope	Key implications for
			management of Ganga floodplain wetlands
The Forest (Conservation) Act, 1980, amended in 1988,1996	Places a restriction on the de-reservation of forests or use of forest land for non-forest purpose by the state	National	Restricts conversion of forest and wetland habitats.
The Biological Diversity Act, 2002	Conservation of biological diversity, sustainable use of its components and fair and equitable sharing of the benefits arising out of the use of biological resources, knowledge and for matters connected in addition to that or incidental thereto	National	Prohibits, without approval of the National Biodiversity Authority Obtaining any biological resource or knowledge associated thereto for research or for commercial utilisation or for bio-survey and bio-utilisation Transferring results for monetary consideration Application for intellectual property rights
The Uttar Pradesh Urban Planning & Development Act, 1973	Administration, protection, conservation and development of urban water bodies	Extends to the whole of Uttar Pradesh, excluding Cantonment areas and lands, owned, requisitioned or taken on lease by the Central Government for the purposes of defence	Legal basis for constitution and functioning of Development Authority Recommends activities to be undertaken or regulated
The Uttar Pradesh Fisheries Act, 1948	Protection, conservation and development of fisheries in the State of Uttar Pradesh	Extends to State of Uttar Pradesh	Vests all fishery with the Department of Fisheries, including powers to allocate rights, regulate fishing, and prohibit detrimental fishing Regulates fishing periods and practices; the formation of association of societies and the collection of funds for the uplift of fishermen and promotion of the fishing industry and designates fishery officer to investigate fishing offences
The Uttar Pradesh Water Management and Regulatory Commission Act, 2008 repealed in the year 2012 and re-enacted in year 2014 by ACT No. 321(2)/LXXIX-V-	To regulate water resources within the State of Uttar Pradesh, facilitate and ensure judicious, equitable, and sustainable management, allocation and optimal utilization of water resources, fix rates for water use and cess on lands benefitted by flood protection through appropriate	Applicable to Uttar Pradesh	The Act empowers the commission to Approve the integrated state water plan/Basin plans prepared by State Water Resources Agency (SWaRA) Determine the allocation and distribution of entitlements of various categories of water use at utility, project level and between various water use entity.

Regulation	Purpose	Scope	Key implications for
			floodplain wetlands
1-14-1(Ka)2-	regulatory instruments		Review and accord
2014	according state water		clearances to new water
	policy		resources projects
			proposed at the river basin
			level/sub basin level.
			Monitor conservation of
			environment and
			development of framework
			for preservation and
			protection of surface and
			groundwater quality
			Promote sound water
			management practices
			throughout the state
Northern India	To act and regulate	Guides the management of	Defines the functions of the
Canal and	irrigation, navigation and	irrigation canals and	Uttar Pradesh Irrigation and
Drainage Act No	drainage in northern	engineering structures in	Water Resource Department
8 of 1873	India. The Act entitles	the states of Uttar Pradesh	in the Ganga basin that
	the provincial	and the territories which	includes construction of
	governments to use and	immediately before 1 <sup>st</sup> Nov.	public works for irrigation,
	control for public	1956 were comprised in	drainage and flood control
	purposes the water of	the states of Punjab and	and navigation, develop
	all rivers and streams	Delhi and applies to all	hydropower, supply water
	flowing in natural	lands including	for irrigation, assess
	channels and of all lakes	permanently or temporarily	irrigation revenues, settle
	and other natural	settled or free from	disputes and provide famine
	collections of still water.	revenue.	relief.

## Major organisations and programmes relevant to wetlands conservation

## A) Government Departments

## Department of Environment and Forest

Uttar Pradesh State Wetland Authority

In line with the notification of the Wetlands (Conservation and Management) Rules, 2017 the Government of Uttar Pradesh constituted the State Wetland Authority with the Hon'ble Minister (Environment) as the Chairperson and Principal Chief Conservator of Forest (Wildlife) as the Member Secretary.

With reference to Rule 5 (6)(b) of Wetlands Rules, the UPSWA has constituted a Technical Committee and a Grievance Committee. The Technical Committee reviews the Brief Documents, Management Plans and advise on any technical matter referred by the State Wetlands Authority. The Grievance Committee consists of four members to provide a mechanism for hearing and forwarding the grievances raised by the public to the UPSWA. The Uttar Pradesh State Wetland Authority (UPSWA) meets at least thrice in a year.

According to Rule 5 (4) of Wetlands Rules, the State Wetlands Authority exercises following powers to perform the said functions: a) Prepare a list of all wetlands of the State or UT within three months from the date of publication of these rules; b) Prepare a list of wetlands to be notified, within six months from the date of publication of these Rules, taking into cognizance any existing list of wetlands prepared/notified under other relevant State Acts; c) Recommend identified wetlands, based on their Brief Documents, for regulation under these rules; d) Prepare a comprehensive digital inventory of all wetlands within one year from the date of publication of these rules and upload the same on a dedicated web portal, to be developed by the Central Government for the said purpose; the inventory ought to be updated every ten years; e) Develop a comprehensive list of activities, to be regulated and permitted within the notified wetlands and their zone of influence; f) Recommend additions, if any, to the list of prohibited activities for specific wetlands; g) Define strategies for conservation and wise use of wetlands within their jurisdiction; h) Review Integrated Management Plan for each of the notified wetlands (including trans-boundary wetlands in coordination with Central Government), i) Recommend mechanisms for maintenance of ecological character through promotional activities for land within the boundary of notified wetlands or wetlands complex have private tenancy rights; j) Identify mechanisms for convergence of implementation of the management plan with the existing State/UT level development plans and programmes; k) Ensure enforcement of these rules and other relevant Acts, rules and regulations and on a half-yearly basis (June and December of each calendar year) inform the concerned State Government or UT Administration or Central Government on the status of such notified wetlands through a reporting mechanism; I) Coordinate implementation of Integrated Management Plans based on wise use principle through various line departments and other concerned agencies; m) Function as a nodal authority for all wetlandspecific authorities within the State or UT Administration; n) Issue necessary directions for the conservation and sustainable management of wetlands to the respective implementing agencies. o) Undertake measures for enhancing awareness within stakeholders and local communities on values and functions of wetlands; and p) Advise on any other matter suo-moto, or as referred by the State Government/UT Administration.

Some of the recent major decisions of the UPSWA include:

- Notification of important wetlands under the provisions of Wetlands (Conservation and Management) Rules, 2017.
- Preparation of wetlands brief documents and their health report cards.
- 1,33,484\* wetlands have been notified in the State Revenue Records which gives protection from being used for any non-wetland use. (\*Ref. F.No. J-22012/36/2020-CS(W): Report submitted to National Green Tribunal).

UP State Biodiversity Board

The Uttar Pradesh State Biodiversity Board (UPSBB) was constituted in the year 2006 (notification no. 1498/14-5-2006-57/2006) under the provisions of Section 22 of the Biological Diversity Act, 2002. The UPSBB meets twice a year under the Chairmanship of the Principal Secretary, Forest Department, Government of Uttar Pradesh.

The main functions of the UPSBB include:

- Advising the State Government, subject to any guidelines issued by the Central Government on matters relating to the conservation of biodiversity, sustainable use of its components and equitable sharing of the benefits arising out of the utilisation of biological resources.
- Regulating by granting of approvals or otherwise requests for commercial utilisation or bio-survey and bio-utilization of any biological resource by Indians.
- Performing such other functions as may be necessary to carry out the provisions of this Act as may be prescribed by the State Government.

Some of the recent major decisions of the UPSBB include:

- Formulation of the Uttar Pradesh State Biological Diversity Rules, 2010 vide notification no. 570/XIV-5-2010-57/2006 dated April 9, 2010.
- Constitution of Biodiversity Management Committees for preparing, maintaining and validating People's Biodiversity Register (PBR) in consultation with the local people.
- Development of the state biodiversity strategy and action plan for 2030 & 2050

## District Ganga Protection Committee

The District Ganga Protection Committee (DGPC) is constituted vide notification by the Central Government in consultation with concerned State Ganga Committee in every specified district abutting River Ganga and its tributaries. The DGPC plays a vital role in prevention, control, and abatement of environmental pollution in the river Ganga. The DGPC in each specified district consists of the District Collector as the Chairperson and the Divisional Forest Officer as the Convener. It is mandated that at least one meeting of the DGPC is convened every three months. The superintendence, direction, and control of the management of the DGPC (including financial and administrative matters) however vests with the National Mission for Clean Ganga which may be exercised by it either directly or through the State Ganga Committee or any of its officer or any other authority specified by it.

The DGPC have the following powers and functions, namely: (a) identifying activities which may be a threat in the area of specified district abutting the river Ganga for protection of the river and its tributaries or its river bed and making a plan for remedial action and take remedial action in respect thereof; (b) taking remedial action at its own end for protection of river Ganga and its tributaries or its river bed abutting in the specified District (excluding enforcement of the provisions of this Order) (c) in the event of its inability to take remedial action, reporting (electronically as well as by sending written communication in hard copy) to the
National Mission for Clean Ganga and concerned State Government, the State Ganga Committee, as the case may be, for issue of direction for protection of river Ganga and to formulate appropriate management or remedial actions. (d) taking suitable administrative and other measures, to give effect to the provisions of this order so as to prevent the environmental pollution in the river Ganga and its tributaries, not being inconsistent with the provisions of this order, or any law for the time being in force.

#### District Wetlands Committee

In 2009, the Government of Uttar Pradesh constituted the district-level wetland committees which were brought under the ambit of the State Wetlands Authority. The District Wetlands Committee works in association with the District Ganga Committee focusing at the basin level conservation efforts for water resources management. The District Wetlands Committee is entrusted with the task of surveying and demarcating wetlands of the district, creating a database on their current situation, and priority ranking for conservation and management needs based on traditional, social, and economic contexts. The committee is directed to forward the list of surveyed wetlands to the Principal Chief Conservator of Forests (Wildlife) for final notification.

The most significant informal institution engaged with the District Wetlands Committee in the management and conservation of Wetlands in Uttar Pradesh is the District Ganga Committee concerned with basin-level conservation efforts for water resources management. This organisation guides the engagement of the District Wetlands Committee with the multi-stakeholder forum through short-term and long-term action plans and work progress is evaluated through expert consultative meetings and workshops. The District Wetlands Committee also ensures to involve the network of Ganga Prahari and Wetland Mitras and empowers stakeholders to contribute to wetlands conservation. Ganga Praharis are motivated and trained volunteers from among the local communities working for biodiversity conservation and cleanliness of the Ganga River with the ultimate objectives of restoring the Nirmal and Aviral Dhara. These 'praharis' are selected through a series of site-level consultative meetings and workshops held in villages located on the banks of the Ganga River and its select tributaries. The local communities have been approached through other agencies too like State Forest Departments, Educational Institutes, National Cadet Corps (NCC), National Service Scheme (NSS) Mahila Mangal Dal, Yuva Mangal Dal, Nehru Yuva Kendras, and Ganga Vichar Manch, etc. to identify the potential Ganga Praharis. Wetland Mitras or 'Friends of Wetlands' are Motivated volunteers from diverse stakeholder groups working together to protect wetlands, and actively engage in conservation initiatives to manage natural resources.

## Department of Namami Gange and Rural Water Supply, Govt. of UP

### State Mission for Clean Ganga-Uttar Pradesh (SMCG-UP)

It is an extended arm of the National Mission for Clean Ganga (NMCG) for the state of Uttar Pradesh and implements the Namami Gange and other programmes through various executing agencies. At the state level it is implementing arm of the State Ganga Committee constituted vide S.O. 3187 E dated 7th October 2016 under Environment protection act 1986.

The primary obligation of society include:

- To coordinate and implement the activities of networking of sewerage and sewage treatment structures, remedial steps for treatment of wetland area, river conservation works including using other measures, development of river banks (riverfront), etc. at the state level.
- To ensure the state government's consent on the programmes and structures of the National Ganga River Basin Authority and obtain approval of the state government's share in these programmes.
- To generate public awareness by information, education, and publicity drive regarding abatement of water pollution along with its control, and treatment, environmental cleanliness of River Ganga.

### Department of revenue and land records

### State Disaster Management Authority

According to the guidelines laid down by the National Disaster Management Authority (NDMA), the Uttar Pradesh State Disaster Management Authority (UPSDMA) was set up in the year 2005. Following this, District Disaster Management Authority (DDMA) was instituted. The UPSDMA is accountable for various actions as envisaged in the National Disaster Management Act, as per Section 18 (2). It lays down guidelines to be followed by the different state and district departments for the purposes of integration of measures for prevention of disasters and mitigation in their development plans and projects and provides necessary technical assistance therein.

A committee was set up under the chairmanship of Principal Secretary Planning for mainstreaming Disaster Risk Reduction (DRR) into development. A Government Order on 'DRR Mainstreaming in development' was issued by the Chief Secretary on the basis of a study on entry points for DRR mainstreaming in development was conducted in the year 2013-4. The departments where mainstreaming initiatives are being carried out include; the Planning Department, Health Department, Fire Department, Civil Defence, Education Department, Panchayati Raj, State institute of health & family welfare, and State institute of rural development.

Integration of wetlands conservation and restoration in the district disaster management plan can be ensured which is critical for the long-term availability of water resources to meet various development needs. The government of Uttar Pradesh has created a state disaster mitigation fund.

#### Irrigation and Water Resources Department

The irrigation works started in Uttar Pradesh with the establishment of the first Irrigation Office in Saharanpur in 1823. Since then, the department has been responsible for execution, design and planning of irrigation and drainage and flood prevention works and overall water management in the state.

The department focus has been on supply side management of water resources and diverting water from the Ganges to meet the growing demands of cities such as Delhi, Noida, Greater Noida and Agra; thermal power plants; Agriculture as well as for pilgrimage purposes. Canal irrigation is guided by the Northern India Canal and Drainage Act No 8 of 1873 <sup>1</sup> when water demands were low. Similarly, other water projects in the basin have received environmental clearances without adequate considerations for the ecological needs of the river and its floodplains. As assessed, water diversions from the river<sup>2</sup> amounts to 60 % of the annual runoff for Ganga up to Allahabad. Dependence on ground water in Ganges canal command has increased with reduced water availability for surface diversion. This in turn has led to lowering of groundwater tables. Lateral seepage from the boundary streams has gone up as consequence regenerated flows in river downstream is reduced.

The State Water Resources Agency (SWaRA) was created in June 2001 for management, planning and sectoral allocation of Water Resources (both Surface & Ground) to various agencies and to give legal base to the above preparation and use of Surface/Ground water and to work as a technical secretariat to the State Water Board. State Water Resources Data Analysis Center (SWaRDAC) has been setup to provide water related data to the State Water Resources Agency (SWaRA) and other Central/State water plans for all river basins of the State.

The Uttar Pradesh Water Management and Regulatory Commission (UPWaMReC) was created as an executing and enforcement, regulatory and advisory body in 2014 to regulate and recommend the tariff for water used for agriculture, industries, drinking, hydro power and other purposes and also for levying cess on land benefited by flood protection and drainage works from the owners of land benefited through appropriate regulatory instruments according to State Water Policy and to assist the State for making policies and execution of the water resources within the State.

The State Water Resources Agency (SwaRa) in collaboration with an Israeli Consultancy firm undertook River Basin Assessments and Planning for all Major River Basins in Uttar Pradesh including the Ganga basin in 2020. The plan has identified encroachment of floodplains in the absence of demarcation of

 $<sup>^{\</sup>rm 1}$  the Northern India Canal and Drainage Act No 8 of 1873 and its UP-specific amendments

<sup>&</sup>lt;sup>2</sup> Water amounting to 27.3 BCM per year

<sup>(</sup>https://www.rid.go.th/thaicid/\_6\_activity/Technical-Session/SubTheme2/2.15-Ravindra\_K.pdf)

floodplains that is reducing groundwater recharge, Sand mining causing destruction of aquatic and riparian habitat, riverbed coarsening and degradation and other physical impacts as the major issues. The report also mentions the lack of coordination between different water user departments at the planning stage as the biggest hurdle in managing the water resources.

A more holistic approach to water management has been prescribed. The plan recommends the maintenance of Minimum Environmental Flow downstream of all possible diversions in the streams. Currently, there are no national guidelines available for such diversions. Most of such diversions are dealt with on case-tocase basis. Wetland specific actions proposed in the Ganga Basin plan are aimed at Wetland development for recharge and environmental & socio-economic benefits such as drinking, fisheries, recreation etc. in 60419.52 ha area, estimated to provide an additional recharge of 101.54 MCM with estimated cost of Rs 4495.21 crores (at 2017 price level) to be implemented by the UPIWRD, Rural Development Department, Fisheries Department, Agriculture Department. Integrated watershed development with emphasis on soil and water conservation in 383676 ha area will provide an additional recharge of 63.52 MCM with cost of Rs 1918.38 crores is proposed to be implemented by the UPIWRD, the Rural Development Department and the Agriculture Department. State Water Resources Data Analysis Center (SWaRDAC) has developed the web-based Basin Assessment and Planning System (BAPS).

#### State Department of Culture & Tourism

The department promotes responsible wetland tourism supporting the local economy to protect habitat from disturbing activities. The state government is promoting major wetlands as tourism, recreation, and water sports hubs. These include the Ramsar sites also and are being accorded more importance than National Parks as these are repositories of rich and diverse biodiversity. Many of these wetland sites have spiritual and religious significance. The promotion of wetlands as a popular recreational and tourism destination will also provide local livelihood opportunities. Uttar Pradesh has the maximum number of nine Ramsar sites amongst 49 designated sites in India. The development plan includes establishing boarding and lodging facilities and access to recreational activities like boating and water sports. The sites are being developed under the financial collaboration of the central and the state government.

#### Panchayati Raj Department

The Gram Panchayat Development Plans serve as the vehicle for consolidated development of the village in the state popularly known as - Hamari Yojana hamara Vikas. The GPDP processes implementation started in the state in the year 2015-16. As per 15th Finance Commission recommendations, Rs. 1.42 Lakh crore tied grant were given to Panchayats for Water & Sanitation during 2021-22 to 2025-26 in the country. Uttar Pradesh has received Rs 22,808 crore as grants for the above period. This is huge push to address issues of sanitation and environmental pollution as it will enable Gram Panchayats to shoulder the responsibility for

potable water supply to every household and community centre and plan and take actions for greywater management, solid waste management, maintenance of open-defecation free status and improved sanitation in villages which will have a positive bearing on wetland health.

#### **Fisheries Department**

Uttar Pradesh Fisheries Department was established in the year 1947, under Animal Husbandry Department with a view to carry out fisheries development in a planned manner. Central Sector Scheme "Blue Revolution: Integrated Development and Management of Fisheries" has been launched in the year 2016-17, bringing all the centrally sponsored /centrally funded schemes in one umbrella, under which various programs of fisheries development can be conducted. The Blue Revolution or the Neel Kranti Mission guidelines aims to create an enabling environment for integrated development of the full potential of fisheries of the country while ensuring the sustainability of, bio-security and address environmental concerns for enabling sustainability of the fishing industry and has been formulated at a total central outlay of Rs 3000 crore for five years. The tentative fund allocation for the Financial Year of 2019-20 for the state of Uttar Pradesh was Rs 30 crores.

#### Department of Rural development

The Mahatma Gandhi National Rural Employment Guarantee Act 2005 requires preparation of a district labour budget for next financial year estimating the anticipated demand for unskilled labour work in the district and a plan for need based works as approved by the Gram Sabha based on the Gram Panchayat Development Plans for the engagement of workers therein. The labour budget includes a component on Natural Resource Management. Under the scheme, 100% of funds in the pre monsoon months can be utilised for water conservation works. The work is taken in convergence and with other programmes of watershed development and irrigation.

Creation of Natural Resource Management assets has led to several positive environmental impacts as increase in groundwater levels, improved water quality. However, scientific planning for wetland conservation is a critical factor mostly lacking as the communities need to have the knowhow of local landscape or hydrology. Supervision of assets being created (whether external or internal) under MGNREGA, maintenance of asset quality and capacity development of the persons involved in planning and execution is needed to for ensuring better outcomes for wetland conservation. For the financial year 2022-23 the approved labour budget is Rs 2600 lakhs in Uttar Pradesh. 730 lakh person days have been generated so far (MGNREGA Portal dashboard as accessed on 20/6/22).

The Uttar Pradesh government plans to construct 789 ponds, each of 0.4 ha in the state under the newly launched national Mission Amrit Sarovar that will help in increasing the availability of water, both on surface and under-ground. The first Amrit Sarovar of the country was inaugurated in April 2022 in Rampur, Uttar Pradesh.

### Department of Agriculture

The Prime Minister's Agriculture Irrigation Scheme (Per Drop More Crop) is a micro irrigation program that encourages the adoption of drip and sprinkler irrigation system in various crops. The scheme covers all the districts of Uttar Pradesh. The priority areas include clusters of ponds constructed/renovated under intervention of per drop more crop in addition to overexploited, critical, semi critical blocks. The benefit of the scheme is admissible to farmers, members of cooperative societies, Self Help Groups, incorporated companies, Panchayati Raj Institutions, noncooperative institutions, trusts, members of group of producer farmers on a first come first serve basis. The amount of grant is directly transferred to the beneficiary's account by Direct Benefit Transfer.

### B) Research & Accademia

Educational institutions specializing in different aspects of floral and faunal ecology carry out short and long-term studies supporting the conservation and management of ecosystems. Uttar Pradesh Environment and Forest Department in collaboration with the Wildlife Institute of India, Dehradun; Department of Wildlife Sciences, Aligarh Muslim University; Chaudhary Charan Singh University, Meerut, and IIT-Kanpur has carried out substantial research on aspects of wetlands conservation in Hastinapur Wildlife Sanctuary. Although the studies have been carried out in silos, sharing and updating information and knowledge among different sectors is important. To address the data and information needs for management planning, strong and effective linkages need to be established amongst different sectoral institutions.

Krishi Vigyan Kendras have been functioning as Knowledge and Resource Centres of agriculture technology supporting initiatives of public, private and voluntary sector for improving the agricultural economy in each district of Uttar Pradesh.

### C) Civil Society Organisations

Under the supervision of the District Collector of several districts, Wetland Brief Documentation Committees have been formed consisting of the citizens (members) from the local community. In another district, Wetland Conservation and Development Authority has put forward the idea of appointing citizens as lake wardens and becoming a partner in conservation and management efforts by playing a watchdog and outreach role. The approach has however been revised by the MoEFCC and is incorporated as one of the pillars of the wetland rejuvenation programme. Other than this, a number of Non-profit organisations are engaged in developmental and conservation activities around the wetlands including the World Wildlife Fund (WWF) – India, which is making an effort to restore the ecological health of the Ganga in Hastinapur and trying to develop it into a model for aquatic biodiversity conservation. Another organisation is The Turtle Survival Alliance, which is presently undertaking a survey of turtle species in the Terai region of Uttar Pradesh.

#### **Ownership aspects**

18.8 % of total surveyed wetlands were found to be fully owned by the Gram Panchayats. These wetlands are common property resources with open access to community members. However, access and usage were also subject to regulation by Gram Panchayats. Wetlands leased out for culture fisheries and commercial cultivation of aquatic plants have partial access for community members.

Protected status is generally found to be good for wetland health and management as it eases the implementation of restoration and management plans. Despite enjoying protection, Kawleshwar Tal managed by a temple committee was found to be eutrophic and highly polluted. Surha Tal, which was declared the Jai Prakash Narayan Bird Sanctuary in 1991 has an area of 3432.93 ha spread over 45 villages in the Ballia district. Of this 3300.15 ha of land belongs to private people and only 132.78 ha is Gram Panchayat land. There is no boundary demarcation on the ground and there is a lack of systematic management based on plan prescriptions.

Government departments own 12.5 % of the wetlands within the landscape. Revenue, Railways are other government departments own certain wetlands located within the landscape mostly situated near railway tracks. Quazipura wetland in Ballia district is owned by Railways.

Certain wetlands are privately owned. Of the sampled wetlands, around 22% were found to be fully owned by private individuals while 4.6% were co-owned with government entities or panchayats. Kawleshwar Tal, in Ballia district was owned by a temple committee.

Joint ownership was seen with 9 % of wetlands present within the landscape with Government departments and Gram Panchayats co-owning the wetlands along with private entities. There was no clear ownership in 34 % of the wetlands (Figure 20).



Figure 20: Graph showing the distribution of wetland ownership

### **Rights and privileges**

Wetlands in this landscape have such associated community rights and privileges which directly affect their usage, ecosystem characteristics as well as services. The communities enjoyed access to bathing/ wallowing of buffaloes and cattle grazing along wetland shorelines in 90.6% and 94% of the surveyed wetlands respectively. Capture fishery is practiced in half of the wetlands. Around 18.8% of the wetlands were leased out for culture fisheries. Plying of boats is an associated activity that is mostly undertaken for fishing and transportation in monsoons when River Ganga and its tributaries are in spate but it was also observed in only 9.4% of the wetlands.

Although less in number due to increasing abstraction of groundwater through borewells for agriculture, dependent communities in almost 43.8 % of wetlands still have the privilege of withdrawing water for agriculture or fisheries.

Amongst surveyed wetlands, 28 % of wetlands communities were permitted to harvest wetland plants for fodder, fuel, fiber, food, medicine, or decorative items. It is mostly an unregulated activity. Yet, it is reported, with exception of grazing, that these pursuits have seen a sharp decline, majorly due to changes in choices, the deteriorating condition of wetlands, and a decline in the availability of wetland resources.

Many wetlands present in the landscape are integral to the socio-cultural life of the dependent communities. They are used for conducting religious ceremonies including immersion of idols and "Tajias". Community rights in the context of religious practices, exist for wetlands that are considered to be sacred and are associated with mythology and culture. Many annual fairs are also organized around wetlands. Religious rights and privileges were enjoyed in half of the wetlands.

Gram Panchayat-owned wetlands, especially those located within the agricultural landscape are used for carrying out agricultural activities in the dry season when the wetland has less water.

Rights and privileges though available in the majority of the wetlands are not uniformly enjoyed by the community, majorly due to poor water quality, deteriorating health, and availability of alternatives. Encroachment, deterioration of soil characteristics owing to excessive use of chemicals are recognized threats in and around wetlands. There is a general lack of community ownership and stewardship that can improve the management and health of these ecosystems. (Figure 21).



Figure 21: Graph depicting the distribution of Rights and Privileges associated with sampled wetlands

### **Evaluation of existing institutional arrangements**

Table 11: Identifying key gaps in the status of the different components of existing institutional arrangements

Enabling institutional	Status of current institutional	Key gaps
conditions and implications	arrangements	
for wetland management		
Defined user and resource bou	Indaries	
Presence of well-defined boundaries around Ganga floodplain wetlands is required to ensure that management zones and actions are defined in spatial terms and linked with user access rights, adverse land and water use change is prevented, and communities have incentives for protecting the wetland.	The wetlands have been entered in to land use records. Wetland maps prepared using satellite data are available with the UPSWA Of the surveyed wetlands 44 % of wetlands were owned by the Gram Panchayats, 23.7 % were present within protected areas, Government departments owned 31% of the wetlands.	Ground demarcation of wetland boundary is yet to be undertaken for a majority of wetlands. Maps available are not of required scale to permit site level management and regulation. For 4.3 % of wetlands, the ownership is not clear. For additional 32 % of wetlands, multiple ownership leads to lack of congruence in management arrangements Balancing of preexisting rights and privileges with conservation outcomes is a challenge
oongrachice		
Rules for management of Ganga floodplain wetlands conform to the functioning of biophysical and social systems. The rules also balance the cost of enforcement of management with the benefit derived from wetland ecosystem services and biodiversity.	The River Ganga (Rejuvenation, Protection and Management) Authorities Order, 2016 sets the overarching regulation and management framework for the Ganga River System, including tributaries, floodplains and connected surface and groundwater regimes. The order defines floodplains as 'areas of River Ganga or its tributaries which	Rules for conservation at floodplain level are clearly outlined but their harmonization with site level wetlands conservation is a challenge. There is limited clarity on activities which are prohibited, regulated and permitted within the wetland and its zone of influence. One third of the wetlands were found to have very bad health

Enabling institutional	Status of current institutional	Key gaps
conditions and implications	arrangements	
for wetland management		
	comes under water on either side of it due to floods corresponding to its greatest flow or with a flood of frequency once in hundred years', Rule 4 (ix) provide that the entire floodplain zone to be construction free zone to reduce pollution sources, pressures and to maintain its natural ground water recharge functions. Rule 4 of wetland conservation and management rules apply to all wetlands above 2.5 ha. Wetlands within PAs are regulated under the purview of Wildlife Protection Act, 1972 and the Ramsar convention. The Water (Prevention and Control of Pollution) Act, 1974 defines stream as a river; water course (whether flowing or for the time being dry); inland water (whether natural or artificial); sub-terranean waters; sea or tidal waters. Section 24 of the Act prohibits any person from knowingly cause or permit any poisonous, noxious or polluting matter determined in accordance with the standards laid down by the State Board to enter (whether directly or indirectly) into any stream or well or sewer or on land Northern India Canal and Drainage Act No 8 of 1873 guides the management of irrigation canals and engineering structures in the states of Uttar Pradesh and the territories which immediately before 1st Nov. 1956 were comprised in the states of Punjab and Delhi and applies to all lands, whether permanently or temporarily settled or free from revenue. Environmental clearances under the EIA Notification of 2006 are required for clearance of new projects and expansion and modernisation of existing projects within the Ganga River basin.	scores and another 18 % had worst wetland health scores suggesting deteriorating health status. This shows there is a lack of implementation of regulation and/or systematic monitoring of water quality along the River Ganges and its floodplains. Over abstraction of water that led to increased sedimentation and reduced flushing, decreased groundwater recharge and increased pollution concentration was reported from several wetlands. Supply side management of water resources, water diversions in the absence of adequate knowledge base on Gangetic floodplain ecology and ascertaining the ecological flows requirements of the River has increased the risk of water pollution and adversely impacted biodiversity habitats, fisheries and wetland based livelihoods.

Enabling institutional conditions and implications for wetland management	Status of current institutional arrangements	Key gaps
Conflict resolution mechanism	1	
Low cost and effective conflict resolution mechanism are available for supporting the implementation of wetland management.	Several cases of conflicts can be observed between the Forest department and the communities, the former being inadequately staffed and financed to control unsustainable resource extraction by the latter; Agriculturists and fishers - Expansion and intensification of agriculture is at the cost of fragmentation of wetland regimes and habitats Conflict resolution mechanism in the form of appeal to the relevant bench of National Green Tribunal is provided within the Wetland (Conservation and Management) Rules, 2017.	Existing ambiguities in wetland ownership in land records yet to be settled. Gram Panchayats (and other wetland owners) do not resolve wetland use related conflicts in a timely manner. District Wetland Committees should take measures to resolve conflicts at the earliest Wetland management needs to be co-adopted by concerned sectors. Stakeholder views as yet are not getting incorporated in management planning
Minimal recognition of rights t	o organize	·
Rights of communities to define management objectives for Ganga floodplain wetlands are not counter to existing government rules and regulations.	Communities enjoy traditional rights and privileges to access wetland resources. Data suggests over extraction of wetland resources (water and biota in particular) that is adversely impacting the ecological character of wetlands.	Checks and balances to be placed to regulate community rights and privileges in accessing wetland resources subject to the threshold levels and to ensure equitable sharing of benefits and maintaining wetlands ecological character. There is no prescribed monitoring and regulatory tool to guide wetlands wise use and ensure adherence. Lack of community level interest and capacity for stewardship of wetlands particularly in case of the Gram Panchayat owned wetlands.
Nested enterprises		
Institutional arrangements for management of Ganga floodplain wetlands are linked with wider developmental planning within the Ganga River Basin.	Multitier institutional arrangements are in place to support basin to site level conservation efforts for River Ganga and its floodplains with the District Ganga Committees constituted in 26 districts abutting Ganga and its tributaries in Uttar Pradesh under the superintendence and control of the State Ganga Committee. The existing District Wetlands Committees constituted by GoUP in 2009 is now guided by the	Aligning departmental programmes and priorities that traditionally have a sectoral focus and are antithetical to wetlands conservation is a challenge specifically those related to water management and agriculture development. Convergence opportunities are yet to be tapped in to. There is a lack of institutional capacities to guide and support integrated management of

Enabling institutional conditions and implications for wetland management	Status of current institutional arrangements	Key gaps
	Ganga Committee in the 26 Ganga floodplain districts. The Divisional Forest Officer is the Convener of the District Ganga Committee. The District Wetlands Committee engages with a multi-stakeholder forum through the District Ganga Committee. There is an opportunity to integrate wetland conservation actions within the District Ganga Committee action plans. There are more funds available that can be deployed for wetland conservation through the NMCG. Now there is greater scope for scaling up wetland conservation actions and adoption of integrated river basin level approach to wetland management. The NMCG structure favours greater collaboration and capacities enhancement of different stakeholders (Government and Non-government bodies) including the nodal officers designated by District Ganga Committees.	wetlands. The need was highlighted for all wetlands, during workshops on desired management actions across the districts. A weak coordination across sectors and amongst stakeholders was observed Though UPSWA has the mandate to manage the Ganga floodplain wetlands, policy impetus for harmonized planning in the basin does not exist. As of now there is a greater focus on need based short term actions. Consultative mechanisms and cohesion amongst administrative units will help to align the objective of integrated management planning of the Ganga floodplain wetlands and its systematic monitoring, review and adaptation with the priorities of the District Ganga Committees.

# Proposed arrangements for managing Ganga floodplain wetlands

#### Wetland management categories

The Ganga floodplain wetlands can be classified in to different categories based on the landscape setting, wetland use and whether the wetlands are situated within protected Area or outside (Table 12). Wetland ownership is heterogenous but ownership can be attached to each class based on the dominant institution.

• Wetlands within Protected Areas (PAs) - A number of wetlands are managed as protected areas. The management rests with the state Department of Environment and Forests. The protected area status allows securing biodiversity habitats by limiting outside human disturbances supported by dedicated conservation funding from the department.

Outside of PAs, wetlands can be grouped in to different categories based on their landscape setting i.e., Rural or Urban.

• Ponds - The wetlands less than 5 ha are classified as ponds. Mostly these wetlands fall within the jurisdiction of a Gram Panchayat. Funds are earmarked as part of village development plans for the development of wetland and water resources. They can also be privately owned.

• Urban/Peri-urban wetlands - The wetlands within urban limits are mostly managed by municipalities unless privately owned.

Another classifier is the wetland use and rights and privileges that communities enjoy in these wetlands. Mostly wetlands are used for agriculture.

• Agricultural floodplains - Agricultural floodplains occupy peripheral areas around villages, rivers, roads. Located away from human settlements, many serve as buffer zones and as connectors and migration corridors between national parks, wildlife sanctuaries and reserved and protected forests.

A description of the four categories of wetlands which emerge on the basis of clubbing hydrogeomorphic classes and institutional arrangements is presented in Table 12

Wetland types N= 106	Features of surrounding landscape	Protected Area and Non-Protected Area	Wetland Use (Agriculture/Urban)/Ponds
Within River Channel – 9.38 %	Rural – 9.38 %	Non-PA – 9.38 %	Agriculture – 9.38 %
Others - 90.62 %	Rural – 56.25 %	Non-PA - 50 %	Agriculture floodplains – 21.88 %
			Ponds – 28.12 %
		PA - 6.25 %	
	Urban – 34.37 %		

Table 12: Distribution of the three different wetland types according to their management categories

### Proposed institutional arrangements

Mission Sahbhagita launched in 2022 to commemorate 75 years of independence, is a Government of India initiative for conservation and wise use of wetlands of national and international importance. The Mission prescribes a multitier institutional arrangement for the management of wetlands that is relevant and can be suitably adopted in the given context. The following institutional arrangement is proposed for management for the management of Ganga floodplain wetlands.

- At Site level: A cadre of ground volunteers such as the Wetland Prabhari assisted by a network of Wetland Mitra/Ganga Praharis coordinating site management with government line departments and agencies, knowledge partners, civil society organisations and corporate sectors.
- At District level: District Wetland Committees ensuring that convergence is built with district-level conservation and development plans and programmes.
- At State level: The Uttar Pradesh State Wetland Authority reviewing and approving site management plans and providing access to funds for

implementing management from central and state-level public sector schemes, as well as corporate sector partnerships.

# **Roles and Responsibilities**

## Wetland Prabharis

The Wetland Prabharis may be responsible for the following activities:

- Install signages displaying information on wetland site's uniqueness, conservation significance, cultural significance, and management arrangements
- Nurture a network of 'Wetland Mitras' for stakeholder engagement in wetland management actions
- Coordinate development of action plan for conservation and sustainable management
- Identify 'cultural icon(s)' and run community campaigns relating the icon to wetlands conservation and sustainable management
- Organize events linked to local legends/cultural values of the wetland.
- Design and implement citizen science programme such as Asian Water bird Census' to engage citizens in wetlands monitoring and management
- Coordinate targeted stakeholder education, awareness and behaviour change campaign to incentive affirmative actions for wetlands conservation and sustainable management through existing or refurbished wetland interpretation centres
- Commission baseline wetland inventories through the support of knowledge partners, corporate and civil society partners
- Connect with Panchayats and Municipalities in the vicinity; connect with local schools and teachers for awareness-raising among children and youth
- Coordinate implementation of the wetland action plan through funds from ongoing development plans and programmes, including through engagement with corporates
- Coordinate periodic wetlands monitoring and management effectiveness review to assess whether mid-course correction in wetland management implementation is required

# District Wetland Committees

The primary responsibilities of the District Wetland Committee include:

- Review wetland management plans, in consultation with all relevant departments and sectors
- Integrate wetland management actions in district level environment plans, disaster risk reduction plans, district development plans and others
- Build convergence of wetland management plan with district level development plans
- Periodic review of management plan implementation and monitoring outcomes

### The Uttar Pradesh State Wetland Authority

The State Wetland Authorities will have the following key roles:

- Mapping of each wetland site with District Wetland Committees, Knowledge Partners, Corporate Sector and CSO Partners
- Designate a Wetland Prabhari for each wetland with a mandate to deliver roles and responsibilities as prescribed
- Review and approve management plans
- Ensure access to funds for implementing management plan actions by building convergence with conservation and development sector schemes
- Provide platform for business engagement in wetlands management
- Review wetlands monitoring information, and undertake mid-term course correction as may be required
- Notify wetland sites under Wetlands (Conservation and Management) Rules, 2017 and other extant regulation

Management categories	Area and other morphological features	Ecosystem services predominan ce	Threats predominan ce	Ownership	Rights & privileges
Wetlands within Protected Areas (N=2)	Surha Tal spans 3433 ha. It is a connected wetland and connects to the Ganges through a nullah. It has mainly horizontal flows. It also feeds an irrigation system. It is said to be an impact crater and has depths in the range of 2.5 m to 9 m. Kawleshwar Tal has moderate depths of 0.5 m – 3m and is isolated with mainly vertical flows.	Surha Tal ranks high in regulatory and supporting services as it serves as a biodiversity habitat for diverse fauna and flora in the area. Kawleshwar Tal is located close to Kameshwar Dham Shiva temple and has significant religious/cult ural significance	Water abstractions for irrigation emerges as key threat for Surha Tal. The wetland also faces threats pollution from runoff from nearby settlements and agricultural fields, weed infestation, excessive biota extraction and encroachme nt.	In Surha Tal, 3432.93 ha is designated as a Bird Sanctuary. Land ownership is largely private with Gram Panchayats owning 3.86 % area. Land rights are yet to be settled. Kawleshwar Tal is fully owned by a temple committee (Mandir Samithi)	The rights and privileges availed are to meet the basic subsistence needs of local communities and not for income generation. Wetlands are used for sustenance community fishing without lease and harvest of aquatic plants (50%). Grazing is permitted in Surha Tal but not in Kawleshwar Tal. The latter was used for religious practices.

Table 13: A detailed description of wetlands under the different management categories

Management categories	Area and other morphological features	Ecosystem services predominan ce	Threats predominan ce	Ownership	Rights & privileges
Pond (N=9)	Small wetlands <5 ha area. The wetlands are naturally formed with flat geomorphology. 11 % ponds were human made depressions. Majority wetlands (78%) are isolated. 33.3 % had inlets. However, mostly these wetlands do not have any outlet. Depth is less than 1 m. All wetlands are seasonally inundated. 77 % wetlands have static waters with vertical flows.	Wetland provided water security benefits during droughts, aided in pest regulation and helped in nutrient recycling Provisioning services derived from wetlands are negligible. The wetlands are perceived to have contribute to disease burden for human and livestock.	Face numerous threats that are due to local factors. Prominent is water extraction of groundwater near wetlands for irrigation, Discharge of nutrient rich agricultural runoff.	Wetland ownership is not clear for 44.4 % wetlands. 33.3 % are owned by Village Panchayats and 22.2 % are under private ownership.	All the wetlands are used for grazing. Fishing without lease is practiced in 22.2% of wetlands. Religious ceremonies practiced around 55.5 % wetlands.
Urban and peri urban wetlands (N=11)	Majority wetlands are small with a median size of 3.72 ha. Mostly wetlands are natural. All wetlands are isolated and more than half are seasonally inundated (55%). 45% wetlands have inlets. The wetlands are surrounded by built up as roads, settlements, railway. Depth varies widely from 0.2 to 1 m.	The regulatory services (Water during droughts and pest regulation were perceived to be most important.	Close proximity to populous settlements subjects the wetlands to high intensity of threats as pollution most significant being discharge of untreated sewage and solid waste dumping and leaching of animal waste. Groundwater extraction around the wetlands is	27% are owned by government and another 27 % are owned by the Panchayats. Ownership is not clear for 18 % of wetlands. The wetlands are exposed to degradation and exploitation due to institutional neglect and lack of maintenance	55% wetlands were used by communities for fishing (With lease as well as with lease). 55 % of wetlands are also used for religious purposes and using water for domestic purposes. All wetlands are used for grazing and bathing of animals.

Management	Area and other	Ecosystem	Threats	Ownership	Rights &
categories	morphological	services	predominan	-	privileges
	features	predominan	се		
		се			
Floodplain agriculture wetlands (N=10)	Wetlands size varies have a median value of 10.06 ha. They occur on flats. 80% wetlands have seasonal inundation. Shallow wetlands with depth of 0.16 to 3 m. 90% wetlands are isolated and have static and vertical water flows.	Wetlands are valued for their regulatory services (water regulation, for providing water during droughts and flood hazard mitigation), water purification and controlling erosion. Nutrient cycling supporting services are valued highly.	high. Construction of power lines and increased sedimentatio n were reported. The wetlands face threat of increased sedimentatio n, excessive groundwater extraction, and discharge of nutrient rich run off from agricultural fields and introduction of invasive species.	40 % are owned by individuals. 10 % by governments and Panchayats each. Ownership is not clear in case of the rest	Agriculture within wetland is practiced in 10 % wetlands but 40% wetlands are subject to water abstractions for irrigation. Community use these wetlands (50%) for capture fisheries. Fishing under lease is carried in 10 % wetlands and harvest of aquatic plants without lease is done in 50% wetlands. Majority serve as grazing grounds.

# 5. Management Framework

Management of floodplain wetlands of River Ganga needs to be based on the recognition of their full range of ecosystem services and biodiversity values, their relationships with ecosystem health, and mainstreaming into conservation development plans and programmes at all levels. The effectiveness of management will be reflected in the ability to sustain the multiple values of wetlands based on the traditional knowledge of communities that have evolved over time, without undermining the key ecological and social processes that underpin the functioning of these wetlands as socioecological systems. Wise use of floodplain wetlands of River Ganga will be realized when the capability of these wetlands to provide diverse ecosystem services and sustain rich diversity is maintained now as well as in the future, on pathways that are aligned with ecosystem principles and guided by sustainable development. The sustainable development framework, as adopted in 2015 calls for addressing five elements – People, Planet, Partnerships, Peace, and Prosperity.

The current chapter sets out the management planning framework including the management goal and purpose, management strategy, objectives, targets and indicators, and likely risks and risk-mitigation options pertaining to the implementation of the management.

### **Management Goal and Purpose**

The overarching goal of managing the floodplain wetlands of River Ganga is "conservation and wise use of wetland ecosystems so as to sustain their full range of ecosystem services and biodiversity values including their contribution to River Ganga ecosystem health".

The purpose is to: a) enhance river ecosystem health, b) enhance water security in the Upper-Ganga basin, c) reduce water-related disaster risks to communities living in and around the wetlands, d) provide livelihood opportunities to local communities based on sustainable use of wetland resources and e) sustain habitats and migration corridors of wetland-dependent species.

### **Management Strategy**

The ecological and hydrological connectivity of the floodplain wetlands with River Ganga provides the physical template in which these wetlands evolve and function. At the same time, the wetlands are also conditioned by the land use in the surrounding areas, traditional uses of the wetland, the cultural and relational linkages that communities have with wetland ecosystems, and the overarching regional developmental planning for different development sectors. Management of these floodplain wetlands is thereby proposed at two levels: a) the interventions at the sub-basin level which are aimed at ensuring that wetlands are embedded in the institutional and governance framework for water, land, and biodiversity management and b) interventions at wetland sites which address the direct drivers of adverse change.

### Strategies for integrating wetlands within sub-basin level plans and programmes

As land and water resources development plans and programmes at the sub-basin level have a bearing on the functioning of floodplain wetlands, the set of strategies at the sub-basin level will be aimed at ensuring consideration of the full range of wetland ecosystem services and biodiversity values in the sub-basin level plans and programmes. The following strategies are proposed:

- Including wetlands conservation within the mandate of the District Ganga Committee. The committees would maintain an overview of the ecosystem health of wetlands within their jurisdiction, review implications of sectoral plans and programmes, commission specific research to address the knowledge gaps and approve the implementation of interventions at specific sites.
- Inventory assessment and monitoring of sub-basin scale processes that influence wetlands. These include weather patterns, geology and geomorphology, water regimes (surface and groundwater), land use and land cover change, and other parameters.
- Ensures the convergence of wetlands conservation action within the district-level plans for the environment, disaster risk reduction, agriculture, fisheries, and other sectors.
- Commissioning strategic impact assessment of major infrastructural development projects in terms of their likely impacts on wetlands and identify necessary impact-mitigation and abatement measures and ensure the implementation through appropriate institutional arrangements including the District Ganga Committee.
- Enhances public awareness of wetlands ecosystem services and biodiversity values through coordinated district-level campaigns.
- Develops the capacity of wetland managers in determining water regime requirements for wetland ecosystem health and communicating and engaging with concerned government departments to ensure their implementation.

#### Strategies for addressing drivers of adverse change within wetland sites

Based on the detailed inventory carried out, each of the floodplain wetlands and wetland complexes can be placed under one of the four categories: a) wetlands located within protected areas, b) floodplain agricultural wetlands, c) urban and peri-urban wetlands, and d) ponds within the jurisdiction of village panchayats (Map 21).

### Wetlands located within Protected Area Network

Management of such wetlands is essentially targeted toward the protection and conservation of endangered wildlife species and their unique habitats. Thus, management is often supplemented with the Protected Area Plan or the Forestry Working Plan. The provisions of the Wildlife Protection Act 1972, and the Forest Conservation Act 1980 provide the basis for the regular monitoring and management of such wetland. The focus should be on increasing the effectiveness of existing management arrangements for wildlife habitat conservation and restoration while reducing conflicts amongst stakeholders.



Map 21: Distribution of wetlands in the in the sub-basin of Ghaghra Confluence to Gomti Confluence in accordance to their management category

The strategy involves:

- Consolidation and demarcation of boundaries.
- Management zoning with the introduction of core and buffer zones.
- High biodiversity areas under private ownership can be recognized as 'Community Reserves' to strengthen the protected area network.
- Stricter enforcement of legal provisions and surveillance arrangements.
- Encourage long-term research by engaging local academic institutes and NGOs.
- Promoting livelihood options for local communities through sustainable ecotourism.

## Wetlands within the jurisdiction of Village Panchayat

Ponds (interchangeably used with the phrase 'wetlands within the jurisdiction of village panchayats') provide decentralized storage and local water security benefits to village communities. Water conservation activities by promoting the management of ponds is also a priority mission of the Jal Shakti Ministry, to be achieved through the application of participatory and integrated approaches to water management. Watershed treatment and water conservation activities are listed as Panchayat subjects. Wetland conservation will benefit from the strengthening of Panchayat's capacities to appreciate the benefits of wetland conservation and undertake the required conservation actions.

### The strategy involves:

- Systematic and regular capacity development for PRI members.
- Increased participation and contribution of communities to decisionmaking by providing representation to PRIs in the District Wetlands Committee.
- Development of SOPs for wetlands conservation and sustainable use to guide village development planning.
- Mapping and building consensus on desired wetland conservation actions through Gram Panchayat Development Planning.
- Implementation of actions through Gram Sabha and convergence funds.
- Capacity development and involvement of village communities in monitoring and assessments activities.

# Floodplain agriculture wetlands

Gangetic floodplains are extensively used for agricultural practices. Promotion of sustainable agricultural practices which economizes water use and enhances productivity should form the core strategy. This should also include regulating the cropping pattern within the core inundation area in line with fluctuating hydrological regimes, by reducing the cropping cycle, allowing for lands to be left fallow during monsoons for natural soil enrichment, and reducing area under water-intensive perennial crops. There is over-dependence on the use of groundwater for irrigation. This has a deleterious impact on the river ecosystem health and needs to be reduced.

The strategy involves:

- Awareness generation and incentivization to promote technology options such as the System of Rice Intensification (SRI) which are known to reduce water use by 40-50% and enhance productivity by 20-30%.
- Reducing the intensity of chemical fertilizer and pesticide use through promotion of organic cultivation and establishment of centers for the supply of quality agricultural inputs.
- Formation of SHG/farmers groups in villages to encourage adoption of alternate income generation programmes with technical support of Krishi Vigyan Kendras (KVKs) on Mushroom cultivation, Animal husbandry, and Poultry and dairy activities.
- Incentives in the form of farming equipment, training, and soft loans to be provided to farmer groups for the adoption of sustainable agricultural techniques.
- Sensitization of farmers on reducing groundwater use in agriculture and on the role of wetlands in providing local water security and irrigation benefits
- Monitoring and research activities pertaining to changes in land use and land cover within the wetland complex and basin, Overall water use pattern within the basin, Surface runoff, and trends in nutrient enrichment.

## Urban and Peri-urban wetlands

Wetlands in urban and peri-urban settings serve multiple functions like that a water treatment plant, flood buffer, carbon sink, groundwater recharge, sediment trap, fish farms, habitats for urban biodiversity, etc. They form an important part of our natural wealth and liquid assets. The conservation of wetlands will immensely support achieving the Government's goal of 'Nal Se Jal' in each household. Under the Wetlands (Conservation and Management) Rules, 2017; construction of any permanent nature, solid waste dumping, and discharge of untreated waste and effluents from industries, cities, towns, and villages into the wetlands have been listed as prohibited activities. Hence conservation of urban wetlands should be aligned with master plans forming an integral part of the city and urban planning.

# The strategy involves:

- Mapping of present and historical wetland regimes including landscape connectivity and preparation of a wetland restoration plan for all urban centres in consultation with water managers and all stakeholders.
- Revival of urban/peri-urban wetlands through various restoration measures (Such as boundary notification, removal of encroachment, restoration of inlets and outlets through selective dredging and desilting, cleaning, water treatment measures, catchment conservation measures) by embedding the restoration plan within AMRUT and Smart Cities mission.
- Creation of infrastructure for the interception, diversion, and treatment of point sources of pollution to manage the water issues (sanitation and availability of safe drinking water) of the city.

- Establishment of a systematic, monitoring and evaluation system involving various stakeholders to gauge the effectiveness of the implementation of wetland restoration actions and their benefits.
- Augment aesthetics of the wetlands for recreational benefits while preserving the ecological character of wetlands and their catchments.
- Plan for species conservation, habitat improvement, and maintenance of migratory routes should be developed as a core part of environmental protection.
- Capacity building, communications and outreach should be made an integral part of wetlands management.

# **Management Objectives and Performance indicators**

Level	Objectives	Performance indicators	Desired outcomes
Sub-basin lev	el		
	Integration of multiple values of wetlands in sectoral development plans is enhanced	The number of sectoral plans and programmes wherein convergence with wetlands conservation has been achieved	Plans for water resources development, irrigation, land resources management, fisheries, and tourism do not lead to adverse impacts on wetlands
	A systematic wetland inventory assessment and monitoring system is used to inform management decisions and assess effectiveness.	Availability of long-term monitoring records on wetlands features Use of monitoring data and information to amend existing management framework	A hierarchical wetland monitoring and assessment system is functional Monitoring reports are produced periodically
	Compliance with existing rules and regulations is maintained	Number of natural wetlands notified under the Wetlands (Conservation and Management) Rules, 2017 Number of violations recorded of extant rules and regulations	All provisions of the Wetlands (Conservation and Management) Rules, 2017 and other extant rules and regulations are fully complied with
Site-level	•		
Wetlands within PAs	Maintain hydrological connectivity with catchments Maintain water quality to support ecosystem	Duration of flood pulse and connectivity of river channels with wetlands DO levels	Inundation regimes (minimum and maximum) achieved in the past 30 years is maintained 4mg/I or more
	brocesses and services Limit anthropogenically induced sedimentation Maintain the naturalness of shorelines	Sedimentation quantity and location The extent of the wetland shoreline	Natural profiles of inlets and outlets are maintained No concretization of the shoreline

Table 14: Management objectives, performance indicators and desired outcomes in the study wetlands at the sub-basin and site levels

Level	Objectives	Performance	Desired outcomes
			Maintananan af 111 a 150
		devoid of any built-up	Maintenance of at least 50 m
		area	buffer around the wetland
	Maintain and improve	Habitat diversity	No species extirpation
	habitat quality to support		Migration corridors for fish and
	the diversity of wetland-		large mammals (Swamp Deer,
	dependent species		Otters) are maintained
			Sighting of key species is
			maintained in the range of 20%
			deviation from the average of
			the last five years
			Counts of migratory waterbirds
			are maintained in the range of
			20% deviation from the average
	Material and a design of		of the last five years
	Maintain and enhance	Species diversity,	Species diversity, richness, and
	populations of species of	richness, and	populations trends remain
	night conservation	populations trends	stable of show an increasing
		The number of	lienu
	Ennance awareness of	offirmative estions by	Increase in aminiative actions
		attitutions by	
	amongst stakeholders	stakenoiders ion	
	amongst stakenolders	and wise use	
	Spaciae invasion throate	Area of wotland under	Habitat is conserved
	are reduced	invasive species	Species that are native
	are reduced	invasive species	ecologically sensitive and of
			conservation importance are
			protected
	Preserve the recreational	Tourist footfall and	Visitors are informed and aware
	and touristic value of	ecologically sensitive	Number of tourists increases
	wetlands	behaviour of tourists	
Floodplain	Maintain hydrological	Duration of flood pulse	Inundation regimes (minimum
agricultural	connectivity with the	and connectivity of river	and maximum) achieved in the
wetlands	wetland catchment	channels with wetlands.	past 30 years are maintained
	Promote good	Cropping practices that	No structural modification of
	agricultural practices	do not modify water	wetland
	aligned with wise use of	regimes or deteriorate	No introduction of chemicals,
	wetlands	water quality or	fertilizers, and pesticides
		introduce exotic	No introduction of exotic
		species	species.
		<b>T</b> I	No intensive water abstraction
	Maintain the naturalness	The extent of the	No concretization of the
	of shorelines	wetland shoreline,	shoreline
		devoid of any built-up	Iviaintenance of at least 50 m
	NASTRICTS STOLEN	area	butter around the wetland
	Maintain and improve	Habitat diversity	No species extirpation
	nabitat quality to support		Wigration corridors for fish and
	the diversity of wetland-		iarge mammais (Nilgai) are
	uependent species		maintaineo Cialitza a fluore a construction
			Signting of key species is
			maintained in the range of 20%

Level	Objectives	Performance	Desired outcomes
		indicators	
			deviation from the average of
			last five years
			Counts of migratory waterbirds
			is maintained in the range of
			20% deviation from the average
			of last five years
	Enhance awareness of	The number of	Increase in affirmative actions
	wetlands blodiversity and	affirmative actions by	
	ecosystem services		
	arrioriyst stakerioiders	and wise use	
	Dromoto local	Depresentation of local	Communities' views rights and
		stakeholdere in wetland	continuanties views rights and
	in wotlands management	management	wotland management
	III wellanus management	structuros	decisions
		Structures	Pro-active engagement of
			women youth and children in
			wetland management
Urban and	Maintain the naturalness	The extent of the	No concretization of the
peri-urban	of shorelines	wetland shoreline,	shoreline
wetlands		devoid of any built-up	Maintenance of at least 50 m
		area	buffer around the wetland
	Maintain hydrological	Duration of flood pulse	Inundation regimes (minimum
	connectivity with the	and connectivity of river	and maximum) achieved in the
	wetland catchment	channels with wetlands	past 30 years is maintained
	Maintain water quality to	DO levels, heavy metal	4mg/l or more
	support ecosystem	concentrations	Heavy metal conc. in sewage
	processes and services		brought to permissible levels
	Limit anthropogenically	Sedimentation quantity	Natural profiles of inlets and
	induced sedimentation	and location	outlets are maintained
	Maintain and improve	Habitat diversity	No species extirpation
	habitat quality to support		Migration corridors for fish and
	the diversity of wetland-		large mammals (Nilgai) are
	dependent species		maintained
			Sighting of key species is
			maintained in the range of 20%
			deviation from the average of
			Coupto of migratory waterbirde
			counts of filigratory water birds
			20% doviation from the average
			of the last five years
	Preserve the scenic and	Absence of built-up	Preserved naturalness of the
	aesthetic beauty of	areas	landscape
	wetlands	Landscape naturalness	
	Preserve the recreational	Tourist footfall and	Registering higher revenues
	and touristic value of	ecologically sensitive	through tourism.
	wetlands.	behaviour of tourists.	
	Enhance awareness of	The number of	Increase in affirmative actions
	wetlands biodiversity and	affirmative actions by	
	ecosystem services	stakeholders for	
	amongst stakeholders	wetlands conservation	
		and wise use	

Level	Objectives	Performance	Desired outcomes
		indicators	
	Promote local stakeholder participation in wetlands management	Representation of local stakeholders in wetland management structures	Communities views rights and capacities are reflected in wetland management decisions. Pro-active engagement of women, youth, and children in wetland management.
Ponds	Maintain the naturalness of shorelines.	The extent of the wetland shoreline, devoid of any built-up area.	No concretization of the shoreline. Maintenance of a 50 m buffer around the pond.
	Maintain water quality to support ecosystem processes and services	DO levels	4mg/l or more
	Maintain non-declining harvest of fish and wetland plants for economic use	Fish harvest (size, quantity, and diversity) Plant harvest (abundance and type)	No individuals of below minimum harvestable size in fish catch No use of illegal mesh size and gear in wetland fisheries. No harvest beyond regenerative capacity
	Preserve cultural and spiritual values and traditional and customary practices aligned with the wise use of wetlands	Celebration of traditions and practices aligned with the wise use of wetlands	Continuation and perpetuation of wise use aligned with traditional and customary practices
	Enhance awareness of wetlands biodiversity and ecosystem services amongst stakeholders	The number of affirmative actions by stakeholders for wetlands conservation and wise use	Increase in affirmative actions
	Promote local stakeholder participation in wetlands management	Representation of local stakeholders in wetland management structures	Communities' views rights and capacities are reflected in wetland management decisions Pro-active engagement of women, youth, and children in wetland management

# Phasing

A functional score (FS) was derived for key functions of the wetland like groundwater recharge potential, flood buffering and water purification using the hydro-geomorphic approach wherein the wetlands were ranked as per the significance of functional attributes like geomorphology, water source, water permanence, hydrodynamics, soil type and vegetation. The score was then aggregated with the ecosystem service index (ESI) derived from the ecosystem services assessment using the RAWES tool for the surveyed wetlands. The aggregate score was the plotted in a quadrant chart against the threat score for the individual wetlands. Wetlands exhibiting High FS+ESI Score and High Threat Score were given High Priority for conservation and management. Wetlands having High FS+ESI Score and Low Threat Score and, Low FS+ESI Score and High Threat Score were given Moderate Priority for conservation and management. Thus, Phase 1 corresponds to high priority, 2 to moderate priority and 3 to low priority wetlands respectively (Figure 22 and Map 22). The plotted graph (Figure 23 and Table 15) for all surveyed wetlands summarises the wetlands prioritised and categorized into three phases based on their significance for management interventions in the sub basin.



Figure 22: Phasing justification diagram based on cumulative aggregate of ecosystem services index, functional scores and threat scores



Figure 23: Categorizing wetlands on the basis of their threat scores, ecosystem services index and phasing



Map 22: Surveyed wetlands under different categories of Priority in the 10 Km buffer zone on either side of the river Ganga in the sub-basin Ghaghra Confluence to Gomti Confluence in Uttar Pradesh

District	High Priority	Moderate Priority	Moderate
			Priority
	High Threat; High (ESI+FS)	High Threat; Low	Low Threat;
		(ESI+FS)	High (ESI+FS)
BALLIA	Surha Tal, Sansar Toal Bhagad,	New Baheri,	Dal Chhapra
	Dahtal Reoti, Rampur Kodahara	Kopwa,	Bhakar
	Dhab/Baghad	Quazipura	
		(Railway Yard	
		Land), Mithwar	
GHAZIPUR			Talwal
	Birna	Urwa	Saresar,
CHANDAULI			Bhogwar,
			Godhana,
			Narsipur
			Pattan,
			Ramgarh,
			Dhanapur

Table 15: Category of wetlands in the Sub-basin based on their phase and management category

### **Risks and risk-mitigation measures**

The management plan design is based on certain assumptions. Table 16 below identifies the risk associated with these assumptions in the management plan and possible risk-management measures.

Table 16: Proposed risk management measures at the goal and objective levels

Risk	Risk-management measures
At Goal Level	
District Ganga Committees have insufficient capacity to integrate wetlands in sectoral plans.	Formulate integrated management plans for conservation and sustainable use of prioritized wetlands. Build management and professional skills of sectoral authority members and staff to mainstream wetlands conservation in sectoral programmes and policies <i>inter alia</i> water resources development, rural development, agriculture, and urban development to ensure complementarity of the sectoral programmes with wetlands ecosystem services.
Wetland conservation actions are restricted to a few large wetlands and	Regulate and control all activities detrimental to the maintenance of biodiversity and other
not taken at a landscape scale.	ecological components, processes, and services of the wetlands

Risk	Risk-management measures
	Ensure compliance with the existing national and state-level regulatory frameworks related to wetlands conservation SWA to approach the state government for enactment of any regulation for achieving conservation and sustainable management of wetlands in the state.
Sectoral pursuits (such as agricultural intensification and large-scale afforestation programmes and urbanization) lead to wetland conversion.	Coordinate and facilitate implementation of the following activities (within the ambit of the site management plans) by different departments, organizations, institutions, and local agencies or communities: a) restoration of hydrological regimes, including improvement of water quality, b) control of silt load from catchments, c) management of plant and animal invasives, d) ecological restoration and habitat improvement, e) sustainable development of capture and culture fisheries, f) livelihood improvement and disaster risk reduction with communities living in and around wetlands, g) community-managed eco-tourism development. Ensure resolution of trans-catchment and multi stakeholder conflicte
Ownership of wetlands is not clear with multiple departments and agencies staking their claim.	SWA to advise the state government, government and non-government agencies, and local authorities on matters pertaining to the conservation and management of wetlands. SWA to act as a nodal agency for clearing all technical matters related to wetlands conservation and management. Formulate policy guidelines for conservation and sustainable management of the wetlands of the state.
Wetland monitoring systems are not established and there is no effort for monitoring the effectiveness of management.	Based on scientific guidelines, a wetlands inventory, assessment, and monitoring system are to be developed and maintained to assess and respond to changes in the wetlands components, processes, and services. Environmental Impact Assessments (EIA) for developmental projects likely to create

Risk	Risk-management measures
	detrimental impacts on wetlands ecosystem services and biodiversity values are to be commissioned. Collate and disseminate periodic reports on the status of wetlands in the state.
At Objective Level	
Wetland management actions are not included within the approved PA management plans.	Management plans of protected areas must focus on the conservation of the forest ecosystem as one functional unit building management interlinkages between terrestrial and freshwater entities.
	ensure wetlands functioning and delivery of ecosystem services.
Sufficient human capacity is not allocated for implementing wetland management. Urban development projects lead to the	Conduct capacity needs assessments and identify priority training areas. Devise capacity development programmes for wetlands management. Recognize wetlands areas as ecologically
concretization of wetland margins and an unsustainable concentration of infrastructural investment.	sensitive within infrastructure development projects or plans.
Tourism is promoted without any connection to ecological sensitivity.	Develop awareness and outreach material for tourists. Conduct a capacity assessment to determine the level of tourism that can be supported at the site. Prepare do's and don'ts for activities permitted and prohibited in ecologically sensitive areas. Restrict tourist movement in ecologically sensitive areas.
Pollution abatement measures are energy-intensive and do not integrate the opportunity to use wetland-mediated solutions.	Promote nature-based solutions, such as wetlands management to ensure hydrological connectivity of the entire system. Restrict waste disposal activities that can alter wetlands water quality.
Livelihood concerns related to the adoption of good agricultural practices are not addressed.	Leverage compensatory schemes or provide alternative livelihoods such as through engagement in wetland-based tourism activities. Promote participatory management.

Risk	Risk-management measures
Conservation of ponds is not linked with	The orientation of Gram-Panchayat towards
Gram-Panchayat Development Plans.	the importance of wetlands and their
	management.
	Integrating wetlands functioning in Gram-
	Panchayat Development Plans.
	Promote participatory management.
Investment in behaviour change	Consideration of stakeholder issues and
communication is insufficient and does	feedback in management implementation.
not lead to awareness generation on	
wetland values and functions.	
Financing of wetland values and	Identify sectoral priorities and align them
conservation is episodic and in project	with the management of wetlands.
mode and not linked with systematic	For different wetlands management
budget allocations.	activities, an analysis of complementarity
	with ongoing development or conservation
	sector schemes may be done to assess the
	extent of funding that can be generated
	through convergence with these schemes.
	Opportunities for private sector participation
	should be identified and encouraged.

# 6. Monitoring Plan

Wetland management is an exercise in decision-making— choosing actions that are expected to best achieve the management objectives. Monitoring plays a central role in wetlands management because these ecosystems are dynamic and variable, and often do not align with the desired results of intended decisions and actions. There are several sources of uncertainty that affect natural resource decisions. Primarily, environmental variation in space and time often drives natural systems in ways that may or may not be consistent with management prescriptions. Secondly, many system variables are not measured directly (i.e., partial system observability), and thirdly, outcomes of management actions often deviate in degree and spatial extent from management prescriptions. Thus, by integrating monitoring into decision-making, adaptive management explicitly addresses these sources of uncertainty and allows decision-makers to simultaneously achieve management objectives and generate new knowledge about how the system responds to management.

Management of floodplain wetlands in the sub-basin spanning from upstream of Ghaghara Confluence to Gomti confluence is primarily focused on meeting the objectives of achieving 'wise use'. Having a system to monitor, detect and describe changes in ecological character is therefore critical to support decision-making for wise use of wetlands. Equally important is ability to assess the effectiveness of management in terms of the capacity to develop and implement integrated planning, management, and evaluation systems to secure wise use of the wetlands.

This chapter describes a monitoring framework for the "Ghaghara Confluence to Gomti confluence" sub-basin at the scale of both sub-basin and individual wetland sites to support integrated management for wetlands wise use. It essentially delineates monitoring objectives, strategy and associated resource requirements.

#### **Monitoring Objectives**

Developing a monitoring plan for the Ghaghara Confluence to Gomti confluence sub-basin requires addressing the inter-related requirements of wetland inventory (which is the collection and/ or collation of basic information for wetland management) and wetland assessment (identification of status of, and threats to wetlands which provides a basis for wetlands monitoring. It is imperative therefore to put in place an integrated Wetland Inventory, Assessment and Monitoring System (WIAMS) to address the overall information needs for wetland management, and to provide a robust decision support system for the same. Following are the specific objectives for establishing WIAMS for the Sub-basin:

- Developing up-to-date and scientifically valid information on the status and trends of wetland features and influencing factors.
- Establishing a baseline for measuring the change in ecosystem components, processes, and services.

- Informing decision-makers and stakeholders on the status and trends in biodiversity, ecological functioning, and ecosystem services of the wetland.
- Supporting compliance with national and state specific legal requirements and regulatory regimes.
- Determining the impacts of developmental projects on ecosystem components, processes, and services.
- Identifying risks to the ecological character and supporting the development of response strategies.
- Assessing the effectiveness of wetland management.

# Monitoring Strategy

Monitoring is proposed to be undertaken at following two levels:

- Sub-basin level to explain status and trends in key hydrological and ecological processes that influence wetland functioning (Table 17).
- At specific sites that explain status and trends in wetland ecological character in response to natural and anthropogenic stresses (Table 18).

The monitoring parameters have been selected on the basis of their ability to reflect the degree to which management objectives are met.

Given the large number of wetlands in the floodplain zone, it is recommended that a few representative sites are taken up for monitoring purposes. These are as follows:

Ponds:	Urwa (Chandauli), Chunni Tal, Dhari Dheeh, Khanpur, Seorai (Ghazipur), Jharkatha Tal, Kopwa, Mithwar, Sarak (Ballia)
Floodplain Agricultural wetlands:	Birna, Ramgarh (Chandauli), Veerpur, Reosara Gang Nahar, Talwal (Ghazipur), Bahkata, Dahtal Reoti, Dal Chhapra Bhakhar, Rampur Kodahara Dhab/Baghad, Sansar Toal Bhagad (Balia)
Urban and peri-urban wetlands:	Saresar, Bhogwar, Nasirpur pattan, Godhana, Dhanapur (Chandauli), Amarupur, Kanuwan, Taraw (Ghazipur), New Baheri, Mishra Newari Dadri Mela Ground Nala/Bhagad, Quazipura (Railway Yard Land) (Ballia)

Wetlands within Protected Areas (PA): Kawleshwar Tal, Surha Tal (Ballia)

The information needed for inventory are derived from the core datasets required to establish a baseline on ecological character for the sub-basin and contains all essential ecosystem components, processes, and services, as well as management related parameters that characterize the site. Within the aquatic environment, information needs pertain to water inflow, quality, and ecosystem services such as provisioning, regulating, culture and supporting.

At the level of wetland, information needs pertain to land-use and land cover change, and threats such as over discharge of household effluents. At the basin scale, the information required is related to geo-morphological and climatological setup, as well as basin-wide management arrangements, particularly those related to land, water resources and urban planning. At all levels, information on institutional arrangements and management practices is included so as to enable the creation of a database on sectoral programmes, and the linked stakeholders, which are likely / have an impact on the wetland state. While not explicitly mentioned, strategic environmental assessments can be commissioned for any developmental project that has/is likely to have a negative impact on the wetlands.

Information needs for monitoring the Ghaghara Confluence to Gomti confluence sub-basin have been derived from the assessment of ecological character carried out for the development of the management plan. Four clusters of needs have been identified: a) land use and land cover change, to assess the dynamics of land use within the catchment; b) hydrological regimes, to assess the flux of water, sediments, and nutrients; c) ecological components and processes, to assess the biodiversity, habitat quality and resource productivity; and d) socioeconomics and livelihoods to assess the trends in ecosystem services – livelihoods interlinkages. This monitoring information adequately addresses the needs of the sub-basin under the Wetlands (Conservation and Management) Act, 2017, and the NPCA Guidelines, 2019.

The monitoring and assessment needs are envisaged to be addressed by a dedicated monitoring programme and specific research and assessment projects. Inventory, being based on collated information on identified wetland features and management practices, will be developed based on the monitoring and assessment information, as well as secondary sources. Inventory, assessment, and monitoring form an integral part of wetland management, and thereby the core activity of UPSWA. The management plan proposes to establish a dedicated wetland monitoring unit with adequate infrastructure support to effectively deliver this function.

Linkages also need to be developed so that data from the existing monitoring networks of different agencies (for example, inundation and flooding information from Central Water Commission and Department of Water Resources; groundwater quality and quantity from Central Ground Water Board; select surface water quality parameters from Uttar Pradesh Pollution Control Board; and fish production from Fisheries Department) can be accessed and shared. Similarly, provision for participation of NGOs and civil society in a monitoring programme has also been built, especially for socioeconomics and livelihoods aspects and biodiversity monitoring (for example, the waterbird census being implemented by NGOs under the aegis of the Asian Waterbird Census). Thematic management needs-based research can be taken up by specialized agencies such as ZSI, BSI, and CIFRI, to complement the monitoring programme.

Table 17: Monitoring	Parameters and	corresponding	indicators at the	e sub-basin level.
<u> </u>		1 3		

	Monitoring parameter	Monitoring Indicator	Monitoring Method	Frequency
Sub-	Ecological	Conservation Sector Plans	Number of wetlands	Review
basin	Changes		conservation &	Once in 10
	5		management	vears
			activities proposed	
			Collaboration between	Review
			various stakeholders	Once every
				year
			Funds available	Review
			through various	Once every
			Central and State	year
			Government schemes	
	Landscape	Development Sectoral	Number of wetlands	Review
	Changes	Plans	conservation &	Once in 5
			management	years
			activities proposed	
			Collaboration between	Review
			various stakeholders	Once every
				year
			Funds available	Review
			through various	Once every
			Central and State	year
			Government schemes	
	Institutional	Effective implementation of	Availability of WIAMS	Review
	Gaps	WIAMS (Wetlands		Once every
		Inventory, Assessment and		year
		Monitoring Systems)		

T-L-L- 10. Manualtania	Development and a second	and a second in a line of the second	
Table TX: Monitoring	Parameters and corre	sponding indicators.	at the wetland site level
rubic ro. monitoring		oponding indicators	

	Monitoring	Monitoring Indicator	Monitoring	Frequen	Locatio			
	parameter		Method	су	n			
	Ecological	Wetland extent defined by	Remote	Once in	All			
	boundary & area	inundation & hydrophytic	Sensing & GIS	2 years	Wetlan			
		vegetation			ds			
me	Boundary defined	PA boundary as per the	Literature	Once in	Selecte			
egi	by Law &	respective notification /	review	5 years	d			
alr	regulation	Wetland boundary as per			Wetlan			
sic		the notification			ds			
Phy Phy	LULC within the	% Cover of various LULC	Remote	Once in	Selecte			
	wetland	classes within the wetland	Sensing & GIS	10 years	d			
		boundary			Wetlan			
					ds			
ne		Inundation (Minimum,	Remote	Once in	All			
ği		Maximum, Interannual	Sensing & GIS	2 years	Wetlan			
lre		variability)			ds			
lica		Inflows (Number,	Physical survey	Once	Selecte			
- Solo		Seasonality/Extent of		every	d			
dro		choking)		year	Wetlan			
Ŧ					ds			
Monitoring	Monitoring Indicator	tor Monitoring Frequen I						
---------------	---	---	--------------------------------------	------------------------------	--	--	--	--
parameter		Method	су	n				
Water regimes	Outflows (Number, Seasonality/Extent of choking)	Physical survey	Once every year	Selecte d Wetlan ds				
	Water use (Volume and Purpose)	Physical survey (Bathymetric profile)	Once in 2 years	Selecte d Wetlan				
	Water balance (Monthly)	Monitoring gauging station	Once every year	Selecte d Wetlan ds				
	Water chemistry (DO, BOD, COD, pH, Nutrients, Heavy metals)	Physical survey (Standard protocols of CPCB to be followed)	Biannual (Winter & Summer )	Selecte d Wetlan ds				
Sedimentary	Sediment flux (Inflow, Outflow & Balance)	Physical survey (Monitoring gauging station)	Once in 2 years	Selecte d Wetlan ds				
regime	Soil texture	Physical survey (Standard protocols of CPCB to be followed)	Once in 2 years	Selecte d Wetlan ds				
	Soil pH	Physical survey (Standard protocols of CPCB to be followed)	Once in 2 years	Selecte d Wetlan ds				
	Soil organic carbon	Physical survey (Standard protocols of CPCB to be followed)	Once in 2 years	Selecte d Wetlan ds				
	Bathymetry	Physical survey (Bathymetric profile)	Once in 2 years	Selecte d Wetlan ds				
Connectivity	Extent of flood pulse (spatial and temporal)	Remote Sensing & GIS	Once every year	Selecte d Wetlan ds				
	Active channels between river and wetlands and within wetlands	Remote Sensing & GIS	Once every year	Selecte d Wetlan ds				
	Migratory pattern of key groups (Fish, Reptile, Mammals, Birds)	Physical survey	Once every year	Selecte d Wetlan ds				

	Monitoring	Monitoring Indicator	Monitoring	Frequen	Locatio
	parameter	_	Method	су	n
	Catchment	Catchment area	Remote	Once in	All
	boundary and		Sensing & GIS	5 years	Wetlan
	area				ds
lts	LULC	% Cover of various LULC	Remote	Once in	All
len		classes within the	Sensing & GIS	10 years	Wetlan
문		catchment			ds
Cat	Degree of	Location and Length of	Remote	Once in	All
	fragmentation	linear structures on	Sensing & GIS	10 years	Wetlan
	, i i i i i i i i i i i i i i i i i i i	wetlands inflow & outflow	and Physical		ds
			survey		
	Different forms	Richness & Abundance List	Physical survey	Once in	Selecte
	of flora & fauna	of Flora & Fauna		2 Years	d
					Wetlan
					ds
		Species distribution	Literature	Once in	Selecte
			review and	2 Years	d
			Physical survey		Wetlan
					ds
		Conservation status	Literature	Once in	Selecte
			review	10 years	d
					Wetlan
					ds
		Relative abundance	Physical survey	Once in	Selecte
				2 Years	d
					Wetlan
					ds
		Keystone	Literature	Once in	Selecte
			review and	2 Years	d
tat 8			physical survey		Wetlan
abit					ds
I A		Economic importance of	Literature	Once in	Selecte
se		flora	review and	5 Years	d
eci			Physical survey		Wetlan
g S					ds
	Habitat	Туре	Physical survey	Once in	Selecte
			and	2 Years	d
			Remote		Wetlan
			Sensing & GIS		ds
		Area	Physical survey	Once in	Selecte
			and	2 Years	d
			Remote		Wetlan
			Sensing & GIS	- ·	ds
		Associated flora & fauna	Physical survey	Once in	Selecte
				2 Years	d
					vvetian
		Dislasiastinas			as Oalasta
		Biological importance		Unce in	Selecte
			Devices and	∠ rears	
			Physical survey		vvetian
	Vagatation	Tura	Dhusias	Onerin	US Dolente
	vegetation cover	туре	Physical survey	Unce in	Selecte
1			ana	2 Years	a

	Monitoring	Monitoring Indicator	Monitoring	Frequen	Locatio
	parameter		Method	су	n
			Remote		Wetlan
			Sensing & GIS		ds
		Area	Remote	Once in	Selecte
			Sensing & GIS	2 Years	d
					Wetlan
					ds
		Density	Physical survey	Once in	Selecte
			and	2 Years	d
			Remote		Wetlan
			Sensing & GIS		ds
		Composition	Physical survey	Once in	Selecte
			and	2 Years	d
			Remote		Wetlan
			Sensing & GIS		ds
		IVI (Importance value index)	Physical survey	Once in	Selecte
			and	2 Years	d
			Remote		Wetlan
			Sensing & GIS	-	ds
	Migratory	Population Counts	Physical survey	Once	Selecte
	species			each	d
				year	Wetlan
				-	ds
		Concentration areas	Physical survey	Unce	Selecte
			and	eacn	0 Matlere
				year	vveuan
		Migratian pariod	Deviced everyor	Casaanal	US Colocto
		Migration period	Physical survey	Seasonal (Wintor	Selecte
				Migront:	u Watlan
				Summer	de
				Migrant)	us
		Conservation status	Literature		Selecte
			review	10 Years	d
				i o i ouro	Wetlan
					ds
╞	Invasive species	Species list	Physical survey	Once in	Selecte
		(Presence/Absence)	and	2 Years	d
			Literature		Wetlan
			review		ds
		Proliferation rate of invasive	Physical survey	Once in	Selecte
		macrophytes		2 Years	d
					Wetlan
					ds
		Proliferation rate of invasive	Physical survey	Once in	Selecte
		fish species		2 Years	d
					Wetlan
					ds
		Area occupied	Physical survey	Once in	Selecte
				2 Years	d
					Wetlan
					ds
ſ	Species mortality	Incidental, Mass	Physical survey	Once in	Selecte
				2 Years	d

	Monitoring	Monitoring Indicator	Monitoring	Frequen	Locatio
	parameter		Method	су	n Matlen
					ds
	Type of	Provisioning	Field survey	Once in	Selecte
	ecosystem	(Presence/Absence)		5 Years	d
	service				Wetlan
		Degulatory	Field outprov	Onco in	US Selecto
		(Presence/Absence)	Field Sul vey	5 Vears	d
					Wetlan
					ds
		Supporting	Field survey	Once in	Selecte
		(Presence/Absence)		5 Years	d
					Wetlan
					ds
		Cultural	Field survey	Once in	Selecte
		(Presence/Absence)	and Literature	5 Years	0 Watlan
spc			Teview		de
iho	Availability of the	Seasonal variation in	Field survev	Once in	Selecte
ivel	ecosystem	ecosystem services		every	d
& L	services			season	Wetlan
ces					ds
ervi	Beneficiaries of	List of stakeholders	Field survey	Once in	Selecte
n Si	the ecosystem	dependent on wetland		2 Years	d Watlen
ster	Services	services			de
osy	Demography	Population	Field survev	Once in	Selecte
Ë	around the			2 Years	d
	wetland				Wetlan
					ds
		Occupation profile	Field survey	Once in	Selecte
				2 Years	d Watlen
					de
		Duration of dependency on	Field survey	Once in	Selecte
		the wetland,		2 Years	d
					Wetlan
					ds
		Income profile	Field survey	Once in	Selecte
				2 Years	d
					wetian
	Stakeholder	List of formal & informal	Field survey:	Once in	us Selecte
e	mapping	institutions and networks	Workshops and	5 Years	d
anc		related to wetlands	Literature		Wetlan
ern		management, their	review		ds
Gov		mandates, roles &			
8		responsibilities and			
ionŝ		aecision-making process	Litoroturo	Oncoin	Colocto
itut	Laws & Regulation	Policy, Legal and Regulatory Framework		Unce In 5 Vears	d
Inst	Regulation	Regulatory Framework		0 10015	Wetlan
					ds

Monitoring	Monitoring Indicator	Monitoring	Frequen	Locatio
parameter		Method	су	n
Resource	State, Central or CSR funds	Literature	Once	Selecte
availability	available	review	every	d
(Finance &			year	Wetlan
Human)				ds

### **Assessing Management Effectiveness**

Wetlands in the Ghaghara Confluence to Gomti Confluence sub-basin are dynamic ecosystems and so are their management needs. Management plans, which are developed based on assumptions known to managers, need to be periodically assessed to make sure that the set goals and objectives are being achieved.

The effectiveness of management towards achieving the overarching objective of maintenance of ecological character can be greatly enhanced if the following questions are periodically reflected upon:

- What is the current status of the wetlands in the landscape?
- Is the management achieving the goal of maintenance of ecological character?
- What are the current and future threats?
- Are adequate resources available for implementing management, and if not, how can they be accessed?
- Are management processes adequate, effective, and efficient?
- What other steps can be taken to improve management?

The Contracting Parties to the Ramsar Convention adopted R-METT (Ramsar Site Management Effectiveness Tracking Tool) to assist Ramsar site managers in assessing the effectiveness of management in achieving wetland wise use outcomes. The assessment looks into the following aspects:

- **Context** of management (wetland ecological character, threats, and risks of adverse change).
- **Management planning** defines how the management goals and objectives have been defined.
- **Inputs** including human, technical and financial resources applied to implement management actions.
- **Process** of management plan implementation.
- **Outputs** (tangible and intangible) that result from the implementation of management actions.
- **Outcomes** concerning the objectives defined by the management plan

It is proposed that management effectiveness assessments for Ghaghara Confluence to Gomti confluence sub basin wetlands be done at least once in five years so that management action plans are revised and updated to reflect the real time condition of wetlands as well as the ability of management to prevent adverse changes in ecological character. A baseline assessment is proposed to be done at the inception of the management plan.

### Infrastructure and Human Resources Requirements

Implementing the monitoring strategy as outlined in the previous sections requires the following physical and human infrastructure support:

- Remote Sensing and GIS unit with advanced capabilities of remote sensing image processing, preparation of maps and development and maintenance of spatial datasets.
- Ecological monitoring laboratory with capabilities for analysis of chemical, physical and biological properties of water and soil.
- Mobile-based citizen reporting system for recording and reporting illegal encroachments.
- Database management system for storing and retrieving monitoring and assessment data. The monitoring data would be stored along with metadata, as per the quality control procedures suggested in the following sections.
- Network of hydro-meteorological and water quality stations for real time monitoring of weather, hydrological and biological variables.

Deployment of the aforementioned resources can be done cost-effectively by applying the lessons and expertise of the existing infrastructure created by the state government for the management of floodplain wetlands. Need-based training programmes can also be conducted to upgrade the skills of the concerned state government departments and agencies.

# Reporting

Reporting constitutes an important element of the wetland monitoring programme. The intended user group, format, style and peer review requirements need to be set in the initial phases of set up of the monitoring programme. Periodic reports, for example as a part of the annual report of the UPSWA should aim to provide a summary overview of the outcomes of monitoring.

Special publications, for example, wetland atlases constituting thematic maps on various parameters are intended to inform stakeholders on wetland status and trends. Outcomes of specific assessments, for example, ecological character status and trends, economic valuation, environmental flows etc. could be made available in the form of technical report series, with an extended summary for a general readership. As the monitoring programs get sophisticated over a period of time, real-time monitoring options through the use of satellite-based data communication techniques can be explored.

# **Quality control**

Monitoring systems are required to ensure the scientific validity of sampling, laboratory analysis, data analysis and reporting. They also play a critical role in preventing the introduction of random and systematic errors in data collection, analysis and reporting. It is recommended that a Quality Management and Assurance Plan is developed for the monitoring programme. The plan should, *inter alia* specify the following:

- **Data quality objectives:** Maximum amount of uncertainty that can be tolerated to ensure that the data is fit for the intended use.
- **Sampling programme design:** Statistical robustness of sampling frame; Means to ensure that samples are representative of the environment; Sample recording; Procedures for minimizing environmental impact.
- **Documentation:** Procedures for field sample record-keeping and methods documentation.
- Sample processing validity (especially for water quality and biological components).
- **Data quality control methods:** Processes for quality control samples, duplicates and replicates; Performance audit procedures including data and systems audit.

### **Review and Adaptation**

A periodic review of the monitoring programme is required to determine the extent to which the objectives of wise use are met, support to management is achieved, and the monitoring system remains relevant for maintaining the wetland state (particularly in the light of new and emerging threats). The review process should also aim at increasing the sophistication of the monitoring system to be able to assess complex landscape scale processes affecting the ecological character of wetland and related management. The review process should include documentation on the way wetland inventory, assessment and monitoring information is being used to support management planning and policy goals. The review should also include identification of appropriate mechanisms to ensure that wetland monitoring is continued in the event of a funding shortfall.

# 7 Action Plan

Actions to meet the management goal, purpose, and objectives (as outlined in chapter 5) are proposed at two levels, namely the sub-basin level to be coordinated by the UPSWA and site level to be coordinated by wetland managers working under the ambit of District Ganga Committees.

# Sub basin level action plan

## Institutional Set-up

Notification of wetlands under Wetland Rules

It is proposed to notify the Ganga Floodplain wetlands under the Wetlands (Conservation and Management) Rules, 2017 to enable application of regulatory provisions. The Rules specifically prohibit conversion of wetlands for non-wetlands usages, direct discharge of untreated sewage from any source, dumping of solid waste, poaching, and any construction of permanent nature within 50 meters of the mean high flood level recorded in the last decade. The rules also require specification of a zone of influence and developmental activities which are likely to adversely influence ecological character of the site. Finally, the State Wetland Authority, notified as per provisions of the Rules has also been entrusted with the task of putting in place an integrated management plan, clearly specifying activities which are to be regulated and permitted within the site, with corresponding thresholds and mechanisms for enforcement of the rules.

Following activities are to be taken:

- Seeking formal consent of the General Body of the UPSWA, to notify Ganga floodplain wetlands under the wetland rules
- Preparation of brief document for notification of the wetlands, containing:
  - Map of wetland boundary
  - Map of zone of influence
  - Ecological character description (information available in Chapter 3)
  - Account of pre-existing rights and privileges
  - List of activities to be permitted within the Ganga Floodplain wetlands and their zone of influence
  - List of activities to be regulated within the Ganga Floodplain wetlands and their zone of influence
  - Modalities for enforcement of regulation (agency responsible for regulation, the mechanism through with regulation shall be done and penal provisions)
- Presentation of the brief documents and draft notification formulated as per the provisions of the Wetlands (Conservation and Management) Rules, 2017 for the approval of the UPSWA
- Publication of draft notification on website of UPSWA and the Government of Uttar Pradesh for the notice of general public
- Revision of the draft notification, incorporating comments and objections

received

- Seeking final approval of the draft notification from the State Wetlands Authority
- Publication of final notification in the State Gazette (to be completed within 240 days from the day on which the approval of State Wetlands Authority to notify the site is obtained)
- Publication of communication material in English and in Hindi for dissemination of information to stakeholders, particularly local communities

Notification/Reorganization of District Wetland Committees

It is proposed to constitute/reform existing district level wetland committees for recommending what activities need to be regulated or permitted within the wetlands in each district, establishing thresholds, and regulation and imposition of penal provisions. The committees must have representation from departments of fisheries, irrigation and flood control, urban development, revenue, agriculture, tourism, environment and wildlife. The committee may have representation from lakeshore fisher and farming communities to ensure that the regulations are arrived at by consensus and have support at various levels and of stakeholders.

In Uttar Pradesh, the District Wetlands Committee (DWC) were constituted in 2009 with an objective of inventorization of all wetlands in the state and their integration in land use records and bringing under the ambit of the State Wetlands Authority (SWA). The District Wetland Committees need to be reorganized and/or notified with a result oriented institutional structure. Specific activities to be undertaken in this regard include

- Finalization of Memorandum of Association and governance structure by the UPSWA, with government line departments, Panchayati Raj and Municipalities and other stakeholders
- Notification of the DWCs
- Staffing and work allocation as per the structure suggested.
- Conducting business as per the set Terms of Reference

Infrastructure development-human resources

A reorganized DWC is proposed to include following units:

- Planning and Design unit: Responsible for strategic planning for conservation and wise use, including assessing adherence to the various policy mandates and regulatory provisions.
- Wetland monitoring unit: Responsible for systematic wetland inventory, assessment with the state wetland monitoring and research center acting as the functional node. The unit shall also be responsible for assessing progress in implementation of various components by line departments and agencies.
- Engineering unit: Responsible for carrying out minor engineering and construction works.

- Watershed management unit: Responsible for monitoring catchment conservation works within the direct basin of wetland complex.
- Community engagement unit: Responsible for liaison with community and civil society organizations, and ensuring integration of community concerns within management actions.
- Communication and outreach unit: Responsible for external communications, based on a communications plan.

## Integrated wetland inventory, assessment, and monitoring system

An integrated wetland inventory, assessment and monitoring system is proposed to be set up to address the overall information needs of wetland management and to provide robust decision support system for the same. Specific objectives and a detailed framework have been outlined in Chapter 6 of the management plan. The following activities are proposed:

Establishment of wetland monitoring and research centre

A state-of-the-art wetland monitoring and centre is proposed to be operationalized for monitoring the ecological, hydrological and socio-economic features of the Ganga floodplain wetlands.

Development of database management system

A database system for storing, retrieving, and analyzing the WIAMS is proposed to be set up in a GIS environment. This will include:

- Development of data quality management and assurance plan including specification of data collection objectives, data quality objectives, sampling program design, data and metadata documentation procedure, data quality control methods and performance audit procedures.
- Development of GIS based database management system.

Wetland monitoring and evaluation

Wetland monitoring and inventory protocols for land use and land cover, hydrological regimes, ecosystem processes and biodiversity and socio-economics and livelihoods as proposed in Chapter 6 will be implemented.

# Ecosystem Health Report Card

It is proposed to develop an Ecosystem Health Report Card, and publish biannually to assess and communicate wetland monitoring information to decision-makers and stakeholders. The health report card summarizes indicators along major indices (water quality, catchment status, biodiversity status) which represent various ecosystem features of the wetlands, and are reported against respective thresholds set in line with management goals. Such a report card will be biennially published in English and Hindi.

### **Research Studies**

Following specific research studies are proposed to be commissioned to address the knowledge gaps in assessing status and trends in ecological character:

- Climate Risk Assessment Climate risk and vulnerability to assess perception of climate risks based on sensitivity and adaptive capacity of critical ecological character elements; climate scenarios with respect to ecological character; and risk management options.
- Wetlands biodiversity assessments Study of floral and faunal abundance and community richness, population trends, conservation status, habitat suitability of wetland dependent species and waterbirds, mapping of migratory corridors of swamp deer, otters and hog deer and breeding and spawning ground of fish.
- Socio-cultural inventory of wetlands Identification and mapping of socio-cultural and religious values and customs associated with wetlands, historical linkages, and heritage values of the floodplain wetlands.
- Multiple wetland values assessment Demographic and socio-economic profiling of wetland dependent communities, resource use and wetland dependency, assessment, and valuation of provisioning, supporting, regulating and cultural services.

### Capacity development

Systematic capacity development of wetland managers, concerned line departments of state government, civil society and other stakeholders is proposed.

Following activities are to be carried out:

- Training needs assessment of the UPSWA, concerned state government agencies, departments, and civil society. The assessment should be taken at two levels (at macro level aligned with strategic goals of wetland conservation at the state level and the needs of integrated management, and at meso level assess whether training is the solution, analyze performance and characteristics of the trainees). The assessment should identify: a) areas of training, b) who needs the specific training, c) mode of training and d) interventions required for maintaining built capacity.
- Development of a training plan for a five years period, and specify baseline for evaluation.
- Implement capacity development activities as specified in the training plan (training workshops, exposure visits, on-job training etc.).
- Use of the wetland webpage as a platform for wetland managers for the exchange of experiences and best practices.
- Conduct effectiveness assessment and revise program, as per need.

#### **Communication and outreach**

Stakeholder engagement in wetland management will be promoted through creating awareness on biodiversity and ecosystem services values, management strategies adopted and opportunities for participation. The ultimate objective is to incentivize affirmative behavioral change for conservation and wise use of wetlands at various levels of planning, programming and decision making. The sub basin level activities will complement the site level communication and outreach interventions and will be largely targeted at levels higher than district. Specific activities to be undertaken include:

### State wide wetland campaign

A wetland campaign is envisaged to be implemented at state level to promote higher awareness on the significance of wetlands and to promote citizen engagement in conservation and wise use of wetlands. Following activities are proposed

- Hiring of an expert agency to design the wetland campaign including key messages, target audience and communication objective, dissemination action (print media, electronic media, direct media, and key performance indicators.
- Implementing the campaign by reaching out to the target audience with specific messages
- Monitoring effectiveness of campaign through the key performance indicators

### Webpage

A dedicated webpage on wetlands of Uttar Pradesh is proposed to be developed and periodically updated with information, datasets, and communication products. It is envisaged that the website would become an important interface of UPSWA and Government of Uttar Pradesh on issues related to conservation of wetlands.

### Resource material

Brochures, fact sheets and awareness materials on Ganga Floodplain wetlands are proposed to be published in English and Hindi for public distribution. A coffee table book is also proposed to be published for serious nature lovers.

### Newsletter

A biannual newsletter highlighting progress made in management plan implementation and key emerging issues related to Ganga Floodplain wetlands is proposed to be published in English and Hindi, and disseminated to all stakeholders.

Workshops and public events

Public events are proposed to be organized on the eve of World Wetlands Day (Feb 2), World Environment Day (June 5) and International Day for Biological Diversity (May 22) as a means of reaching out to public on the issues of wetland conservation and wise use. Public events on specific issues, as pollution abatement, sustainable fisheries, waterbird conservation and water management are also proposed to be organized as a means of engaging with stakeholders.

#### Management implementation and review

A mid-term and end-term review of management plan implementation is proposed to assess the extent to which stipulated objectives have been achieved with a high degree of resource efficiency and in participation with stakeholders. Wetlands International South Asia shall carry out the evaluation, specifically looking at the following elements:

- Degree to which wetland ecological character is being maintained as a result of management being applied
- Implementation quality, timeliness, and resourcing of activities
- Quality and comprehensiveness of wetlands monitoring
- Effectiveness of management being applied, in terms of design, activities, outcomes and impacts
- Quality of stakeholder engagement in implementation of various activities and discharging wetland management functions
- Changes in external environment, requiring adaptation in management plan

### Site level action plan

Actions specific to four management categories are given below. The actions are guided by the wetland strategies outlined in chapter 5. While many actions others cater to category specific management needs, some of these activities apply to all categories. These are:

### Agriculture floodplains

Activities to meet the objectives of the agriculture floodplains wetlands management category are proposed under different management interventions namely; institutional set-up, wetlands delineation and demarcation, enhancing hydrological regimes, pollution abatement, species and habitat conservation, resource development and livelihoods & monitoring and review (Table 19).

#### Institutional set-up

- Formation of a multi-stakeholder forum as a wetlands-mitra network is proposed as an effective arrangement for cross-sectoral coordination and multi-stakeholder engagement in wetlands management. Specifically, the network shall:
  - o Support implementation of various management activities on ground.
  - Promote awareness on wetland values and functions within community stakeholders.

- Articulate community views and suggestions on various management interventions.
- Support adoption of alternative and new knowledges/skills/technologies aimed at reducing livelihood vulnerabilities and advancing wise use of wetlands.
- Systematic wetlands inventory, assessment and monitoring system is proposed to be established to address the overall information needs of wetland management and support decision making and management.
- To support integrated management of wetlands, capacity building of stakeholders needs to be enhanced through professional training workshops on:
  - o Integrated wetlands management
  - Wetlands inventory assessment and monitoring
  - o Land use planning for multiple wetlands use
  - o Wetlands and climate change mitigation and adaptation
  - Integrating wetlands wise use in developmental planning
- The site-management plan is to be prepared by the concerned Divisional Forest Officer. After being endorsed by the PCCF-Wildlife (Principal Chief Conservator of Forests-Wildlife), it is subsequently approved by the SWA.
- Signage indicating the wetland as a Ramsar Site, an Important Bird Area or a Biodiversity Hotspot is proposed to be placed at all major entry points of the wetlands complex.
- Workshops and public events are proposed to be organized on the eve of World Wetlands Day (Feb 2), World Environment Day (June 5) and International Day for Biological Diversity (May 22) as a means of reaching out to public on the issues of wetland conservation and wise use.
- Public events on specific issues, as pollution control or water management are also proposed to be organized as a means of engaging with stakeholders.
- Development of resource material on the wetland including posters, brochures, pamphlets, films and education kits and Publication of newsletter.

# Wetlands delineation and demarcation

### Wetlands demarcation

It is proposed to demarcate wetland boundary by placing geo-tagged pillars all along the wetland periphery. Demarcation will be done using geo-tagged boundary pillars. Pillars will be placed at an interval of approximately 100 m or as the case may be. Approval of the demarcated boundary of the wetland will be obtained from the State Wetlands Authority. Activities to be carried out are as follows:

- Completion of field reconnaissance survey. Wherein detailed mapping of wetland extent using Remote Sensing and GIS and ground truthing will be undertaken.
- Removal of encroachments. The issue has to be addressed at the administrative level and removed following due legal processes.
- Placement of geo-tagged pillars. These will be concrete cemented pillars.

### Enhancing hydrological regimes

Clearing of inlets and outlets

• Identification and cleaning and maintenance of inlets and outlets to identify flow impediments.

# Pollution abatement

Constructed wetlands involving horizontal subsurface flow through large gravel and sandfilled channels that is planted with aquatic vegetation is proposed in prioritized wetlands as a pollution abatement measure. The location of constructed wetlands and design may be finalized in the first year of management plan implementation, and the wetland development work taken up in the second and third year of the management plan.

## Species and habitat conservation

Creation and maintenance of People's Biodiversity Registers

- With support from the State Biodiversity Board (SBB), People's Biodiversity Registers are created at the local level under the guidance of the Biodiversity Management Committee (BMC).
- For creating the Peoples' Biodiversity Register, training by experts should be conducted to prepare document which contains comprehensive information on the landscape, demography of the village and locally available bio-resources. To prepare species inventories, training by wildlife experts should be conducted on habitat mapping and identification of local flora and fauna.
- Training on Asian Waterbird Census (AWC) must be conducted annually during winter season. This is a must for wetlands that are known to be frequented by migratory waterbirds of the central Asian flyway.

### Habitat mapping and surveillance

- Exposed to riverine flood pulses the floodplains serve as breeding and spawning grounds for fishes, migratory corridors for wildlife, and as habitats for ecotone species such as Sarus Cranes. Actions include mapping of key habitat and breeding areas followed by regular monitoring and surveillance through community groups.
- Community sensitization and formation of bird protection committees to monitor waterbird habitats and to control any human disturbance. Incentives in the form of recognition and training as bird guides could be provided to the committee members.

### Management of invasive species

- Growth of invasive macrophytes to be managed by either manual or mechanical removal of thick stands of emergent vegetation like *Phragmites karka*, *Ipomoea aquatica*, *Eichhornia crassipes* etc. to improve hydrological connectivity, check eutrophication and increase fish breeding areas.
- Control of invasive macrophytes such as Water Hyacinth can also be done through meshing of inlets.

#### Resource development and livelihoods

Sustainable fisheries development

- Formation of user groups or fisher cooperatives as key community institutions managing fishery operations in the wetland complex. Revisiting institutional structure to ensure genuine co-operative character owned by their members, governed by their elected representatives, and managed professionally. Wherever required, bye laws for management of society operations may be facilitated.
- Microcredit support provided through linkages with Fisheries Department and NABARD.
- Training on sustainable fisheries development through workshops on: sustainable fish culture practices, management of fish hatchery, integrated fish farming and policy and regulatory requirements for fish culture.
- Regulating use of banned fishing gears like use of mosquito nets for harvesting of fish.
- Controlling harvesting of fingerlings.
- Controlling introduction of exotic species by measures such as selective netting.
- Gears of mesh size 4cm or above ought to be promoted. This must be enforced on an urgent basis as panchayat owned ponds that forms a common property resource frequently witness such kind of activities.
- Construction and upgradation of jetties.

# Promoting sustainable agriculture practices

Krishi Vigyan Kendras function as knowledge centres on agricultural technology and should be involved in developing farmers capacities on sustainable wetland agriculture practices. Related activities are:

- Organising district level workshops for farmers and others stakeholders to promote and adoption of natural farming in wetland catchment zones. Wetlands like Usraila jhil in Raebareli, Saibasi pond in Kanpur nagar and Manpur lake in Unnao districts having more than 85% of catchment area under agriculture should be prioritized for such activities.
- Capacity development of farmers on various aspects like soil aeration, intercropping, vermicomposting, soil conservation techniques, use of climate resilient and less water intensive crop varieties, water conservation techniques like drip irrigation, micro-irrigation etc. bio-manures, multiple cropping and adoption of eco-friendly practices should be facilitated in a zone/ district wise manner in collaboration with Krishi Vigyan Kendras.
- Facilitate availing of farm loans on Kisan Credit Cards for marginal farmers and credit under NABARD refinancing schemes.

#### Monitoring and review

A mid-term review of management plan implementation is proposed to assess the extent to which stipulated objectives have been achieved with a high degree of resource efficiency and in participation with stakeholders. An external committee on wetlands is proposed to be formed by the SWA to carry out the evaluation, specifically looking at the following elements:

- Degree to which wetland ecological character is being maintained as a result of management being applied.
- Implementation quality, timeliness, and resourcing of activities.
- Quality and comprehensiveness of wetlands monitoring.
- Effectiveness of management being applied, in terms of design, activities, outcomes and impacts.
- Quality of stakeholder engagement in implementation of various activities and discharging wetland management functions.
- Changes in external environment requiring adaptation in management plan.

Mana	gement Category - Floodplair	Agricultural wetlands						-				-			
	Wetlands		Chandauli	Birna	Ramgarh	Ghazipur	Veerpur	Reosara Gang Nahar	Talwal	Ballia	Bahkata	Dahtal Reoti	Dal Chhapra Bhakhar	Rampur Kodahara Dhab/Baghad	Sansar Toal Bhagad
I	Institutional Set-up														
		Constitution of wetland mitra network		∢	1		1	1	1		√	1	1	1	1
		Training and orientation on wetland management		~	•		~	1	1	-	~	1	1	~	~
		Issue-specific training		1	1		1	1	1		1	1	1	1	1
		Finalisation and endorsement of site- management plan		~	~		~	~	~		~	~	~	~	~
		Signage		1	1		1	1	1		1	1	1	1	1
		Outreach programmes		✓	•		✓	1	1		1	1	1	1	✓
2	Wetlands delineation & dem	arcation													
2.1	Wetland demarcation														
		Placement of geo-tagged boundary pillars		~	1		~	~	~		~	1	~	~	~
		Removal of encroachments													
3	Enhancing hydrological regin	nes													
3.1	Clearing inlets and outlets			✓											
4	Pollution abatement														
		Constructed wetlands					~		1					1	
				-			ŀ	-	ŀ		-		-	•	

Table 19: Proposed phase-wise activities under the management category - Floodplain Agriculture

Mana	gement Category - Floodplain A	Agricultural wetlands				_									
	Wetlands		Chandauli	Birna	Ramgarh	Ghazipur	Veerpur	Reosara Gang Nahar	Talwal	Ballia	Bahkata	Dahtal Reoti	Dal Chhapra Bhakhar	Rampur Kodahara Dhab/Baghad	Sansar Toal Bhagad
5	Species and habitat conservation	on													
5.1	Creation and Maintenance of People's Biodiversity Registers														
		Training		1	1		✓	1	1		✓	1	✓	1	1
		Creation of People's Biodiversity		1	7		1	1	1		1	1	1	1	1
		Registers		Ľ	·		•	Ľ	ľ		•	Ť.	Ť	·	ľ
5.2	Habitat mapping and surveillance			1	1		✓	1	1		1	1	1	1	1
		Mapping of key habitat areas													
		Mapping of fish breeding and spawning grounds													
		Formation of community groups to monitor habitats													
		Community sensitization													
5.3	Management of invasive species														
		Removal of water hyacinth and other			,			,			,	,			,
		invasive macrophytes			1		1	1	1		1	~	~	*	1
6	Resource development and live	lihoods													
6.1	Sustainable fisheries development	-		✓			_				1		✓	1	1
		Formation of user groups and setting up		∢							1		1	1	1
		rules and regulations							-		,				,
		Microcredit support		*					-		-		*	*	*
		development		✓							✓		✓	1	✓
		Assistance for craft and gear		✓						-	~		~	~	1
	<b>.</b>	Construction and upgradation of jetties		✓			_								
6.2	Promoting sustainable agriculture practices										~		1	1	1
		Training through KVKs on sustainable wetland agriculture practices									~		~	~	1
		Microcredit support to farmers									1		1	1	1
		Wetland agro-product based microenterprise									~		•	1	~
7	Monitoring and review														
		Monitoring		1	~		~	•	1		~	1	•	•	•
		Monitoring (Representative Sites)		✓					1			1		1	1
		Management plan mid-term review (External)		1	1		1	~	~		~	~	~	~	~

#### Ponds

Activities to meet the objectives of the pond management category are proposed under different management interventions namely; institutional set-up, wetlands delineation and demarcation, enhancing hydrological regimes, species and habitat conservation, resource development and livelihoods and monitoring and review (Table 20).

#### Institutional set-up

- Formation of a multi-stakeholder forum as a wetlands-mitra network is proposed as an effective arrangement for cross-sectoral coordination and multi-stakeholder engagement in wetlands management. Specifically, the network shall:
  - Support implementation of various management activities on ground.
  - Promote awareness on wetland values and functions within community stakeholders.
  - Articulate community views and suggestions on various management interventions.
  - Support adoption of alternative and new knowledges/skills/technologies aimed at reducing livelihood vulnerabilities and advancing wise use of wetlands.
- Systematic wetland inventory, assessment and monitoring system is proposed to be established to address the overall information needs of wetland management and support decision making and management.
- To support integrated management of wetlands capacity building of stakeholders needs to be enhanced through professional training workshops on:
  - Integrated wetlands management
  - Wetlands inventory assessment and monitoring
  - Land use planning for multiple wetlands use
  - Wetlands and climate change mitigation and adaptation
  - o Integrating wetlands wise use in developmental planning
- The site-management plan is to be prepared by the concerned Divisional Forest Officer. After being endorsed by the PCCF-Wildlife (Principal Chief Conservator of Forests-Wildlife), it is subsequently approved by the SWA.
- Signage indicating the wetland as a Ramsar Site, an Important Bird Area or a Biodiversity Hotspot is proposed to be placed at all major entry points of the wetlands complex.
- Workshops and public events are proposed to be organized on the eve of World Wetlands Day (Feb 2), World Environment Day (June 5) and International Day for Biological Diversity (May 22) as a means of reaching out to public on the issues of wetland conservation and wise use.
- Public events on specific issues, as pollution control or water management are also proposed to be organized as a means of engaging with stakeholders.
- Development of resource material on the wetland including posters, brochures, pamphlets, films and education kits and Publication of newsletter.

#### Wetlands delineation and demarcation

#### Wetlands demarcation

It is proposed to demarcate wetland boundary by placing geo-tagged pillars all along the wetland periphery. Demarcation will be done using geo-tagged boundary pillars. Pillars will be placed at an interval of approximately 100 m or as the case may be. Approval of the demarcated boundary of the wetland will be obtained from the State Wetlands Authority.

Activities to be carried out are as follows:

- Completion of field reconnaissance survey wherein detailed mapping of wetland extent using Remote Sensing and GIS and ground truthing will be undertaken.
- Removal of encroachments.
- Placement of geo-tagged pillars. These will be concrete cemented pillars.

# Creation of vegetative buffers

Afforestation activities to be promoted to arrest soil erosion. Indigenous soil binding plant species to be planted in consultation with local communities through PRA exercise. For raising plantations and maintenance following activities are proposed:

- Nursery raising through community organizations.
- Preparatory works, including deweeding and making pits for plantation.
- Plantation of saplings into the prepared pits.
- Protection measures (including watch and ward) from fire, cattle etc.
- The plantation shall be maintained for three years after creation, and handed over to the respective village committee for operation as per the approved Forest Working Plan.

## Enhancing hydrological regimes

Clearing inlets and outlets

• Identification and cleaning and maintenance of inlets and outlets to identify flow impediments.

Selective desilting

• Selective desilting of highly silted up wetlands areas to enhance their water holding capacity and overall wetland water regime stability.

# Pollution abatement

Village ponds are the ultimate recipients of untreated sewage and sewerage from the settlements which dot its periphery. Also, intensification of agriculture in adjoining areas has led to increased use of fertilizers and pesticides. Coupled with changes in circulation and mixing pattern, excessive loading of nutrients has promoted growth of macrophytic vegetation. Activities for pollution abatement are as follows:

- Survey of wastewater nallahs that are clogging the channels and increasing waterlogging.
- Manual scouring of scum and other waste material. The waste-collectors will form an integral part of the solid waste management system.
- Applying of in-situ inflowing nallah treatment for efficient control of sewage quantity and quality received within the wetland.
- Relocation of dumping sites. The wetlands may be designated a zero-waste zone. A management framework for this purpose, including components on regulation and behaviour change may be drawn up, in consultation with stakeholders. Screens/mesh are proposed to be placed at all inlets to prevent transport of solid-waste/plastic in the canal system of the wetland.

#### Species and habitat conservation

Creation and maintenance of People's Biodiversity Registers

- With support from the State Biodiversity Board (SBB), People's Biodiversity Registers are created at the local level under the guidance of the Biodiversity Management Committee (BMC).
- For creating the Peoples' Biodiversity Register, training by experts should be conducted to prepare document which contains comprehensive information on the landscape, demography of the village and locally available bio-resources. To prepare species inventories training by wildlife experts should be conducted on habitat mapping and identification of local flora and fauna.
- Training on Asian Waterbird Census (AWC) must be conducted annually during winter season. This is a must for wetlands that are known to be frequented by migratory waterbirds of the central Asian flyway.

Habitat mapping and surveillance

- Identification of potential areas for restoration and improvement as waterbird habitats.
- Maintenance of different forms of waterbird habitats based on inventorisation and habitat mapping:
  - Open water areas as feeding areas for diving species, such as pochards, grebes and coots, and as open roosting areas for other flocking waterbird species.
  - Reed beds and channels for migratory ducks and geese.
  - Reed beds and open marsh vegetation for nesting species.
  - Trees along wetland edge for tree nesting species.
  - Patches of wet grasslands and open grounds for grazing ducks, geese, and shorebirds.
- Community sensitization and formation of bird protection committees to monitor waterbird habitats and to control any human disturbance. Incentives in the form of recognition and training as bird guides could be provided to the committee members.
- In areas important for reed nesting bird species, grazing and harvesting of macrophytes need to be completely banned during breeding season.
- For areas of tree nesting bird species, cutting of trees and tall bushes along the periphery of the wetland to be banned.

Management of invasive species

- Growth of invasive macrophytes to be managed by either manual or mechanical removal of thick stands of emergent vegetation like Phragmites karka, Ipomoea aquatica, Eichhornia crassipes etc. to improve hydrological connectivity, check eutrophication and increase fish breeding areas.
- Control of invasive macrophytes such as Water Hyacinth can also be done through meshing of inlets.

### Resource development and livelihoods

Sustainable fisheries development

- Regulating use of banned fishing gears like use of mosquito nets for harvesting of fish. Gears of mesh size 4cm or above ought to be promoted. This must be enforced on an urgent basis as panchayat owned ponds that forms a common property resource frequently witness such kind of activities.
- Controlling harvesting of fingerlings.
- Controlling introduction of exotic species by measures such as selective netting.

# Water Hyacinth-based enterprise

Promoting alternate/additional livelihood options based on value addition to existing resources e.g., develop a community led handicrafts enterprise based on macrophytic vegetation such as Water Hyacinth. Other micro-enterprises to reduce pressure on wetland resources such as apiculture may also be promoted.

# Multi-purpose shelter

Strengthening community managed disaster risk reduction capability in the villages through promoting contingency planning and community risk reduction interventions such as construction of flood shelters, fuel bank and grain bank.

Construction of approach roads as a comprehensive coverage of facilities to the villages. Other incentives particularly focusing on marginalised communities (fisher) include provisioning of safe drinking water supply, sanitation and health facilities, and community toilets.

# Monitoring and review

A mid-term review of management plan implementation is proposed to assess the extent to which stipulated objectives have been achieved with a high degree of resource efficiency and in participation with stakeholders. An external committee on wetlands is proposed to be formed by the SWA to carry out the evaluation, specifically looking at the following elements:

- Degree to which wetland ecological character is being maintained as a result of management being applied
- Implementation quality, timeliness, and resourcing of activities
- Quality and comprehensiveness of wetlands monitoring
- Effectiveness of management being applied, in terms of design, activities, outcomes and impacts
- Quality of stakeholder engagement in implementation of various activities and discharging wetland management functions
- Changes in external environment requiring adaptation in management plan.

Mana	gement Category - Ponds	_												
	Wetlands		Ballia	Jharkatha Tal	Корwa	Mithwar	Sarak	Chandauli	Urwa	Ghazipur	Chunni Taal	Dhari Dheeh	Khanpur	Seorai
I	Institutional Set-up	<u>.</u>						_						
		Constitution of wetland mitra network		✓	√	1	1		∢		1	1	1	1
		Training and orientation on wetland												
		management		v	Ý	Ÿ	*		*		v	v	Y	¥
		Issue-specific training		✓	✓	1	1		✓		1	1	1	✓
		Finalisation and endorsement of site-		1	1	1	1		1		1	1	1	~
		management plan												
		Signage		✓	✓	✓	✓		✓		✓	✓	✓	✓
		Outreach programmes		~	1	1	1		✓		-	✓	1	~
2	Wotlands delineation & domar	ration												
21	Wethed demarcation	Cation												
2.1	Wetland demarcation													_
		Placement of geo-tagged boundary pillars		1	1	1	1		1		1	1	1	~
		Removal of encroachments		1	1	1	1		1		1	1	1	1
2.2	Creation of vegetative buffers				-	-								
		Plantation of native species		1	1	1	1		1		1	1	1	✓
		Maintenance		∢	1	1	1		1		1	1	1	~
3	Enhancing hydrological regime	S												
3.1	Clearing inlets and outlets				1	1								1
3.2	Selective desilting			1	1	1	1		✓		✓	1	1	~
4	Pollution abatement													
		Survey of wastewater nallahs		✓	1	1	1				1	1	1	~
		Manual scouring of scum and other		✓	1	1	1				1	1	1	~
		waste materials		_										
		Polocation of dumping sitos		•	*	*	¥ ./				<b>*</b>	v	¥ ./	*
		Relocation of dumping sites					*						¥	
5	Species and habitat conservati	on												
-	Creation and Maintenance of													
5.1	People's Biodiversity Registers													
	. , ,	Training		✓	1	1	1		✓		1	1	1	~
		Creation of People's Biodiversity Registers	5	✓	1	1	1		∢		1	1	1	~
5.2	Habitat mapping and surveillance													
		Mapping of key habitat areas												
		Formation of community groups to												
		monitor habitats												
		Community sensitization												
	M	Surveillance and reporting												
5.3	Mangement of invasive species	Demond of united by sinch and ashee												
		Removal of water nyacinth and other		✓	1	1	1				1	1	1	~
6	Resource development and live	elihoods												
		Sustainable fisheries development				1			✓					
		Water hyacinth-based enterprise		✓	1	1	1				1	1	1	✓
		Multi-purpose shelter		✓	1	1	1		✓		1	1	1	✓
		Construction of approach roads		✓	1	1	1		✓		1	1	1	1
7	Monitoring and review													
		Monitoring		1	1	1	1		1		1	1	1	1
		Monitoring (Representative Sites)				1								
		Management plan mid-term review		1	1	1	1		1		1	1	1	1
		(External)												

Table 20: Proposed phase-wise activities under the management category – Ponds category

### Urban and Peri-Urban Wetlands

Activities to meet the objectives of the urban and peri-urban wetlands management category are proposed under different management interventions namely; institutional set-up, wetlands delineation and demarcation, enhancing hydrological regimes, pollution abatement, species and habitat conservation and wetlands education and interpretation (Table 21).

Institutional set-up

- Formation of a multi-stakeholder forum as a wetlands-mitra network is proposed as an effective arrangement for cross-sectoral coordination and multi-stakeholder engagement in wetlands management. Specifically, the network shall:
  - Support implementation of various management activities on ground.
  - Promote awareness on wetland values and functions within community stakeholders.
  - Articulate community views and suggestions on various management interventions.
  - Support adoption of alternative and new knowledges/skills/technologies aimed at reducing livelihood vulnerabilities and advancing wise use of wetlands.
- Systematic wetlands inventory, assessment and monitoring system is proposed to be established to address the overall information needs of wetland management and support decision making and management.
- To support integrated management of wetlands capacity building of stakeholders needs to be enhanced through professional training workshops on:
  - Integrated wetlands management
  - Wetlands inventory assessment and monitoring
  - Land use planning for multiple wetlands use
  - Wetlands and climate change mitigation and adaptation
  - o Integrating wetlands wise use in developmental planning
- The site-management plan is to be prepared by the concerned Divisional Forest Officer. After being endorsed by the PCCF-Wildlife (Principal Chief Conservator of Forests-Wildlife), it is subsequently approved by the SWA.
- Signage indicating the wetland as a Ramsar Site, an Important Bird Area or a Biodiversity Hotspot is proposed to be placed at all major entry points of the wetlands complex.
- Workshops and public events are proposed to be organized on the eve of World Wetlands Day (Feb 2), World Environment Day (June 5) and International Day for Biological Diversity (May 22) as a means of reaching out to public on the issues of wetland conservation and wise use.
- Public events on specific issues, as pollution control or water management are also proposed to be organized as a means of engaging with stakeholders.
- Development of resource material on the wetland including posters, brochures, pamphlets, films and education kits and Publication of newsletter.

### Wetlands delineation and demarcation

#### Wetlands demarcation

It is proposed to demarcate wetland boundary by placing geo-tagged pillars all along the wetland periphery. Demarcation will be done using geo-tagged boundary pillars. Pillars will be placed at an interval of approximately 100 m or as the case may be. Approval of the demarcated boundary of the wetland will be obtained from the State Wetlands Authority. Activities to be carried out are as follows:

- Completion of field reconnaissance survey. Wherein detailed mapping of wetland extent using Remote Sensing and GIS and ground truthing will be undertaken.
- Removal of encroachments.
- Placement of geo-tagged pillars. These will be concrete cemented pillars.

## Creation of vegetative buffers

Afforestation activities to be promoted to arrest soil erosion. Indigenous soil binding plant species to be planted in consultation with local communities through PRA exercise. For raising plantations and maintenance following activities are proposed:

- Nursery raising through community organizations.
- Preparatory works, including deweeding and making pits for plantation.
- Plantation of saplings into the prepared pits.
- Protection measures (including watch and ward) from fire, cattle etc.
- The plantation shall be maintained for three years after creation, and handed over to the respective village committee for operation as per the approved Forest Working Plan.

### Enhancing hydrological regimes

### Clearing of inlets and outlets

• Identification and cleaning and maintenance of inlets and outlets to identify flow impediments.

### Selective desilting

• Selective desilting of highly silted up wetlands areas to enhance their water holding capacity and overall wetland water regime stability.

### Pollution abatement

Village ponds are the ultimate recipients of untreated sewage and sewerage from the settlements which dot its periphery. Also, intensification of agriculture in adjoining areas has led to increased use of fertilizers and pesticides. Coupled with changes in circulation and mixing pattern, excessive loading of nutrients has promoted growth of macrophytic vegetation. Activities for pollution abatement are as follows:

- Survey of wastewater nallahs that are clogging the channels and increasing waterlogging.
- Manual scouring of scum and other waste material. The waste-collectors will form an integral part of the solid waste management system.
- Applying of in-situ inflowing nallah treatment for efficient control of sewage quantity and quality received within the wetland.

- Construction of sand gravel-beds for inflow filtration.
- Establishment of floating treatment wetlands.
- Relocation of dumping sites. The wetlands may be designated a zero-waste zone. A
  management framework for this purpose, including components on regulation and
  behaviour change may be drawn up, in consultation with stakeholders.
  Screens/mesh are proposed to be placed at all inlets to prevent transport of solidwaste/plastic in the canal system of the wetland.

#### Species and habitat conservation

Creation and maintenance of People's Biodiversity Registers

- With support from the State Biodiversity Board (SBB), People's Biodiversity Registers are created at the local level under the guidance of the Biodiversity Management Committee (BMC).
- For creating the Peoples' Biodiversity Register, training by experts should be conducted to prepare document which contains comprehensive information on the landscape, demography of the village and locally available bio-resources. To prepare species inventories training by wildlife experts should be conducted on habitat mapping and identification of local flora and fauna.
- Training on Asian Waterbird Census (AWC) must be conducted annually during winter season. This is a must for wetlands that are known to be frequented by migratory waterbirds of the central Asian flyway.

Habitat mapping and surveillance

- Identification of potential areas for restoration and improvement as waterbird habitats.
- Maintenance of different forms of waterbird habitats based on inventorisation and habitat mapping:
  - Open water areas as feeding areas for diving species, such as pochards, grebes and coots, and as open roosting areas for other flocking waterbird species.
  - Reed beds and channels for migratory ducks and geese.
  - Reed beds and open marsh vegetation for nesting species.
  - Trees along wetland edge for tree nesting species.
  - Patches of wet grasslands and open grounds for grazing ducks, geese and shorebirds.
- Community sensitization and formation of bird protection committees to monitor waterbird habitats and to control any human disturbance. Incentives in the form of recognition and training as bird guides could be provided to the committee members.
- In areas important for reed nesting bird species, grazing and harvesting of macrophytes need to be completely banned during breeding season.
- For areas of tree nesting bird species, cutting of trees and tall bushes along the periphery of the wetland to be banned.

Management of invasive species

- Growth of invasive macrophytes to be managed by either manual or mechanical removal of thick stands of emergent vegetation like Phragmites karka, Ipomoea aquatica, Eichhornia crassipes etc. to improve hydrological connectivity, check eutrophication and increase fish breeding areas.
- Control of invasive macrophytes such as Water Hyacinth can also be done through meshing of inlets.

#### Wetlands education and interpretation

#### Interpretation infrastructure

A wetlands interpretation centre is proposed to be constructed. Following facilities are proposed to be developed in the interpretation complex: Exhibits including posters, models, flying patterns hanging from ceiling, wetland birds interactive panel and ecosystem food chain, viewing gallery comprising panels highlighting the ecological, socioeconomic and cultural aspects. Desks fitted with adequate displays, bird identifications books. Children's Play area consisting of open dioramas and floorings with underwater paintings should be developed as a special section to cater to the young visitors. The area should have several innovative environment-oriented games and interactive food chain, fish trap games, jigsaw puzzles etc. Auditorium having audio-visual facilities for screening documentaries and arranging talks/workshops/meetings. Children's Play area consisting of open dioramas and floorings with underwater paintings and interactive food chain, fish trap games, jigsaw puzzles etc. Auditorium having should be developed as a special section to cater to the young visitors. The area should have several innovative environment-oriented games and interactive food chain, fish trap games, and floorings with underwater paintings should be developed as a special section to cater to the young visitors. The area should have several innovative environment-oriented games and interactive food chain, fish trap games, jigsaw puzzles.

#### Construction of watch towers

Watchtowers may be constructed at vantage points. They should be equipped with binocular and telescope facilities for better viewing.

### Establishment of walking trails

Walking trails around the wetlands should be established to enable visitors to have a better view of the landscape.

### Monitoring and review

A mid-term review of management plan implementation is proposed to assess the extent to which stipulated objectives have been achieved with a high degree of resource efficiency and in participation with stakeholders. An external committee on wetlands is proposed to be formed by the SWA to carry out the evaluation, specifically looking at the following elements:

- Degree to which wetland ecological character is being maintained as a result of management being applied.
- Implementation quality, timeliness and resourcing of activities.
- Quality and comprehensiveness of wetlands monitoring.
- Effectiveness of management being applied, in terms of design, activities, outcomes and impacts.
- Quality of stakeholder engagement in implementation of various activities and discharging wetland management functions
- Changes in external environment requiring adaptation in management plan.

Table 21: Proposed phase-wise activities under the management category – Urban and Peri-Urban wetlands

	Wetlands		Chandauli	Saresar	Bhogwar	Nasirpur pattan	Godhana	Dhanapur	Ghazipur	Amarupur	Kanuwan	Taraw	Ballia	New Baheri	hra Newari Dadri Mela Ground Nala/Bhagad
	Institutional Set-up														Nich
		Constitution of wetland mitra network		<b>`</b>	1	1	1	1		1	~	<u>~</u>		<b>.</b>	
		Training and orientation on wetland		•	•	•	•			•	-	· •		•	
				•	•	•	•	•		•	· ~	•		•	
		Finalisation and endorsement of site-		•	•	•	•	•		•	-	•		•	
		management plan		✓	1	1	1	1		~	1	1		✓	۷
		Signage		√	1	1	1	1		✓	1	1		1	v
		Outreach programmes		√	1	1	1	1		✓	1	1		1	,
2	Wetlands delineation & dema	rcation													
2.1	Wetland demarcation														
		Placement of geo-tagged boundary pillars		✓	1	1	1	1		✓	1	✓		✓	٧
		Removal of encroachments		✓	✓	1	1	1		✓	1	1		✓	۷
2.2	Creation of vegetative buffers														
		Plantation of native species		✓	1	1	1	1				1			٧
		Maintenance		✓	1	1	1	1				1			٧
2	Enhancing hydrological regim	85													
3.1	Clearing of inlets and outlets					✓		1							
3.2	Selective desilting			✓	1	1	1	1		✓	1	1		✓	1
	U														
4	Pollution abatement														
		Survey of wastewater nallahs		∢	1	1	1			✓	✓	1		✓	٧
		Manual scouring of scum and other									1	1			
		waste materials		•	*	•	*			*	•	•		•	'
		Installation of waste sieves at inlets		1	1	1	✓			1	1	1		✓	1
		Construction of sand gravel-beds for		✓	1	1	✓			✓	1	1		✓	۱
		wetlands		1	1	1	1					1			۱
		Relocation of dumping sites								✓	1	1		1	
	Constant of the bits of the second														
5	Creation and Maintenance of														
5.I	People's Biodiversity Registers														
		Training		1	1	1	1	1		✓	1	1		1	•
		Creation of People's Biodiversity Register	s	✓	1	1	1	1		✓	· •	· •		1	,
		Asian Waterbird Census		✓	1	1	1	, ,		✓	· •	•		· •	•
					-		-	Ľ.			-	-		-	-
5.2	Mangement of invasive species														
5.2	Mangement of invasive species	Removal of water hyacinth and other									_	_			

Management Cate	gory - Urban and P	eri-Urban wetlands														
Wetlands			Chandauli	Saresar	Bhogwar	Nasirpur pattan	Godhana	Dhanapur	Ghazipur	Amarupur	Kanuwan	Taraw	Ballia	New Baheri	Mishra Newari Dadri Mela Ground Nala/Bhagad	Quazipura (Railway Yard Land)
6 Wetland edu	ucation and interpre	etation														
				∢	1	1	1	1		✓	✓	1		✓	✓	✓
		Watch Towers		√	1	1	1	1				✓			✓	
		Walking Trails		1	1	1	1	•				1			1	
7 Monitoring a	and Review															
		Monitoring		∢	1	1	1	∢		∢	1	1		1	✓	1
		Monitoring (Representative Sites)		1		1		1				1			1	
		Managemnet Plan Mid term reiew		∢	1	1	1	1		✓	✓	1		√	✓	✓

#### Wetlands within Protected Area

Activities to meet the objectives of the wetlands within protected area management category are proposed under different management interventions namely; institutional set-up, enhancing of hydrological regimes, species and habitat conservation, sustainable tourism development and monitoring and review (Table 22).

Institutional set-up

- Formation of a multi-stakeholder forum as a wetlands-mitra network is proposed as an effective arrangement for cross-sectoral coordination and multi-stakeholder engagement in wetlands management. Specifically, the network shall:
  - o Support implementation of various management activities on ground
  - Promote awareness on wetland values and functions within community stakeholders
  - Articulate community views and suggestions on various management interventions
  - Support adoption of alternative and new knowledges/skills/technologies aimed at reducing livelihood vulnerabilities and advancing wise use of wetlands
- Systematic wetland inventory, assessment and monitoring system is proposed to be established to address the overall information needs of wetland management and support decision making and management.
- To support integrated management of wetlands capacity building of stakeholders needs to be enhanced through professional training workshops on:
  - o Integrated wetlands management
  - Wetlands inventory assessment and monitoring
  - Land use planning for multiple wetlands use

- Wetlands and climate change mitigation and adaptation
- o Integrating wetlands wise use in developmental planning
- The site-management plan is to be prepared by the concerned Divisional Forest Officer. After being endorsed by the PCCF-Wildlife (Principal Chief Conservator of Forests-Wildlife), it is subsequently approved by the SWA.
- Signage indicating the wetland as a Ramsar Site, an Important Bird Area or a Biodiversity Hotspot is proposed to be placed at all major entry points of the wetlands complex.
- Workshops and public events are proposed to be organized on the eve of World Wetlands Day (Feb 2), World Environment Day (June 5) and International Day for Biological Diversity (May 22) as a means of reaching out to public on the issues of wetland conservation and wise use.
- Public events on specific issues, as pollution control or water management are also proposed to be organized as a means of engaging with stakeholders.
- Development of resource material on the wetland including posters, brochures, pamphlets, films and education kits and Publication of newsletter.

## Enhancing hydrological regimes

Clearing and maintenance of inlets and outlets

• Identification and cleaning and maintenance of inlets and outlets to identify flow impediments.

## Selective desilting

• Selective desilting of highly silted up wetlands areas to enhance their water holding capacity and overall wetland water regime stability.

### Species and habitat conservation

Species inventory and population count

- Training by wildlife experts on habitat mapping and inventorisation of wetland species along with an assessment of preferred habitat zones of key wetland species.
- Augmenting surveillance infrastructure including construction of watch towers, procurement of equipment for bird watching and mobile vans and boats for patrolling.
- Training on Asian Waterbird Census (AWC) must be conducted annually during winter season. This is a must for wetlands that are known to be frequented by migratory waterbirds of the central Asian flyway.
- Knowledge of the health of resident and migratory species that inhabit the wetlands is critical to understanding the risk and potential of transmission of avian diseases to other birds and animals, domestic poultry, and people. Specific studies need to be undertaken to establish a baseline of the common and potentially harmful zoonotic diseases.

Management of invasive species

- Growth of invasive macrophytes to be managed by either manual or mechanical removal of thick stands of emergent vegetation like Phragmites karka, Ipomoea aquatica, Eichhornia crassipes etc. to improve hydrological connectivity, check eutrophication and increase fish breeding areas.
- Control of invasive macrophytes such as Water Hyacinth can also be done through meshing of inlets.

### Sustainable tourism development

- A wetlands interpretation centre is proposed to be constructed. Following facilities are proposed to be developed in the interpretation complex: Exhibits including posters, models, flying patterns hanging from ceiling, wetland birds interactive panel and ecosystem food chain, viewing gallery comprising panels highlighting the ecological, socioeconomic and cultural aspects. Desks fitted with adequate displays, bird identifications books. Children's Play area consisting of open dioramas and floorings with underwater paintings should be developed as a special section to cater to the young visitors. The area should have several innovative environment-oriented games and interactive food chain, fish trap games, jigsaw puzzles etc. Auditorium having audio-visual facilities for screening documentaries and arranging talks/workshops/meetings. Children's Play area consisting of open dioramas and floorings with underwater paintings should be developed as a special section to cater to the young visitors. The area should have several innovative environment-oriented games and interactive food chain, fish trap games, jigsaw puzzles.
- To enable visitors to have a better view of the landscape boardwalks around the wetlands should be constructed. Wooden benches may also be established to provide sitting/resting facilities.
- Watchtowers may be constructed at vantage points. They should be equipped with binocular and telescope facilities for better viewing.

### Monitoring and review

A mid-term review of management plan implementation is proposed to assess the extent to which stipulated objectives have been achieved with a high degree of resource efficiency and in participation with stakeholders. An external committee on wetlands is proposed to be formed by the SWA to carry out the evaluation, specifically looking at the following elements:

- Degree to which wetland ecological character is being maintained as a result of management being applied
- Implementation quality, timeliness and resourcing of activities
- Quality and comprehensiveness of wetlands monitoring
- Effectiveness of management being applied, in terms of design, activities, outcomes and impacts
- Quality of stakeholder engagement in implementation of various activities and discharging wetland management functions
- Changes in external environment requiring adaptation in management plan.

Table 22: Proposed phase-wise activities under the management category – Wetlands within Protected Area category

nage	ement category - Wetlands within Pr	rotected Areas		_	
	Wetlands		Ballia	Kawleshwar Tal	
1	Institutional Set-up				
	-	vvorksnops for constitution of wetland mitra		√	
		Training and orientation workshop on wetland		1	
		Issue-specific training workshops		1	
		rinalisation and endorsement or site-management		1	1
		Signages (Publication and Installation)		1	
		brochures)		√	
2	Enhancing hydrological regimes				
2.1	outlets			✓	
2.2	Selective desilting			✓	
3	Species and habitat conservation				
3.1	Species inventory and population count			1	
		Training		✓	
		Periodic updation		1	
		Conduct species survey - Asian Waterbird Census		✓	
		Zoonotic disease surveillance		√	
3.2	Management of invasive species	removal of water hyacinut and other invasive		√	
		macrophytes			
4	Sustainable tourism development				
		Interpreptation Infrastructure		√	
		Boardwalks		✓	
		Watch Towers		✓	
5	Monitoring and review				
		Management plan mid-term review (External)		1	
					t

# 8 Budget and Financing

#### **Budget**

Management plan implementation will entail a budget of ₹ 42.03 crores. Of this, the budget allocated for the sub-basin level actions is ₹ 16.7 crores (39.73%) and that for the site level actions is about ₹ 25.33 crores (60.26%). Out of the total budget, the activities proposed under phase 1 will require ₹ 14.24 crores, phase 2 will require about ₹ 5.59 crores and phase 3 will require ₹ 5.49 crores (Table 23).

### Financing

The management plan may be financed under the National Mission of Clean Ganga (NMCG) under the relevant scheme guidelines. Conservation of village ponds may be financed under Amrut Sarovar Scheme. For wetlands within the protected area network, it is recommended that the management interventions and actions are linked with protected area plan implementation. Additional sources of funds may be sourced from National Plan for Conservation of Aquatic systems (wherein 40% State funds will have to be provided as State share).

Table 23: Summarised budget for management plan implementation at the sub-basin and site levels

	Number of Wetlands	Total Amount	Phase 1	Phase 2	Phase 3
Sub-basin level actions		16,70,00,000			
Wetland level actions					
Wetlands within Protected areas	2	11,20,24,635	10,82,23,250	-	38,01,385
Urban and Peri-urban wetlands	11	4,93,78,621	1,10,65,872	2,04,77,214	1,78,35,535
Flood plain agricultural wetlands	10	6,08,96,607	2,31,21,258	2,55,30,999	1,22,44,350
Ponds	9	3,10,29,116	-	99,62,601	2,10,66,515
Total	32	42,03,28,979	14,24,10,380	5,59,70,814	5,49,47,785

Detail activity wise budget plan for the sub-basin level (Table 24) and site level indicating all four management categories viz., wetland within protected areas (Table 25), urban and peri-urban wetlands (Table 26), floodplain agricultural wetlands (Table 27) and ponds (Table 28) are as follows:

## Table 24: Detailed activity wise budget for sub-basin level activities

	Wetlands	Rate	Unit	Physical	Amount	Year I		Year 2		Year 3		Year 4		Year 5	
						Physical	Financial	Physical	Financial	Physical	Financial	Physical	Financial	Physical	Financial
1	Institutional Set-up				1,80,00,000		36,00,000		36,00,000		36,00,000		36,00,000		36,00,000
1.1	Notification of wetlands under	To be done													
	Wetland Rules	departmentally													
1.2	committees	departmentally													
	Infrastructure development-	75 000	Per person per				24 00 000		24 00 000		24 00 000		24 00 000		24 00 000
1.3	human resources	75,000	month	20		4	36,00,000	4	36,00,000	4	36,00,000	4	36,00,000	4	36,00,000
	Integrated workand														
2	inventory assessment and				10,89,00,000		5,25,00,000		5,16,00,000		16,00,000		16,00,000		16,00,000
2.1	Establishment of wetland monitoring and research center						5,00,00,000		5,00,00,000						
2.2	Development of database						10.00.000		1.00.000		1.00.000		1.00.000		1.00.000
2.2	management system						10,00,000		1,00,000		1,00,000		1,00,000		1,00,000
2.3	Wetland monitoring						10,00,000		10,00,000		10,00,000		10,00,000		10,00,000
2.4	Ecosystem health report						5,00,000		5,00,000		5,00,000		5,00,000		5,00,000
3	Research Studies				2,50,00,000		60,00,000		1,30,00,000		60,00,000		-		-
3.1	Climate Risk Assessment						30,00,000		20,00,000						
3.2	Hydrological connectivity						30,00,000		20,00,000						
	Inventorization of wetlands								30.00.000		20.00.000				
3.2	biodiversity								30,00,000		20,00,000				
3.3	Socio-cultural inventory of Multiple wetland values								30,00,000		20,00,000				
5.1									50,00,000		20,00,000				
4	Capacity development				62,00,000		20,00,000		8,00,000		13,00,000		8,00,000		13,00,000
4.1	Training needs assessment						15,00,000				-				
4.2	Development of training plan	E 00.000	Por worksha				5,00,000		F 00 000		-		E 00.000		E 00.000
4.3	Capacity development Post-training handholding support	5,00,000 t	r er worksnop	4				I	3.00.000	1	3.00.000	I	3.00.000	1	3.00.000
4.5	Effectiveness assessment	-							.,,		5,00,000				5,00,000
5	Communication and outreac	h			69,00,000		20,00,000		11,00,000		16,00,000		11,00,000		11,00,000
5.1	Webpage				18,00,000		10,00,000		2,00,000		2,00,000		2,00,000		2,00,000
5.2	Resource material	2,50,000	Per publication	4	10,00,000	2	5,00,000			2	5,00,000				
5.3	Newsletter	1,00,000	Per issue	5	5,00,000	1	1,00,000	1	1,00,000	1	1,00,000	1	1,00,000	1	1,00,000
5.4	wworkshop and public events	4,00,000	Per event	9	36,00,000	1	4,00,000	2	8,00,000	2	8,00,000	2	8,00,000	2	8,00,000
6	Management implementation	and review			20,00.000						10,00,000				10,00,000
6.1	Mid-term review										10,00,000				
6.2	Annual learning events										-				10,00,000
					14 70 00 000		6 61 00 000		7 01 00 000				71.00.000		84.00.000
					16,70,00,000		6,61,00,000		7,01,00,000		1,51,00,000		71,00,000		86,00,000

# Table 25: Detailed activity wise budget for wetland level activities in wetlands within protected areas

a (ha)					Physical	Phase 1 Amount	Phase 2 Physical	Amount	Phase 3 Physical	Phase 3 Amount	Total Amount
cumferance )											
ofinlets											
of outlets											
ked inlets											
ked outlets											
imentation											
ution as threat											
d-waste nping											
a covered by er hyacinth											
ting Fishery											
sing											
itutional Set-up						89,00,000.00				14,00,000.00	1,03,00,000.00
	Workshops for constitution of wetland mitra network	100000	Per Workshop	13.00	12.00	12,00,000.00			1.00	1,00,000.00	13,00,000.00
	Training and orientation workshop on wetland management	100000	Per Workshop	6.00	5.00	5,00,000.00			1.00	1,00,000.00	6,00,000.00
	Issue-specific training workshops	100000	Per Workshop	8.00	5.00	5,00,000.00			3.00	3,00,000.00	8,00,000.00
	Finalisation and endorsement of site- management plan	Lumpsum	Per Wetland			25,00,000.00				2,00,000.00	27,00,000.00
	Signages (Publication and Installation)	Lumpsum	Per Wetland			7,00,000.00				2,00,000.00	9,00,000.00
	Outreach programmes (Publication of field/event brochures)	Lumpsum	Per Wetland			35,00,000.00				5,00,000.00	40,00,000.00
	of inlets of outlets (ed inlets (ed outlets mentation ution as threat d-waste ping covered by er hyacinth ting Fishery sing tutional Set-up	of inlets         of outlets         eed inlets         eed outlets         mentation         ution as threat         j-waste         j-waste         ping         covered by         r hyacinth         ting Fishery         sing         tutional Set-up         Workshops for constitution         of wetland mitra network         Training and orientation         workshop on wetland         management         Issue-specific training         workshops         Finalisation and         endorsement of site-         management plan         Signages (Publication and         Installation)         Outreach programmes         (Publication of field/event         brochures)	Spinlets       Spinlets         Spinlets       Spinlets         eed outlets       Spinlets         inlets       Spinlets         ution as threat       Spinlets         J-waste       Spinlets         ging       Spinlets         covered by       Spinlets         rhyacinth       Spinlets         tutional Set-up       Spinlets         spinlets       Spinlets         tutional Set-up       Spinlets         spinlets       Spinlets         spinlets       Spinlets         spinlets       Spinlets         spinlets       Spinlets         Signages (Publication and Installat	of inlets       inlets         of outlets       inlets         ied inlets       inlets         ied outlets       inlets         ising       inletsion         isin	of inlets       inlets       inlets         of outlets       inlets       inlets         ied inlets       inlets       inlets         ied outlets       inlets       inlets         ising       inlets       inlets         ising       inlets       inlets         vorkshops for constitution of wetland mitra network       100000         ising       inlets       inlets         Vorkshops on wetland mitra network       100000       Per Workshop         ising       inlotentation workshop on wetland not intaning workshops       100000       Per Workshop         ising       inlotentation       inlotentation       inlotentation         workshops       inlotentation       inlotentation       inlotentation         isingeres (Publication and installation)	SectorSectorSectorSectorSectorof inletsImage and the sectorImage and the sectorImage and the sectorImage and the sectorinletsImage and the sectorImage and the sectorImage and the sectorImage and the sectorinletsImage and the sectorImage and the sectorImage and the sectorImage and the sectorinletsImage and the sectorImage and the sectorImage and the sectorImage and the sectorinletsImage and the sectorImage and the sectorImage and the sectorImage and the sectorinletsImage and the sectorImage and the sectorImage and the sectorImage and the sectorinletsImage and the sectorImage and the sectorImage and the sectorImage and the sectorinletsImage and the sectorImage and the sectorImage and the sectorImage and the sectorinletsImage and the sectorImage and the sectorImage and the sectorImage and the sectorinletsImage and the sectorImage and the sectorImage and the sectorImage and the sectorinletsImage and the sectorImage and the sectorImage and the sectorImage and the sectorinletsImage and the sectorImage and the sectorImage and the sectorImage and the sectorinletsImage and the sectorImage and the sectorImage and the sectorImage and the sectorinletsImage and the sectorImage and the sectorImage and the sectorImage and the sector<	findetsImage and the set of th	Initial contentInterfaceInterfaceInterfaceInterfaceInterfacefinitesInterfaceInterfaceInterfaceInterfaceInterfaceInterfaceInterfaceindustsInterfaceInterfaceInterfaceInterfaceInterfaceInterfaceInterfaceindustsInterfaceInterfaceInterfaceInterfaceInterfaceInterfaceInterfaceinterfaceInterfaceInterfaceInterfaceInterfaceInterfaceInterfaceinterfaceInterfaceInterfaceInterfaceInterfaceInterfaceInterfaceinterfaceInterfaceInterfaceInterfaceInterfaceInterfaceInterfaceinterfaceInterfaceInterfaceInterfaceInterfaceInterfaceInterfaceinterfaceInterfaceInterfaceInterfaceInterfaceInterfaceInterfaceinterfaceInterfaceInterfaceInterfaceInterfaceInterfaceInterfaceinterfaceInterfaceInterfaceInterfaceInterfaceInterfaceInterfaceinterfaceInterfaceInterfaceInterfaceInterfaceInterfaceInterfaceinterfaceInterfaceInterfaceInterfaceInterfaceInterfaceinterfaceInterfaceInterfaceInterfaceInterfaceInterfaceinterfaceInterfaceInterfaceInterfaceInterfaceInterfaceinterfaceInte	Index in letsImage and the set of th	Index 	Index I finitesInch I (under I finitesInch 

	Wetlands		Rate	Unit	Physical	Phase 1 Physical	Phase 1 Amount	Phase 2 Physical	Phase 2 Amount	Phase 3 Physical	Phase 3 Amount	Total Amount
2	Enhancing hydrologi	cal regimes					8,58,23,250.00		0		3,01,385.00	86124635
2.1	Clearing and maint	enance of inlets and outlets	25	Person days per inlet/outlet @ Rs 204 per person day	-	-	-	-	-	-	-	-
2.2	Selective desilting		50	Per m3	17,22,492.70	*****	8,58,23,250.00		-	6,027.70	3,01,385.00	8,61,24,635.00
5	5 Species and habitat conservation						20,00,000.00		-		5,00,000.00	25,00,000.00
5.1	Species inventory an	nd population count	Lumpsum	Per Wetland			20,00,000.00				5,00,000.00	25,00,000.00
		Training	Lumpsum	Per Wetland								
		Periodic updation	Lumpsum	Per Wetland								
		Conduct species survey - Asian Waterbird Census	Lumpsum	Per Wetland								
		Zoonotic disease surveillance	Lumpsum	Per Wetland								
5.2	5.2 Management of invasive species											
		Removal of water hyacinth and other invasive macrophytes										
6	6 Sustainable tourism development						1,10,00,000.00		-		15,00,000.00	1,25,00,000.00
		Interpreptation Infrastructure	Lumpsum	Per Wetland			80,00,000.00				10,00,000.00	90,00,000.00
		Boardwalks	Lumpsum	Per Wetland			15,00,000.00				2,50,000.00	17,50,000.00
		Watch Towers	Lumpsum	Per Wetland			15,00,000.00				2,50,000.00	17,50,000.00
7	7 Monitoring and review						5,00,000.00				1,00,000.00	6,00,000.00
		review (External)	Lumpsum	Per Wetland	600000		500000				1,00,000.00	6,00,000.00
							10 82 23 250 00				38 01 385 00	11 20 24 635 00
### Table 26: Detailed activity wise budget for wetland level activities in urban and peri-urban wetlands

Wetlands		Rate	Unit	Physical	Phase I Physical	Phase I Amount	Phase 2 Physical	Phase 2 Amount	Phase 3 Physical	Phase 3 Amount	Amount
	Area										ha
	Circumferance (m2)										
	Pollution as a threat										
	Number of inlets and outlets										
	Choked inlets										
	Choked outlets	•									
	Solid-waste dumping										
	Area covered by water hyacinth (>30%)										
	Possibility of peripheral plantation										
	Sewage into wetland projected										
	Number of rafters needed										
	Phasing										
I Institutional Set-up						1900000		4750000		3800000	10450000
	Constitution of wetland mitra network	100000	Per wetland	П	2	200000	5	500000	4	400000	1100000
	Training and orientation on wetland management	50000	Per wetland	П	2	100000	5	250000	4	200000	550000
	Issue-specific training	50000	Per wetland	11	2	100000	5	250000	4	200000	550000
	Finalisation and endorsement of site-management plan	50000	Per wetland	П	2	100000	5	250000	4	200000	550000
	Signage	200000	Per wetland	11	2	400000	5	1000000	4	800000	2200000
	Outreach programmes	500000	Per wetland	П	2	1000000	5	2500000	4	2000000	5500000

	Wetlands		Rate	Unit	Physical	Phase I Physical	Phase I Amount	Phase 2 Physical	Phase 2 Amount	Phase 3 Physical	Phase 3 Amount	Amount
2	Wetlands delineation	n & demarcation					592610		1000299		597892	2190800
2.1	Wetland demarcation	Placement of geo-tagged boundary pillars	8000	Per pillar (placed every 100 m)	156	39	312000	70	560000	47	376000	1248000
		Removal of encroachments	To be done at administrative level									
2.2	Creation of vegetative											
		Plantation of native species	100000	Per ha	7.86	2.34	233842	4	366915	2	184910	785667
		Maintenance	20000	Per ha	7.86	2.34	46768	4	73383	2	36982	157133
3	Enhancing hydrologi	cal regimes					303262		486140		283417.5	1072819.75
3.1	Clearing of inlets and outlets		204	Person days per inlet/outlet @ Rs 204 per person day	100.00	50.00	10200.00	50	10200	0	0.0	20400
3.2	Selective desilting		50	Per m3	21048.40	5861.24	293062	9519	475940.25	5668	283417.5	1052419.75
4	Pollution abatement	t					2570000		3910000		4440000	10920000
		Survey of wastewater nallahs	20000	Per impacted wetland	10.00	2.00	40000	4	80000	4	80000.0	200000
		Manual scouring of scum and oth	75000	Per impacted wetland	10.00	2.00	150000	4	300000	4	300000.0	750000
		Installation of waste sieves at inle	250000	Per impacted wetland	10.00	2.00	500000	4	1000000	4	1000000.0	2500000
		Construction of sand gravel- beds for inflow filtration	700000	Per MLD	3.00	1.00	700000	I	700000	I	700000.0	2100000
				D. D. G.			1100000	62	820000	0/	0(0000.0	2870000
		Establishment of floating treatment wetlands	10000	Per Katter	287.00	118.00	1180000	63	830000	00	860000.0	

	Wetlands		Rate	Unit	Physical	Phase I Physical	Phase I Amount	Phase 2 Physical	Phase 2 Amount	Phase 3 Physical	Phase 3 Amount	Amount
5	Species and habitat c	onservation					700000		1830775		1714226	4245001
5.1	Creation and Maintenance of People's Biodiversity Registers											
		Training	50000	Per wetland	11.00	2.00	100000	5	250000	4	200000.0	550000
		Creation of People's Biodiversity	100000	Per wetland	11.00	2.00	200000	5	500000	4	400000.0	1100000
		Asian Waterbird Census	200000	Per wetland	11.00	2.00	400000	5	1000000	4	800000.0	2200000
5.3	Mangement of invasive											
		Removal of water hyacinth and other invasive macrophytes	50000	per ha per impacted wetland	7.90	0.00	0	2	80775	6	314226.0	395001
6	Wetland education a	nd interpretation					300000		5500000		400000	12500000
			500000	Per wetland	11.00	2.00	1000000	5	2500000	4	200000.0	5500000
		Watch Towers	500000	Per tower	7.00	2.00	1000000	3	1500000	2	1000000.0	3500000
		Walking trails	500000	Per wetland	7.00	2.00	1000000	3	1500000	2	1000000.0	3500000
7	Monitoring and Revie	ew					2000000		300000		300000	8000000
		Monitoring	2,50,000	Per wetland	11.00	2.00	500000	5	1250000	4	1000000	2750000
		Monitoring (Representative Sites)	5,00,000	Per wetland	5.00	2.00	1000000	I	500000	2	1000000	2500000
		Managemnet Plan Mid term reiew (External)	2,50,000	Per wetland	11.00	2.00	500000	5	1250000	4	1000000	2750000
							11065872		20477214		17835535	49378621

	Wetlands		Rate	Unit	Physical	Phase I Physical	Phase I Amount	Phase 2 Physical	Phase 2 Amount	Phase 3 Physical	Phase 3 Amount	Amount
		Area										ha
		Circumferance										m2
		No. of inlets and outlets										
		Choked inlets										
		Choked outlets										
		Pollution as a threat										
		Solid-waste dumping										
		Area covered by water hyacinth										
		Wetland agriculture										
		Existing Fishery										
		Phasing										
1	Institutional Se	et-up					1320000		1320000		660000	3300000
		Constitution of wetland mitra network	100000	Per network	10		400000	4	400000	2	200000	1000000
		Training and orientation on wetland management	50000	Per network	10	-	4 200000	4	200000	2	100000	500000
			50000	Dan a standa	10				200000	2	100000	50000
		issue-specific training	50000	Per network	10		+ 200000	4	200000	2	100000	500000
		Finalisation and endorsement of site-management plan	50000	Per wetland	10		4 200000	4	200000	2	100000	500000
		Signage	15000	Per signage	20	٤	3 120000	8	120000	4	60000	300000
		Outreach programmes	50000	Per programme per 50 ha	10		4 200000	4	200000	2	100000	500000
2	Wetlands delin	eation & demarcation					1640000		1768000		216000	3624000
2.1	Wetland demarcation											
		Placement of geo-tagged	8000	Per pillar (placed every 100 m)	453	201	5 1640000	221	1768000	27	216000	3624000
		boundary pillars		· · · F (F								
		Removal of encroachments	To be done at									
3	Enhancing hyd	rological regimes					20400		0		0	20400
3.1	Clearing inlets			Person days per inlet/outlet @	100	100	20400	c	0	0	0	20400
	and outlets			Rs 204 per person day								

# Table 27: Detailed activity wise budget for wetland level activities in floodplain agriculture wetlands

	Wetlands		Rate	Unit	Physical	Phase I Physical	Phase I Amount	Phase 2 Physical	Phase 2 Amount	Phase 3 Physical	Phase 3 Amount	Amount
4	Pollution abat	ement				•	50000	; )	500000		50000	
		Constructed wetlands	500000	Per impacted wetland with identified inflows	3	1	500000		500000		500000	1500000
5	Species and ha	bitat conservation					2540858		3347999.4		2068350	7952207.4
	Creation and						2010000					
5.1	Maintenance of People's											
		Training	50000	Per Gram Panchayat	10	) 4	200000	4	200000	2	100000	50000
_		Creation of People's Biodiversity	100000	Per Gram Panchayat	10	4	400000	4	400000	2	200000	1000000
5.2	Habitat mapping		Lump sum				1550000		2275000		1725000	5550000
		Mapping of key habitat areas Papping of fish preeding and										
		rormation or community groups										
		Community sensitization										
5.3	Management of	Removal of water hyacinth and other invasive macrophytes	10000	Per ha	90.22074	39.0858	390858	46.79994	467999.4	4.335	5 43350	902207.4
	_											
6 6.1 1	ble fisheries deve	lopment and livelihoods	Lump sum				6100000		360000		300000	1000000
		Formation of user groups and set	ting up rules an	d regulations								
		Microcredit support										
		Training on sustainable fisheries of	development									
		Assistance for craft and gear										
		Construction and upgradation of	jetties									
6.3	Fromoung		Lump sum				700000		12500000		7500000	2700000
		Training through KVKs on sustainable wetland agriculture										
		Microcredit support to farmers										
		microenterprise										

	Wetlands		Rate	Unit	Physical	Phase I Physical	Phase I Amount	Phase 2 Physical	Phase 2 Amount	Phase 3 Physical	Phase 3 Amount	Amount
		Training through KVKs on									-	
		sustainable wetland agriculture										
		Microcredit support to farmers										
		vvetiand agro-product based										
		BIC FOOD FOR FILM										
7	Monitoring and	l review					4000000		2500000		1000000	7500000
		Monitoring	2,50,000	Per wetland	10	4	1000000	4	1000000	2	500000	2500000
		Monitoring (Representative Sites)	5,00,000	Per wetland	5	4	2000000	I	500000	0	0	2500000
		Management plan mid-term review (External)	2,50,000	Per wetland	10	4	1000000	4	1000000	2	500000	2500000
							23121258		25530999.4		12244350	60896607.4

	Wetlands		Rate	Unit	Physical	Phase I Physical	Phase I Amount	Phase 2 Physical	Phase 2 Amount	Phase 3 Physical	Phase 3 Amount	Amount
		Area										ha
		Circumferance										m
		No. of inlets and outlets										
		Pollution as a threat										
		Choked inlets										
		Choked outlets										
		Solid-waste dumping										
		(presence and absence)										
		Area covered by water										
		hyacinth (>10%)										
		Existing Fishery ( based on										
		5.3 a and b)										
		Increased sediment										
		deposition										
		Phasing										
Т	Institutional S	et-up					C	ט	2400000		4800000	7200000
		Constitution of wetland							2 00 000		(	
		mitra network	1,00,000	Per wetland	9		-	3	3,00,000	6	6,00,000	9,00,000
		Training and orientation										
		an wetland management	50,000	Per wetland	9		-	3	1,50,000	6	3,00,000	4,50,000
		on wettand management										
		Issue-specific training	50,000	Per wetland	9		-	3	1,50,000	6	3,00,000	4,50,000
		Finalisation and										
		endorsement of site-	50,000	Per wetland	9		-	3	1,50,000	6	3,00,000	4,50,000
		management plan										
		Signage	50,000	Per wetland	9		-	3	1,50,000	6	3,00,000	4,50,000
		Outreach programmes	5,00,000	Per wetland	9		-	3	15,00,000	6	30,00,000	45,00,000

Table 28: Detailed activity wise budget for wetland level activities in ponds

	Wetlands		Rate	Unit	Physical	Phase I Physical	Phase I Amount	Phase 2 Physical	Phase 2 Amount	Phase 3 Physical	Phase 3 Amount	Amount
2	Wetlands deli	neation & demarcation	n n			1	0	i	286966		620000	906966
2.1	Wetland demarcation											
		Placement of geo-tagged boundary pillars	8,000	Per pillar (placed every 100 m)	76		-	24	1,92,000	52	4,16,000	6,08,000
		Removal of encroachments	To be done at the administrative level									
2.2	Creation of vegetative buffers											
		Plantation of native species	1,00,000	Per ha	2.491381052		-	0.791384626	79,138	1.70	1,70,000	2,49,138
		Maintenance	20,000	Per ha	2.491381052		-	0.791384626	15,828	1.70	34,000	49,828
3	Enhancing hy	drological regimes					-		127360		276515	403875
3.1	Clearing inlets and outlets		25	Person days per inlet/outlet @ Rs 204 per person day	3		-	2	10,200	1.00	5,100	١5,300
3.2	Selective desilting		50	Per m3	7771.5		-	2343.2	1,17,160	5428.30	2,71,415	3,88,575
4	Pollution aba	tement					-		6,90,000		24,70,000	31,60,000
		Survey of wastewater nallahs	20,000	Per impacted wetland	8		-	2	40,000	6	1,20,000	I,60,000
		Manual scouring of scum and other waste materials	75,000	Per impacted wetland	8		-	2	١,50,000	6	4,50,000	6,00,000

	Wetlands		Rate	Unit	Physical	Phase I Physical	Phase I Amount	Phase 2 Physical	Phase 2 Amount	Phase 3 Physical	Phase 3 Amount	Amount
5	Species and ha	abitat conservation				:	C	) D	850000		2100000	2950000
	Creation and											
	Maintenance of											
5.1	People's											
	Biodiversity											
	Registers	<b>T</b> · · ·	50.000	<b>D</b>	<u> </u>			2	1 50 000	,	2 00 000	4 50 000
		I raining	50,000	Per wetland	9		-	3	1,50,000	6	3,00,000	4,50,000
		Creation of People's Bioc	1,00,000	Per wetland	9		-	3	3,00,000	6	6,00,000	9,00,000
F 2	Habitat mapping											
5.2	and surveillance											
		Manning of key habitat										
		areas										
		Formation of										
		community groups to										
		monitor habitats										
		Community sensitization										
		Surveillance and										
		reporting										
E 2	Mangement of											
5.5	invasive species											
		Removal of water	2,00,000	Per impacted wetland	8							16,00,000
		hyacinth and other					-	2	4,00,000	6	12,00,000	
		invasive macrophytes										
6	Resource deve	elopment and livelihood	ls				-		42,08,275		90,00,000	1,32,08,275
		Sustainable fisheries development	50,000	per ha per impacted wetland	4.1655		-	4.1655	2,08,275	0	-	2,08,275

	Wetlands		Rate	Unit	Physical	Phase I Physical	Phase I Amount	Phase 2 Physical	Phase 2 Amount	Phase 3 Physical	Phase 3 Amount	Amount
		Water hyacinth-based enterprise	5,00,000	l group per wetland	8		-	2	10,00,000	6	30,00,000	40,00,000
		Multi-purpose shelter	5,00,000	Per wetland	9		-	3	15,00,000	6	30,00,000	45,00,000
		Construction of approach roads	5,00,000	Per wetland	9		-	3	15,00,000	6	30,00,000	45,00,000
7	Monitoring an	d review					-		14,00,000		18,00,000	32,00,000
		Monitoring	2,50,000	Per wetland	9		-	3	7,50,000	6	15,00,000	22,50,000
		Monitoring (Representative Sites)	5,00,000	Selected wetland	I		-	I	5,00,000	0	-	5,00,000
		Management plan mid- term review (External)	50,000	Per wetland	9		-	3	١,50,000	6	3,00,000	4,50,000
							-		99,62,601		2,10,66,515	3,10,29,116

### 9. Reference

- Brinson, M.M. 1993. A hydrogeomorphic classification for wetlands, Technical Report WRP-DE-4, U.S. Army Corps of Engineers Engineer Waterways Experiment Station, Vicksburg, MS. http://el.erdc.usace.army.mil/wetlands/pdfs/wrpde4.p
- Butchart, H. M. et. al. (+ 44 authors). (2010). Global Biodiversity: Indicators of Recent Declines. Science. Vol 328, Issue 5982. Pp. 1164-1168.
- Central Pollution Control Board. (2013). Pollution Assessment: River Ganga, 206. <u>http://cpcb.nic.in/upload/NewItems/NewItem\_203\_Ganga\_report.pdf</u>. Accessed 1 Apr 2019.
- Finlayson, C Max, Nick Davidson, Dave Pritchard, G Randy Milton, and Heather Mackay. 2011. "The Ramsar Convention and Ecosystem-Based Approaches to the Wise Use and Sustainable Development of Wetlands." Journal of International Wildlife Law & Policy 14 (3–4): 176–98.
- Finlayson, C Max. 2012. "Forty Years of Wetland Conservation and Wise Use: EDITORIAL." Aquatic Conservation: Marine and Freshwater Ecosystems 22 (2): 139–43. https://doi.org/10.1002/aqc.2233
- Kanaujia, A and Kumar, A. (2013). Amphibians of Uttar Pradesh and their ecological importance. *In* Water & Biodiversity. Souvenir (2013) published by the Uttar Pradesh State Biodiversity Board.
- Mao, H., Kathuria, D., Duffield, N., & Mohanty, B. P. (2019). Gap filling of highresolution soil moisture for SMAP/sentinel-1: a two-layer machine learningbased framework. Water Resources Research, 55(8), 6986-7009.
- McFeeters, S.K. (1996). The use of the Normalized Difference Water Index (NDWI) in the delineation of open water features, International Journal of Remote Sensing, 17:7, 1425-1432.
- McInnes and Everard 2017. Rapid Assessment of Wetland Ecosystem Services (RAWES): An example from Colombo, Sri Lanka. <u>Ecosystem Services</u>. <u>Volume 25</u>, June 2017, Pages 89-105
- Millennium Ecosystem Assessment (2005). (*Ed.*): Rashid Hassan, Robert Scholes and Neville Ash. Published by Island Press, 1718 Connecticut Avenue, Suite 300, NW, Washington, DC 20009.
- Pekel, J.-F & Cottam, Andrew & Gorelick, Noel & Belward, Alan. (2016). Highresolution mapping of global surface water and its long-term changes. Nature. 540. 10.1038/nature20584.
- Rahmani, A.R., Kumar, B., Ahmad, S., Mehta, P. & Rahman, F. (2019). Sarus Crane in North Uttar Pradesh: Status survey of Sarus and mapping of its wetland habitats. Bombay Natural History Society, Mumbai, pp 1 - 109.
- Ramsar Convention on Wetlands. (2018). Global Wetland Outlook: State of the World's Wetlands and their Services to People. Gland, Switzerland: Ramsar Convention Secretariat.

- Ramsar Convention Secretariat. (2010): Laws and institutions: Reviewing laws and institutions to promote the conservation and wise use of wetlands. Ramsar handbooks for the wise use of wetlands, 4th edition, vol. 3. Ramsar Convention Secretariat, Gland, Switzerland
- Reed, P.B. Jr. (1988). National list of plant species that occur in wetlands: national summary. U.S Fish Wildl. Serv. Biol. Rep. 88 (24). 244 pp.
- Rouse, J.W., Haas, R.W., Schell, J.A., Deering, D.W., Harlan, J.C., 1974. Monitoring 915 the vernal advancement and retrogradation (Greenwave effect) of natural vegetation. 916 NASA/GSFCT Type III Final Report. Greenbelt, MD, USA: NASA/GSFCT.
- Sarkar, U. K., S.C Rebello., G.E Khan., V.K Dubey., A.K Pathak and S.P Singh. (2013). Patterns of fish biodiversity in Uttar Pradesh: current status and challenges for sustainable management of resources. *In* Water & Biodiversity. Souvenir (2013) published by the Uttar Pradesh State Biodiversity Board.
- Shi, Z., Lamb, H. F., & Collin, R. L. (1995). Geomorphic change of saltmarsh tidal creek networks in the Dyfi Estuary, Wales. Marine Geology, 128(1-2), 73-83.
- Singh, S., Basu, D., Tripathi, A., Singh, R and Singh, Ram. (2009). An evaluation of distribution, status and abundance of freshwater turtles in Uttar Pradesh. In book: Freshwater Turtle and Tortoises of India- WII ENVIS Bulletin 2009 (pp.81-89). Published by Wildlife Institute of India, Dehradun.
- Sinha, Rajiv, Shivika Saxena, and Manudeo Singh. "Protocols for Riverine Wetland Mapping and Classification Using Remote Sensing and GIS." *Current Science* 112, no. 7 (2017): 1544–52.
- Sundar, K.S Gopi and Choudhury, B.C. (2006). Conservation of the Sarus Crane (*Grus antigone*) in Uttar Pradesh, India. Journal of the Bombay Natural History Society. 103.

### Annexes

Annex 1

### List of wetland plant species

Family	Scientific name	Common english name	Туре
Alismataceae	Sagittaria latifolia	Arrow head	Emergent hydrophytes
Amaranthaceae	Alternanthera philoxeroides	Alligator weed	Moist loving hydrophytes
Amaranthaceae	Alternanthera sessilis	Sessile joy weed	Moist loving hydrophytes
Apiaceae	Centella asiatica	Indian coinwort	Moist loving hydrophytes
Apiaceae	Bacopa monenieri	Pennywort	Moist loving hydrophytes
Araceae	Pistia stratiotes	Water lettuce	Free floating hydrophytes
Asteraceae	Xanthium strumarium	Rough cockleburr	Emergent hydrophytes
Cannabaceae	Cannabis sativa	Hemp	Emergent hydrophytes
Ceratophyllaceae	Ceratophyllum demersum	Horn wort	Submerged hydrophytes
Convolvulaceae	<i>Ipomoea</i> spp.	lpomoea spp.	Emergent hydrophytes
Fabaceae	Oxalis tetraphylla	Four leaf clover	Free floating hydrophytes
Hydrocharitaceae	Hydrilla verticillata	Water thyme	Submerged hydrophytes
Lemnaceae	Lemna minor	Duck weed	Free floating hydrophytes
Menyanthaceae	Nymphoides hydrophylla	Crested floating heart	Submerged hydrophytes
Nelumbonaceae	Nelumbo nucifera	Lotus	Emergent hydrophytes
Nymphaeaceae	Nymphaea caerulea	Blue water lily	Emergent hydrophytes
Oxalidaceae	Oxalis acetosella	Wood sorrel	Emergent hydrophytes
Plantaginaceae	Veronica anagallis- aquatica	Water speedwell	Emergent hydrophytes
Poaceae	Phragmites spp.	Common reed	Moist loving hydrophytes
Polygonaceae	Polygonum plebeium	Knot weed	Moist loving hydrophytes
Polygonaceae	Persicaria hydropiper	Water pepper	Moist loving hydrophytes
Pontederiaceae	Eichhornia crassipes	Water hyacinth	Free floating hydrophytes
Potamogetonaceae	Potamogeton nodosus	Long leaf pond weed	Submerged hydrophytes

Dopupoulooooo	Ranunculus	Cursed	Emergent
Ranunculaceae	sceleratus	buttercup	hydrophytes
Tranaceae	Trana natana	Matar abastruit	Free floating
Парасеае	Tapa hatans	Water chesthut	hydrophytes
Typhaceae	Typha spp	Cattail	Moist loving
Турпасеае	Typna spp.	Gattali	hydrophytes
Zastoracia	Zactora marina	Folgrace	Submerged
ZUSIEIacede	205181711111111	Lei yi ass	hydrophytes

### Annex 2

Family	Common name	Scientific name	
Cyprinidae	Hamilton's barila	Barilius bendelisis	
Bagridae	Gangetic mystus	Mystus mystus	
Clariidae	Walking catfish / Magur	Clarias batrachus	
Cyprinidae	Rohu	Labeo rohita	
Cyprinidae	Spotfin swamp barb	Puntius sophore	
Cyprinidae	Common carp	Labeo catla	
Cyprinidae	Ticto barb	Pethia ticto	
Cyprinidae	Silver carp	Hypophthalmichthys molitrix	
Cyprinidae	Carp	Catla catla	
Cyprinidae	Mrigal carp / White carp	Cirrhinus mrigala	
Cyprinidae	Orangefin labeo	Labeo calbasu	
Cyprinidae	Ticto barb	Puntius ticto	
Bagridae	Striped dwarf catfish	Mystus tengra	
Siluridae	Helicopter catfish	Wallago attu	
Mastacembelidae	Zig-zag eel	Mastacembelus armatus	
Channidae	Snakehead	Channa marulius	
Channidae	Spotted snakehead	Channa punctatus	
Channidae	Striped snakehead / Mudfish	Channa striatus	
Channidae	Dwarf snakehead	Channa gachua	
Gobiidae	Tank goby	Glossogobius giuris	
Belonidae	Freshwater garfish	Xenentodon cancila	
Ambassidae	Elongate glassy perchlet	Chanda nama	
Nandidae	Gangetic leaffish	Nandus nandus	

### Annex 3

### List of amphibian species

Family	Common name	Scientific name
Bufonidae	Common Indian Toad	Duttaphrynus melanostictus
Dicroglossidae	Indian Bullfrog	Hoplobatrachus tigerinus
Ranidae	Common frog / Grass frog	Rana temporaria

#### Annex 4

### List of reptilian species

Family	Common name	Scientific name
Agamidae	Garden Lizard	Calotes versicolor
Colubridae	Indian Ratsnake/Dhaman	Ptyas Mucosus
Elapidae	Black Cobra	Naja naja
Trionychidae	Indian Flapshell Turtle	Lyssemys punctata

### Annex 5

#### List of mammalian species Scientific name Family Common name Bovidae Blue bull Boselaphus tragocamelus Canidae Golden Jackal Canis aureus Lepus nigricollis Leporidae Indian Hare Sciuridae Five-striped Squirrel Funambulus pennantii Herpestidae Common Mongoose Herpestes edwardsii

### List of bird species

Family	Common name	Scientific name
Podicipedia	ae: Grebes	
	Little Grebe	Tachybaptus ruficollis
Phalacroco	racidae: Cormorants	·
	Indian Cormorant or Indian Shag	Phalacrocorax fuscicollis
	Little Cormorant	Phalacrocorax niger
Anhingidae	: Darter	
	Darter or Snake Bird	Anhinga malanogaster
Ardeidae: H	lerons, Egrets, Bitterns	
	Cattle Egret	Bubulcus ibis
	Grey Heron	Ardea cinereal
	Indian Pond Heron	Ardeola grayii
	Large Egret	Casmerodius albus
	Little Egret	Egretta garzetta
	Purple Heron	Ardea purpurea
Family Cicc	oniidae: Storks	
	Asian Openbill	Anastomus oscitans
	Black-necked Stork	Ephippiorhynchus asiaticus
	Painted Stork	Mycteria leucocephala
Family Thre	eskiornithidae: Ibises, Spoonbills	
	Black Ibis	Pseudibis papillosa
	Eurasian Spoonbill	Platalea leucorodia
	Oriental-white Ibis	Threskiornis melanocephalus
Family Ana	tidae: Ducks, Geese	
	Bar-headed Goose	Anser indicus
	Brahmini Shelduck	Tadorna ferruginea
	Comb Duck	Sarkidiornis melanotos
	Common Pochard	Aythya ferina
	Common Teal	Anas crecca
	Eurasian Wigeon	Anas penelope
	Gadwall	Anas Strepera
	Gargany	Anas querquedela
	Greylag Goose	Anser anser
	Mallard	Anas platyrhynchos
	Northern Pintail	Anas acuta
	Northern Shoveller	Anas clypeata
	Red-crested Pochard	Rhodonessa rufina
	Spot-billed Duck	Anas poecilorhyncha
Family Acc	ipitridae: Kites, Eagles, Vultures etc.	
	Black Kite	Milvus migrans
	Egyptian Vulture	Neophron percnopterus
	Greater Spotted Eagle	Aquila hastata
	Pallid Harrier	Circus macrourus

	Shikra	Accipiter badius	
	Steppe Eagle	Aquila nipalensis	
	Western Marsh-Harrier Circus aeruginosus		
Family Falco	onidae: Falcons		
	Eurasian Hobby	Falco subbuteo	
Family Phas	sianidae: Pheasants, Partridges		
	Black Francolin	Francolinus francolinus	
	Grey Francolin	Francolinus pondicerianus	
	Indian Peafowl	Pavo cristatus	
Family Gruio	dae: Cranes		
	Sarus Crane	Grus antigone	
	Common Crane	Grus grus	
Family Ralli	dae: Rails, Coots		
	Common Coot	Fulica atra	
	Common Moorhen	Gallinula chloropus	
	Purple Moorhen	Porphyrio porphyrio	
	White-breasted Waterhen	Amaurornis phoenicurus	
	Watercock	Gallicrex cinerea	
Family Jaca	nidae: Jacanas		
	Bronze-winged Jacana	Metopidius indicus	
	Pheasant-tailed Jacana	Hydrophasianus chirurgus	
Family Rostr	atulidae: Painted Snipe		
	Greater Painted Snipe	Rostratula benghalensis	
Family Chara	adridae: Plovers, Lapwings		
	Little-ringed Plover	Charadrius dubius	
	Northern Lapwing	Vanellus vanellus	
	Red-wattled Lapwing	Vanellus indicus	
	White-tailed Lapwing	Vanellus leucurus	
Family Scolo	ppacidae: Sandpipers, Snipes etc.		
	Black-tailed Godwit	Limosa limosa	
	Common Greenshank	Tringa nebularia	
	Common Redshank	Tringa totanus	
	Common Sandpiper	Actitis hypoleucos	
	Common Snipe	Gallinago gallinago	
	Green Sandpiper	Tringa ochropus	
	Little Stint	Calidris minuta	
	Marsh Sandpiper	Tringa stagnatilis	
	Pintail Snipe	Gallinago stenura	
	Ruff	Philomachus pugnax	
	Spotted Redshank	Tringa erythropus	
	Wood Sandpiper	Tringa glareola	
Family Recu	rvirostridae: Stilts, Avocet		
	Black-Winged Stilt	Himantopus himantopus	
	Pied Avocet	Recurvirostra avosetta	

Family Burl	hinidae: Stone curlew	
	Stone-Curlew	Burhinus oedicnemus
Family Colu	umbidae: Pigeons, Doves	
	Blue Rock Pigeon	Columba livia
	Eurasian Collared-Dove	Streptopelia dacaocta
	Little Brown Dove	Streptopelia senegalensis
	Red Collared-Dove	Streptopelia tranquebarica
	Yellow-legged Green-Pigeon	Treron phoenicoptera
Family Psit	tacidae: Parakeets	
	Rose-ringed Parakeet	Psittacula krameri
Family Cuc	lidae: Cuckoos, Crow Pheasants	
	Asian Koel	Eudynamys scolopacea
	Brain Fever Bird	Hierococcyx varius
	Greater Coucal	Centropus sinensis
	Eurasian Cuckoo	Cuculus canorus
Family Tyte	onidae: Barn Owls	
	Barn Owl	Tyto alba
Family Strig	gidae: Owls, Owlets	,
	Dusky Eagle Owl	Bubu coromandus
Family Alce	edinidae: Kingfishers	
	White-breasted Kingfisher	Halcyon smyrnensis
	Pied Kingfisher	Ceryle rudis
	Small Blue Kingfisher	Alcedo atthis
Family Mer	opidae: Bee-eaters	
	Blue-tailed Bee-eater	Merops philippinus
	Small Bee-eater	Merops orientalis
Family Cor	aciidae: Rollers	1
	Indian Roller	Coracias benghalensis
Family Upu	ipidae: Hoopoes	, ,
	Ноорое	Upupa epops
Family Buc	erotidae: Hornbills	
	Indian Grey Hornbill	Ocyceros birostris
Family Pici	dae: Woodpeckers, Wrynecks	
	Lesser Golden-backed	Dinopium benghalense
	Woodpecker	
Family Alau	Jdidae: Lark, Bushlark	
	Common Crested Lark	Galerida cristata
Family Hiru	Indinidae: Martins and Swallows	
	Common Swallow	Hirundo rustica
	Plain Martin	Riparia paludicola
	Wire-tailed Swallow	Hirundo smithii
Family Mot	acillidae: Wagtails, Pipits	
	Citrine Wagtail	Motacilla citreola
	Large-pied Wagtail	Motacilla maderaspatensis
	Paddy-field Pipit	Anthus rufulus

	Yellow Wagtail	Motacilla flava			
Family Campephagidae: Minivets					
Small Minivet		Pericrocotus cinnamomeus			
Family Pycr	Family Pycnonotidae: Bullbulls				
	Red-vented Bulbull	Pycnonotus cafer			
Family Lanii	dae: Shrikes				
	Rufous-backed Shrike	Lanius schach			
Family Musi	icapidae: Redstarts, Chats, Robins				
	Black Redstart	Phoenicurus ochruros			
	Blue-throat	Luscinia svecica			
	Common Stonechat	Saxicola torquata			
	Indian Chat	Cercomela fusca			
	Indian Robin	Saxicoloides fulicata			
	Oriental Magpie Robin	Copsychus saularis			
	Pied Bushchat	Saxicola caprata			
	Common Babbler	Turdoides caudatus			
	Jungle Babbler	Turdoides striatus			
	Large Grey Babbler	Turdoides malcolmi			
	Striated Babbler Turdoides earlei				
	Ashy Prinia Prinia socialis				
	Common Chiffchaff Phylloscopus collybita				
	Common Tailorbird	Orthotomus sutorius			
	Plain Prinia Prinia inornata				
	Rufous-fronted Prinia	Prinia buchanani			
	Streaked Fantail-Warbler	Cisticola juncidis			
	Red-throated Flycatcher	Ficedula parva			
	Asian Brown Flycatcher	Muscicapa dauurica			
Family Nect	ariniidae: Sunbirds				
	Purple Sunbird	Nectarinia asiatica			
Family Estri	ldidae: Munias				
	Black-headed Munia	Lonchura malacca			
	Red Munia	Amandava amandava			
	Spotted Munia	Lonchura punctulata			
	White-throated Munia	Lonchura malabarica			
Family Pass	eridae: Sparrows				
	House Sparrow	Passer domesticus			
	Baya Weaver	Ploceus philippinus			
	Black-breasted Weaver	Ploceus benghalensis			
	Streaked Weaver	Ploceus manyar			
Family Sturr	nidae: Mynas, Starlings				
	Asian-pied Starling	Sturnus contra			
	Bank Myna	Acridotheres ginginianus			
	Brahminy Myna	Sturnia pagodarum			
	Common Myna	Acridotheres tristis			

	Common Starling Sturnus vulgaris	
Family Orioli	dae: Orioles	
	Eurasian Golden Oriolus oriolus	
Family Dicru	ridae: Drongos	
	Black Drongo	Dicrurus macrocercus
Family Corvi	dae: Crows, Treepies	
	House Crow	Corvus splendens
	Indian Treepie	Dendrocitta vagabunda
	Jungle Crow	Corvus macrorhynchos

### Stay in touch

Wetlands International South Asia A-25, Floors 1 & 2, Defence Colony New Delhi-110024, India Tel: +91 11 24338906, 46038906 Email: <u>wi.southasia@wi-sa.org</u> URL: https://south-asia.wetlands.org





### Priority wetlands for phase wise implementation in respective districts

	Wetlands within Protected Areas	Ponds	Urban and Peri-Urban Wetlands	Floodplain agricultural wetlands
Sub basin I				
Phase I	Amroha district - Tigri; Muzzafarnagar district - Mahmoodpur, Mansurpur Jheel, Ishhakwala, Raharwa Jadid, Lalpur, and Shahpur	Badaun dsitrict - Palpur, Piprol Pukhta; Aligarh district - Dhurra Khas urf Premnagar; Muzzafarnagar district - Khai Khera, Chaurawala, Farrukhabad - Amilpur, Karanpur Datt, Kuthila jheel, Kharagpur khandauli; Kasganj district - Soron, Bijnor district - Balawali	Badaun district - Khairpur Khaerati, Farrukhabad district - Kamalganj, and Rampur Dhafarpur	Aligarh district - Sisai, Sikri; Bulandshahar district - Hakimpur, Muzzafarnagar district - Kalewala Jheel; Kasganj - Sikandarpur khurd, Ram Chittonni; Bijnor district - Khanpur Khadar
Phase II	Amroha district - Sujamna; Meerut district - Jalalpur Johra, Rustampur Bhikund, Sarai Khadar, Muzzafarnagar district - Bhuwapur,Samana; Hapur district - Kothla Jheel (Khadar), Bijnor district - Saidpura Urf Naipura, Badshahpur, Manshahpur-1, and Jalpur	Badaun district - Bhavanipur Khalli, Amroha district - Rasulpur Bhawanr Ahatmali, Ashikpur, Sambhal district - Deepanagla, and Deepanagla 3 Aligarh district - Panihara, Bulandshahar district - Gesupur, Kapsaipur, Karanwas, Nandpur Talab, Shahjahanpur district - Bharatpur, Islamganj, Rajepur Raipur, Muzzafarnagar district - Wazirabad, Kasganj district - Hodalpur, Sadikpur Talaab, Bijnor district - Rajarampur, Chahadwala,	Amroha district - Gajraula; Bulandshahar district - Amartahl urf Unchagaon	Aligarh district - Gangabas; Bulandshahar district - Bani Nagla-I, Hapur district - Kulpur Jheel, Kalyanpur Jheel, Kasaganj district - Bastoli Brahmapur, Farrukhabad district - Deosi husenpur and Sambhal district - Deepanagla 2
Phase III	Meerut district - Behsuma Talaab, Muzzafarnagar district - Purkazi Rural, Haiderpur, Farrukhabad dsitrict - Ravannaguljar bag	Badaun district - Tikaikham, Amroha district - Mukarampur Mustakam, Shareefpur Sumali, Jaithal; Sambhal district - Paratpur, Narupura, Aligarh district - Raipur khas, Ajwaindher,		Sambhal district - Naraura Barrage, Aligrah district - Abhepur Bahlolpur, Kumrauwa, Sikandarpur, Shahjahanpur district - Naugawan Jheel

	Wetlands within Protected Areas	Ponds	Urban and Peri-Urban Wetlands	Floodplain agricultural wetlands
		Bulandshahar district - Mohammadpur, Khadar, Niwadi khadar, Shahjahanpur district - Noorpur Tarsoura, Farrukhabad district - Bahbalpur, Kasganj district - Nakara Wetland, Johri, Bijnor district - Gajrola achpal, Manshahpur 2, Mandawar.		
Sub basin II				
Phase I		Prayagraj district - Numaiya Dahi Jheel Khedwa Tal, Unnao district - Kushrajpur Pond		Sant Ravidas Nagar - Samdha Tal, Prayagraj district - Bada Talab, Upardaha, Unnao district - Mela Ramkaur Lake, Kanpurnagar district - Katri Jaisarmau
Phase II	Mirzapur district - Bhokawa Bandha, Lower Khajuri Dam, Tanda Dari Tal	Rae Bareli district - Milkipur Tal, Bharda Tal, Prataparh district - Saray Jay Chandra (Malak Tilhai), Unnao district - Liloi Jhil, Majharapiper kheda, Manpur Lake, Rawat Pond, Varanasi district - Sarai Dangari, Fatehpur district - Okhara Kuwarpur, Itarora Pilkhini, Aliganj Nan Kheriya, Sanpkhera, Madar, Kanpurnagar district - Rehnas Talab, Saray Jay Chandra (Malak Tilhai) Kaushambi district - Bharwari, Daulatpur Kashar	Prayagraj district - Bela Kachar Talab, Nivari Tal, Varanasi district - Chancha Tal, Chunagir Tal, Fatehpur dsitrict - Sanganv, Chakki, Mausampur Morara Kanpurnagar district - Mama Talab, Shivrajpur, and Shivrajpur-2	Mirzapur district - Kall Jalsannad Mirzapur district - Belwan, Jogiya Dari Nala, Karnawati Nala, Prayagraj district - Bhiti Taluka Talab, Rae Bareli district - Gangsari Tal, Usraila Jhil, Bara Sawayaya Hasan, Patti Tal, Jasauli Tal, Kamoli Tal, Bakwa Tal, Bakulahi River, Dudhwan Tal, Kondra Jhil, Matrauli Tal, Unnao dsitrict - Baraila Jhil, Dhanuhikheda Lake, Chattrapur lake Fatehpur district - Bhalewa-2 Hardoi district - Terwakulli, Arwal Paschim, Murwa Shahabuddinpur Kannauj district - Gangdharapur, Madharpur Kannauj Kanpurnagar district - Saibasi Pond, and Katri bajidpur
Phase III	Fathepur district - Manikpur Reserve Forest, Mirzapur dsitrict - Tanda Dari Tal	Hardoi district - Dharampur, Talab (Rural), Tithi Gaon Pansala Unnao district - Unchagaon Pond, Kanti Pond, Kannauj district - Nadsiya Gram Samaj,	Kanpurnagar district - Sanigvan, Prayagraj district - Dhobiyan Basti Talab Handia, Varanasi district - Pandeypur, Kausahmabi disrict - Sirathu NP, Fathepur district- Fatehpur MB,	Sant Ravidas Nagar district - Gonda Shubans Tal, Kurauna Tal, Pura Rasai Tal Unnao district - Maraunda (Jamalnagar Lake), Kannauj district - Ismailpur Digan, Pratapgarh district - Ramdas Patti, Devar

	Wetlands within Protected Areas	Ponds	Urban and Peri-Urban Wetlands	Floodplain agricultural wetlands
		Prataparh district - Jasauli, Tikuri Dashrathpur, Saray Jaychandra, Narsinghpur, Mirzapur district - Bhuiya Khoh Dam, Kaushambi district - Gauspur, Parsara, Fathepur district - Bhalewa-I,Thari, Karsawan Kanpurnagar district - Hindupur, Madara Rai Guman	Fatehpur MB 2, Fatehpur MB 3, Fatehpur MB 4, and Fatehpur MB 5	Patti, Fathepur district - Audhara, Basohani, Paliya Bujurg 1, Paliya Bujurg 2, Rae Bareli district - Baburia Tal, Raipur Thappa Haweli Tal, and Bara Tal
Sub basin III				
Phase I	Ballia district- Surha Tal	-	Chandauli district - Saresar, Nasirpur Pattan	Chandauli district- Birna; Ballia district - Dahtal Reoti, Rampur Kodahara Dhab/Baghad, Sansar Toal Bhagad,
Phase II		Ballia district - Kopwa, Chandauli district - Mithwar Urwa	Chandauli district - Bhogwar, Godhana, Dhanapur; Ballia district - New Baheri, Quazipura (Railway Yard Land).	Chandauli district - Ramgarh, Ghazipur district - Talwal, Ballia district - Bahkata, Dal Chhapra Bhakhar,
Phase III	Ballia district - Kawleshwar Tal	Ballia district - Jhakath Tal, Sarak, ; Ghazipur district - Chunni Taal, Dhari Dheeh, Khanpur, Seorai	Ghazipur district - Amaraupur, Kanuwan, Taraw; Ballia district - Mishra Newari Dadri Mela Ground Nala/Bhagad	Ghazipur district- Veerpur, Reosara Gang Nahar,

Annex 6

#### List of field surveyors

#### **Cluster One**

Amroha District Rakesh Kumar, Forester Sunil Kumar Chandola, Forester Shah Alam, Forest Guard

#### **Bijnore District**

Hardev Singh, Forester Motilal, Forester Nitish Kumar, Forester Sanjay Kumar Matpal, Forest Guard Shah Alam, Forest Guard

#### **Bulandshahr District**

K D Sharma, Deputy Ranger Shani Gautam, Forester

#### Hapur District

Vinod Kumar, Forester

#### Meerut District

Sansar Singh, Forester Atul Dubey, Forest Guard

#### **Muzaffarnagar District**

Mohan Kumar Bahukhandi, Range Officer Bijendra Kumar, Forester Shabih Haider, Forester Ramesh Chand, Forest Guard Satender, Forest Guard

#### **Cluster Two**

#### **Aligarh District**

Devendra Gupta, Forest Guard Vinay Kumar, Forest Guard Yogesh Gautam, Forest Guard

#### **Badaun District**

Naved Ikram, Range Officer Shivam Shankdhar, Forest Guard Vikendra Kumar, Forest Guard

#### Kasganj District

Jagdish Tomar, Deputy Ranger Mukesh Mathur, Forester Ajay Mohan, JRF

Sambhal District R. K Pathak, Range Officer

#### Shahjahanpur District

Vikas Pratap Singh, Deputy Ranger

#### **Cluster Three**

Farrukhabad District Raj Kumar, Forester Hardoi District Manmohan Singh, Forester Narendra Kumar Verma, Forester Ram Dhani, Surveyor

### Kannauj District

Pramod Singh, Forester

### Kanpurnagar District

Lallu Singh, Range Officer Krishan Kumar Gupta, Forester Pradeep Kumar Yadav, Forest Guard

#### Unnao District

A. C Kumar, Range Officer Santosh Awasthi, Forester Vipin Kumar, Forester Dinesh Pandey, Forest Guard Sharad Bajpayi, Forest Guard Vipin kumar, Forest Guard

#### **Cluster Four**

#### Fatehpur District

R. L Saini, Range Officer Abhinav Singh, Forester Ravindra Kumar, Forester Deepak Kumar, Computer Operator

#### Kaushambhi District

Dara Singh Yadav, Range Officer Ashish Chaubey, Forester Zia Rehman, Forester

#### **Pratapgarh District**

Girish Chandra Yadav, Forest Guard Mahfooz Ali, Forest Guard Vijay Saroj, Forest Guard Vinod Kumar, Forest Guard Pawan Singh, Draftsman

#### **Prayagraj District**

Vijay Pratap Singh, Deputy Ranger Bodhraj Tripathi, Forester Shailesh kumar, Forester Sumit Kumar, Forester Vipin Singh, Forester

#### **Raebareilly District**

Dinesh Chandra Gupta, Forester Mahendra Mishra, Forester Yeshveer Singh, Clerk

#### **Cluster Five**

#### **Badohi District**

Ritesh Mishra, Range Officer Shivlal Singh, Forester Ramanand Prasad, Forest Guard Nandlal, Mali Tirathraj Yadav, Mali **Ballia District** Amit Kumar, Forester Bhupinder Tiwari, Forester

Chandauli District Jitender Yadav, Forester Ravindra Sonkar, Forester

**Ghazipur District** Ashish Ram, Forest Guard

**Mirzapur District** Luvkush, Forest Guard Ramji, Forest Guard Shiv, Forest Guard Virendra Yadav, Forest Guard

### Varanasi District

Rahul, Forest Guard Devesh Mishra, Forester Akash Yadav, Forester Awinash Rai, Forester

Annex 7

रजिस्ट्री सं० डी० एल०-33004/99





असाधारण

EXTRAORDINARY भाग II—खण्ड 3—उप-खण्ड (ii)

PART II—Section 3—Sub-section (ii)

प्राधिकार से प्रकाशित

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### जल संसाधन, नदी विकास और गंगा संरक्षण मंत्रालय

अधिसूचना

नई दिल्ली, 7 अक्तूबर, 2016

**का.आ. 3187(अ).**—गंगा नदी में पर्यावरणीय प्रदूषण की रोकथाम, नियंत्रण एवं उपशमन और जल का सतत पर्याप्त प्रवाह सुनिश्चित करने के उपाय करने तथा इससे संबंधित अथवा प्रासंगिक मामलों हेतु केन्द्र, राज्य और जिला स्तर पर प्राधिकरणों का गठन करना जरूरी है, जिससे गंगा नदी का पुनरुद्धार करके इसे इसकी प्राकृतिक एवं मूल स्थिति में लाया जा सके।

जहां, गंगा नदी भौगोलिक, ऐतिहासिक, सामाजिक-सांस्कृतिक एवं आर्थिक कारणों से अद्वितीय महत्व की है जो इसे राष्ट्रीय नदी का दर्जा देता है;

और जहां, गंगा नदी तेजी से हो रहे शहरीकरण एवं औद्योगिकीकरण के कारण सीवेज, औद्योगिक बहिस्राव एवं अन्य प्रदूषकों के बढ़ने के कारण गंभीर स्थिति में है;

और जहां, प्रतिस्पर्धी मांग को पूरा करने की आवश्यकता को ध्यान में रखते हुए जनसंख्या, शहरीकरण, औद्योगिकीकरण, अवसंरचना विकास में वृद्धि के कारण सिंचाई, पेयजल आपूर्ति, औद्योगिक उपयोग एवं जल विद्युत के लिए गंगा नदी के जल की मांग बढ़ रही है;

और जहां, अविलंब निम्नलिखित कार्रवाई किए जाने की आवश्यकता है------

(ए) व्यापक आयोजना एवं प्रबंधन के लिए इस अंतर्राज्यीय एवं अंतर्क्षेत्रीय समन्वय को प्रोत्साहित करने के लिए नदी बेसिन दृष्टिकोण अपनाकर गंगा नदी में प्रदूषण में प्रभावी कमी तथा नदी का संरक्षण सुनिश्चित करना;

(बी) नदी की पूरी लंबाई के क्षेत्र में सतत प्रवाह सुनिश्चित करने के उद्देश्य से गंगा नदी में पारिस्थितिकीय प्रवाह बनाए रखना जिससे इसकी पारिस्थितिकीय समग्रता को पुनः स्थापित किया जा सके और यह स्वयं अपना पुनरूद्धार करने में सक्षम हो सके;

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(सी) गंगा नदी के आस-पास के क्षेत्रों में प्रतिबंध लगाना जहां उद्योग, प्रचालन अथवा प्रक्रियांए अथवा उद्योगों का वर्ग, प्रचालन अथवा प्रक्रियांए नहीं की जाएंगी अथवा कुछ सुरक्षा उपायों के साथ की जाएंगी;

(डी) किसी भवन, संयंत्र, उपकरणों, मशीनों, निर्माण अथवा अन्य प्रक्रियाओं, सामग्री अथवा पदार्थों के निरीक्षण का प्रावधान करना और ऐसे प्राधिकरणों, अधिकारियों तथा व्यक्तियों को गंगा नदी में पर्यावरणीय प्रदूषण की रोकथाम, नियंत्रण एवं कमी लाने के लिए कदम उठाने के निर्देश देना जैसा कि यह आवश्यक समझे।

(ई) गंगा नदी में पर्यावरणीय प्रदूषण की समस्या से संबंधित अन्वेषण एवं अनुसंधान करना एवं प्रायोजित करना और पर्यावरणीय प्रदूषण फैलाने वाली संभावित निर्माण प्रक्रियाओं, सामग्री तथा पदार्थों की जांच करना;

(एफ) गंगा नदी में पर्यावरणीय प्रदूषण से संबंधित मामलों के संदर्भ में सूचना एकत्रित एवं प्रसारित करना और पर्यावरणीय प्रदूषण की रोकथाम, नियंत्रण एवं कमी लाने के संबंध में मैनुअल, कोड अथवा गाइड तैयार करना;

और जहां, गंगा के पुनरुद्धार के लिए समान रूप से उत्तरदायी होने के कारण संबंधित राज्य सरकारों को राज्य स्तर पर नदी संरक्षण क्रियाकलापों का समन्वय एवं कार्यान्वयन करना होगा और उनके राज्य में गंगा नदी के व्यापक प्रबंधन के लिए कदम उठाने होंगे:

और जहां, गंगा नदी में प्रदूषण को समाप्त करने और संरक्षण, सुरक्षा और प्रबंधन के लिए इस आदेश के अंतर्गत केंद्र सरकार और राज्य सरकारों तथा प्राधिकरणों के सामूहिक प्रयासों को सुदृढ़ करने के लिए आयोजना, वित्त पोषण, निगरानी और समन्वय की आवश्यकता होगी।

अब, इसलिए, पर्यावरण (संरक्षण) अधिनियम, 1986 (1986 का 29) (इसके बाद उक्त अधिनियम कहा गया है) की धारा 3 तथा 4, 5, 9,10, 11,19, 20 और 23 की उपधारा (2) तथा (3) के अनुच्छेद (i), (ii), (v), (vi), (vii), (viii), (ix), (x), (xii) तथा (xiii) के साथ उपधारा (1) द्वारा दी गई शक्तियों का प्रयोग करते हुए और पूर्ववर्ती पर्यावरण एवं वन मंत्रालय में भारत सरकार की 30 सितंबर 2009 की अधिसूचना संख्या का.आ. 1111(अ), 30 सितंबर 2009 की अधिसूचना संख्या का.आ. 2539(अ), 30 सितंबर 2009 की अधिसूचना संख्या का.आ. 2493(अ), 30 सितंबर 2009 की अधिसूचना संख्या का.आ. 2494(अ), 30 सितंबर 2009 की अधिसूचना संख्या का.आ. 2495(अ) और 8 फरवरी 2010 की का.आ. 287(अ) और जल संसाधन, नदी विकास और गंगा संरक्षण में 29 सितंबर 2014 की का.आ. संख्या 2539(अ) का अधिक्रमण करते हुए, ऐसे अधिक्रमण से पहले किए गए अथवा छोड़े गए कार्यों को छोड़कर, केन्द्र सरकार एतद्वारा-

(i) ऐसी शक्तियों तथा कार्यों को करने के उद्देश्य से इस आदेश में उल्लिखित नामों से प्राधिकरण गठित करती है (उक्त अधिनियम की धारा 5 के तहत निर्देश जारी करने की शक्ति के साथ और इस आदेश में उल्लिखित मामलों के संदर्भ में उपाय करने के लिए) ;

(ii) केन्द्र सरकार के पर्यवेक्षण एवं नियंत्रण और इस आदेश के प्रावधानों के शर्ताधीन इस आदेश में विनिर्दिष्ट प्राधिकारी अथवा प्राधिकारियों को निर्देश देती है कि वे इस आदेश में उल्लिखित शक्तियों का प्रयोग अथवा कार्यों का निष्पादन अथवा उपाय करेंगे जैसे कि इन प्राधिकारियों को उक्त अधिनियम द्वारा इन शक्तियों का प्रयोग करने, इन कार्यों का निष्पादन करने अथवा ऐसे उपाय करने का अधिकार दिया गया है;

(iii) यह निर्देश देती है कि उक्त अधिनियम के किसी प्रावधान के तहत गंगा नदी और उससे जुड़े मामलों के संबंध में इसकी सभी शक्तियों एवं कार्यों (धारा 3 की उपधारा (3) के तहत किसी प्राधिकरण के गठन की शक्ति और उक्त अधिनियम की धारा 6 और 25 के तहत नियम बनाने को छोड़कर) का प्रयोग इस आदेश में विनिर्दिष्ट शर्तों एवं सीमाओं के शर्ताधीन इस आदेश द्वारा गठित प्राधिकरणों और इस आदेश में विनिर्दिष्ट अधिकारियों द्वारा भी किया जा सकेगा।

1. लघु शीर्षक एवं प्रारंभ- (1) इस आदेश को गंगा नदी (संरक्षण, सुरक्षा एवं प्रबंधन) प्राधिकरण आदेश, 2016 कहा जाए।

(2) यह सरकारी राजपत्र में प्रकाशन की तारीख से लागू होगा।

**2. आदेश को लागू करने का क्षेत्र-** यह आदेश गंगा नदी में प्रदूषण की प्रभावी कमी तथा संरक्षण, सुरक्षा एवं प्रबंधन के उद्देश्य से गंगा नदी बेसिन वाले राज्यों अर्थात हिमाचल प्रदेश, उत्तराखंड, उत्तर प्रदेश, मध्य प्रदेश, छत्तीसगढ़, बिहार, झारखंड, हरियाणा, राजस्थान, पश्चिम बंगाल और राष्ट्रीय राजधानी क्षेत्र दिल्ली और ऐसे अन्य राज्य जिनमें गंगा नदी की प्रमुख उपनदियां स्थित हैं, पर लागू होगा, जैसा कि गंगा नदी के संरक्षण, सुरक्षा तथा प्रबंधन के लिए राष्ट्रीय परिषद निर्णय ले।

3. परिभाषाएं, यदि संदर्भ में अन्य रूप में अपेक्षित न हो-

(ए) "अधिनियम" का अर्थ पर्यावरण (संरक्षण) अधिनियम, 1986 (1986 का 29) होगा।

(बी) "बेसिन" का अर्थ क्षेत्र में मृदा, जल, वनस्पति तथा अन्य प्राकृतिक संसाधन सहित जल निकाय अथवा जल मार्ग के संपूर्ण आवाह क्षेत्र से है और इसमें आवाह आधार पर भूमि, जल, वनस्पति एवं अन्य प्राकृतिक संसाधन शामिल है।

(सी) "बफर क्षेत्र" का अर्थ उस क्षेत्र से है जो नदी के बाढ़ मैदान से आगे है।

(डी) "आवाह" अथवा "आवाह क्षेत्र" में वह संपूर्ण भूमि क्षेत्र शामिल है जिसमें वर्षा, हिम अथवा बर्फ का अपवाह जल मार्ग के गंगा नदी अथवा इसकी उपनदियों में मिलने अथवा गंगा नदी अथवा इसकी उपनदियों में जल छोड़ने से पहले एक जल निकाय अथवा जल मार्ग में गिरता है।

(ई) "व्यावसायिक मछली पालन" का अर्थ गंगा नदी अथवा इसकी उपनदियों में नेट, जहर अथवा अन्य आधुनिक फिशिंग गेयर अथवा पद्धतियों द्वारा व्यावसायिक प्रयोजन से बड़े पैमाने पर मछली पालन से है।

(एफ) "सक्षम प्राधिकारी" का अर्थ केन्द्र सरकार से है।

(जी) "वनकटाव" का अर्थ विशेष रूप से गंगा नदी के आवाह क्षेत्र में वन क्षेत्र में कमी, विशेषतौर पर मानवजनित क्रियाकलापों द्वारा अथवा वन के वैज्ञानिक प्रबंधन के लिए नियोजित रूप से इस हटाने को छोड़कर वन में पेड़ों अथवा वनस्पति को हटाने से है।

(एच) "अवक्रमित वन" का अर्थ गंगा नदी अथवा इसकी उपनदियों के आस-पास आवाह क्षेत्र में मूल वन क्षेत्र अथवा वनस्पति घनत्व में कमी वाले वन से है।

(आई) "निर्देश" का अर्थ अधिनियम की धारा 5 के तहत जारी निर्देश से है और "निर्देश देने" का अर्थ इसी के अनुसार होगा।

(जे) "जिला गंगा समिति" का आशय, पैराग्राफ 53 में उल्लिखित जिला गंगा सुरक्षा समिति से है।

(के) "इंजीनियर्ड डायवर्जन" का अर्थ गंगा नदी अथवा इसकी उपनदियों के जल को नहरों अथवा अन्य इंजीनियरिंग संरचनाओं में अंतरित करने के लिए बनाई गई अथवा संस्थापित संरचना अथवा यंत्र से है।

(एल) "बाढ़ मैदान" का अर्थ गंगा नदी अथवा इसकी उपनदियों के ऐसे क्षेत्र से है जो इसके अधिकतम प्रवाह के संगत बाढ़ अथवा 100 वर्ष में एक बार आने वाली बाढ़ के समान बाढ़ के कारण दोनों ओर जल के अंदर आ जाता है।

(एम) "घाट" का अर्थ गंगा अथवा इसकी उपनदियों के तट पर ढलान वाले भाग से है जिसमें कृत्रिम रूप से निर्मित सीढ़ियां और गंगा नदी अथवा इसकी उपनदियों के जल तक मानव की सरल पहुंच के लिए प्रयुक्त भूमि के ढलान वाले क्षेत्र शामिल है और धार्मिक अथवा अन्य संबंधित प्रयोजन से ऐसे भागों का प्रयोग शामिल है।

(एन) "स्थानीय प्राधिकरण" में पंचायती राज संस्थाएं, नगरपालिकाएं, जिला बोर्ड, छावनी बोर्ड, नगर नियोजन प्राधिकरण अथवा जिला परिषद अथवा अन्य कोई निकाय अथवा प्राधिकरण, जिस भी नाम से जाना जाता हो, जिसे एक विशिष्ट स्थानीय क्षेत्र में आवश्यक सेवाएं देने हेतु अथवा नागरिक सेवाओं के नियंत्रण एवं प्रबंधन के लिए कानून द्वारा मान्यता दी गई हो।

(ओ) "राष्ट्रीय स्वच्छ गंगा मिशन" का अर्थ पैराग्राफ 31 में उल्लिखित प्राधिकरण है।

(पी) "अधिसूचना" का अर्थ सरकारी राजपत्र में प्रकाशित अधिसूचना से है और "अधिसूचित करने" का अर्थ इसी के अनुसार होगा।

(क्यू) "प्रदूषित पदार्थ" में ठोस अपशिष्ट शामिल होगा जिसमें पशुओं के शव, रसोई अथवा अस्तबल का अपशिष्ट, गोबर, कचरा, सड़ी हुई अथवा दुर्गंधयुक्त सामग्री और किसी भी प्रकार की गंदगी शामिल है जो सीवेज में नहीं आती। (आर) "व्यक्ति" में निम्नलिखित शामिल है-

(i) एक व्यक्ति अथवा समूह अथवा व्यक्तियों का संघ शामिल किया गया हो अथवा नहीं;

(ii) कंपनी अधिनियम, 2013 (2013 का 18) के तहत स्थापित कंपनी;

(iii) किसी केन्द्रीय अथवा राज्य अधिनियम द्वारा स्थापित कोई निगम;

(iv) एक स्थानीय प्राधिकरण;

(V) उपर्युक्त उपखंडों में से किसी में भी न आने वाला प्रत्येक न्यायिक व्यक्ति।

(एस) "नदी तल" का अर्थ गंगा नदी अथवा इसकी उपनदियों के क्षेत्र के सूखे हिस्से से है और इसमें वह स्थान शामिल है जहां गंगा नदी अथवा इसकी उपनदियां बहती हैं जब वे जल से भर जाती हैं और गंगा नदी अथवा इसकी उपनदियों के किनारे स्थित भूमि शामिल है जो जल का सर्वाधिक प्रवाह होने पर अपने प्राकृतिक चैनल में जल को बनाए रखती है।

(टी) "नदी तल खेती" में जल के कम प्रवाह के समय गंगा नदी अथवा इसकी उपनदियों के नदी तल पर मौसमी कृषि अथवा खेती से है।

(यू) "गंगा नदी" धारा का अर्थ उत्तराखंड राज्य में 6 प्रमुख धाराओं की संपूर्ण लंबाई अर्थात अलकनंदा, धौलीगंगा, नंदाकिनी, पिंडर, मंदाकिनी और भागीरथी से है जो अपने मूल ग्लेशियर से विष्णु प्रयाग, नंद प्रयाग, कर्ण प्रयाग, रूद्र प्रयाग और देव प्रयाग में उनके संबंधित संगम तक है और नदी की मुख्य धारा भी इसमें शामिल है और उसके बाद प्रयागराज सहित गंगा सागर तक और इसकी सभी उपनदियां शामिल हैं।

(वी) "कूड़ा करकट" का अर्थ राख, टूटी हुई ईंटों, गारे, टूटे हुए कांच, धूल अथवा किसी प्रकार के अपशिष्ट और गंदगी से है।

(डब्ल्यू) "मिट्टी के खनन" का अर्थ सूखे चैनल बेल्ट, बाढ़ मैदान अथवा गंगा नदी अथवा इसकी उपनदियों के भाग से नदी में बड़े पैमाने पर मिट्टी को हटाने से है।

(एक्स) "सीवेज अपशिष्ट" का अर्थ किसी सीवरेज प्रणाली अथवा सीवेज निपटान कार्य के बहिस्राव से है और इसमें खुले नालों का सीवेज शामिल है।

(वाई) "सीवरेज स्कीम" का अर्थ ऐसी स्कीम से है जो एक स्थानीय प्राधिकरण भूमिगत बंद सीवर के माध्यम से जल को फ्लश करके सीवेज हटाने की प्रक्रिया शुरू करें।

(जेड) "अनुसूची" का अर्थ इस आदेश के साथ संलग्न अनुसूची है।

(जेडए) "विनिर्दिष्ट जिले" का अर्थ हिमाचल प्रदेश, उत्तराखंड, उत्तर प्रदेश, मध्य प्रदेश, छत्तीसगढ़, बिहार, झारखंड, हरियाणा, राजस्थान, पश्चिम बंगाल और राष्ट्रीय राजधानी क्षेत्र दिल्ली और ऐसे अन्य राज्य जिनमें इस आदेश में उल्लिखित गंगा नदी की प्रमुख उपनदियां स्थित हैं, में गंगा नदी अथवा इसकी उपनदियों के 15 किमी. के क्षेत्र में गंगा नदी के आस-पास स्थित प्रत्येक जिले के क्षेत्र से है।

(जेडबी) "राज्य गंगा समिति" का अर्थ पैरा 2 में उल्लिखित राज्यों में से प्रत्येक राज्य के लिए इस आदेश के तहत गठित राज्य गंगा संरक्षण, सुरक्षा एवं प्रबंधन समिति से है।

(जेडसी) राज्य गंगा नदी संरक्षण प्राधिकरण का अर्थ प्रत्येक राज्य में अधिनियम के तहत पूर्व गठित प्राधिकरण से है अर्थातः-

(i) पर्यावरण एवं वन मंत्रालय में दिनांक 8 फरवरी, 2010 की भारत सरकार की अधिसूचना संख्या का.आ. 287(अ) द्वारा गठित बिहार राज्य गंगा नदी संरक्षण प्राधिकरण।

(ii) पर्यावरण एवं वन मंत्रालय में दिनांक 30 सितंबर, 2009 की भारत सरकार की अधिसूचना संख्या का.आ. 2495(अ) द्वारा गठित झारखंड राज्य गंगा नदी संरक्षण प्राधिकरण। (iii) पर्यावरण एवं वन मंत्रालय में दिनांक 30 सितंबर, 2009 की भारत सरकार की अधिसूचना संख्या का.आ. 1111(अ) द्वारा गठित उत्तराखंड राज्य गंगा नदी संरक्षण प्राधिकरण।

(iv) पर्यावरण एवं वन मंत्रालय में दिनांक 30 सितंबर, 2009 की भारत सरकार की अधिसूचना संख्या का.आ. 2493(अ) द्वारा गठित उत्तर प्रदेश राज्य गंगा नदी संरक्षण प्राधिकरण।

(v) पर्यावरण एवं वन मंत्रालय में दिनांक 30 सितंबर, 2009 की भारत सरकार की अधिसूचना संख्या का.आ. 2494(अ) द्वारा गठित पश्चिम बंगाल राज्य गंगा नदी संरक्षण प्राधिकरण।

(जेडडी) "धारा" में नदी, जल मार्ग (प्रवाहित हो रहे हों अथवा कुछ समय के लिए सूखे हों), अंतर्देशीय जल (प्राकृतिक अथवा कृत्रिम) और उपक्षेत्र जल शामिल है।

(जेडई) "गंगा नदी की उपनदियों" का अर्थ उन नदियों अथवा धाराओं से है जो गंगा नदी में प्रवाहित होती हैं और इनमें यमुना नदी, सोन नदी, महानंदा नदी, कोसी नदी, गंडक नदी, घाघरा नदी और महाकाली नदी तथा उनकी उपनदियां अथवा ऐसी अन्य नदियां जिन्हें राष्ट्रीय गंगा नदी संरक्षण, सुरक्षा एवं प्रबंधन परिषद इस आदेश के उद्देश्य से विनिर्दिष्ट करे, शामिल हैं।

2. इस आदेश में प्रयुक्त किए गए तथा परिभाषित नहीं किए गए शब्दों एवं पदों का अर्थ यदि पर्यावरण (सुरक्षा) अधिनियम, 1986 (1986 का 29) में परिभाषित किया गया है तो उनका अर्थ वही समझा जाएगा जो उक्त अधिनियम में दिया गया है।

**4. गंगा नदी की सुरक्षा, प्रबंधन एवं संरक्षण के लिए उपाय करने हेतु अपनाए जाने वाले सिद्धांत-** (1) गंगा नदी के संरक्षण, सुरक्षा एवं प्रबंधन के लिए उपाय करने हेतु निम्निलिखित सिद्धांत अपनाए जाएंगे अर्थातः-

(i) गंगा नदी को एक एकल प्रणाली के रूप में प्रबंधित किया जाएगा;

(ii) गंगा नदी के जल की रासायनिक, भौतिक एवं जीव विज्ञानीय गुणवत्ता को पुनःस्थापित करने एवं इस बनाए रखने का कार्य समयबद्ध ढंग से किया जाएगा;

(iii) गंगा नदी को पारिस्थितिकीय ढंग से सतत पद्धति में प्रबंधित किया जाएगा;

(iv) गंगा नदी में प्राकृतिक मौसमी विविधता में परिवर्तन किए बिना नदी में प्रवाह बनाए रखा जाएगा;

(v) गंगा नदी के देशान्तरीय, लेटरल तथा ऊर्ध्वाधर आयाम (कनेक्टिविटी) नदी प्रबंधन प्रक्रियाओं तथा पद्धतियों में शामिल किए जाएंगे;

(vi) सतही प्रवाह तथा उपसतही जल (भूजल) के बीच समग्र संबंध को पुनःस्थापित किया जाएगा एवं बनाए रखा जाएगा;

(vii) आवाह क्षेत्र में खोई प्राकृतिक वनस्पति को पुनः सृजित किया जाएगा एवं बनाए रखा जाएगा;

(viii) गंगा नदी बेसिन में जलीय एवं तटीय जैव-विविधता को पुनः सृजित एवं संरक्षित किया जाएगा;

(ix) प्रदूषण के स्रोत, दबाव को कम करने और इसके प्राकृतिक भूजल पुनर्भरण विशेषताओं को बनाए रखने के लिए गंगा नदी के तट और इसके बाढ़ मैदान को निर्माण मुक्त जोन बनाया जाएगा;

(x) संरक्षण, सुरक्षा एवं प्रबंधन में जनता की भागीदारी, किसी विनियम, मानक में संशोधन करना एवं लागू करने, संरक्षण, सुरक्षा एवं प्रबंधन के लिए बहिस्राव न्यूनीकरण योजना अथवा कार्यक्रम को प्रोत्साहन दिया जाए और गंगा नदी के संरक्षण, सुरक्षा एवं प्रबंधन की प्रक्रियाओं एवं पद्धतियों का अभिन्न हिस्सा बनाया जाएगा;

(2) राष्ट्रीय स्वच्छ गंगा मिशन देश के लोगों की आवश्यकताओं, प्रौद्योगिकी में उन्नयन तथा लोगों की सामाजिक-आर्थिक स्थिति को ध्यान में रखते हुए और राष्ट्रीय संयुक्त संस्तुति की समृद्ध विरासत के संरक्षण के लिए उपपैरा (1) के तहत विनिर्दिष्ट सिद्धांतों के अतिरिक्त सिद्धांत विनिर्दिष्ट कर सकता है।

**5. गंगा नदी में जल का पारिस्थितिकीय प्रवाह बनाए रखा जाए-** (1) प्रत्येक राज्य सरकार, यह सुनिश्चित करने का प्रयास करेगी कि पैरा के उप पैरा (iv) में दिए गए अनुसार गंगा नदी में हर समय जल का अबाधित प्रवाह बनाए रखा जाए।

(2) प्रत्येक राज्य सरकार भी गंगा नदी में इसकी पारिस्थितिकीय समग्रता को बनाए रखने के लिए विभिन्न मौसम में जल का पर्याप्त प्रवाह बनाए रखने के प्रयास करेगी और इस लक्ष्य को प्राप्त करने के लिए सभी संबंधित प्राधिकरण समयबद्ध ढंग से उचित कार्रवाई करेंगे।

(3) इस पैरा के प्रयोजन से जल के औसत प्रवाह का निर्धारण राष्ट्रीय स्वच्छ गंगा मिशन द्वारा गंगा नदी पर विनिर्दिष्ट बिन्दुओं पर विनिर्दिष्ट जल वैज्ञानिक प्रेक्षण केन्द्रों द्वारा किया जाएगा।

बशर्ते कि राष्ट्रीय स्वच्छ गंगा मिशन द्वारा पारिस्थितिकी को ध्यान में रखते हुए गंगा नदी पर विभिन्न बिन्दुओं के लिए नदी में जल का औसत प्रवाह निर्धारित किया जाए।

### 6. गंगा नदी और उसकी उप नदियों में पर्यावरणीय प्रदूषण की रोकथाम, नियंत्रण एवं कमी लाना

(1) कोई व्यक्ति गंगा नदी अथवा इसकी उपनदियों अथवा इसके तटों पर प्रत्यक्ष रूप से अथवा अप्रत्यक्ष रूप से अशोधित अथवा शोधित सीवेज अथवा सीवेज कीचड़ नहीं डालेगा;

बशर्ते कि जहां किसी स्थानीय प्राधिकरण के पास इस आदेश के लागू होने की तारीख को सीवेज अथवा कीचड़ के एकत्रण, भंडारण, ले जाने और निपटान के लिए सीवरेज स्कीम अथवा अवसंरचना नहीं है अथवा गंगा नदी अथवा इसकी उपनदियों के आस-पास के क्षेत्र में उपर्युक्त तारीख तक ऐसी अवसंरचना प्रचालन में न हों, ऐसा प्रत्येक स्थानीय प्राधिकरण इस आदेश के लागू होने की तारीख से राष्ट्रीय स्वच्छ गंगा मिशन द्वारा विनिर्दिष्ट अवधि में स्थानीय प्राधिकरण के क्षेत्र में सीवेज के एकत्रण, भंडारण, ले जाने एवं निपटान के लिए ऐसी अवसंरचना विकसित करेगा अथवा ऐसी अवसंरचना प्रचालन में लाएगा।

(2) कोई व्यक्ति प्रत्यक्ष रूप से अप्रत्यक्ष रूप से गंगा नदी अथवा इसकी उपनदियों अथवा इनके तटों पर अशोधित अथवा शोधित व्यावसायिक बहिस्राव, औद्योगिक अपशिष्ट नहीं छोड़ेगा;

बशर्ते यह भी कि जहां किसी उद्योग अथवा औद्योगिक क्षेत्र प्रबंधन के पास इस आदेश के लागू होने की तारीख को औद्योगिक बहिस्राव शोधन स्कीम अथवा अवसंरचना न हो अथवा गंगा नदी अथवा इसकी उपनदियों के आस-पास के क्षेत्र में उपर्युक्त तारीख को ऐसी अवसंरचना प्रचालन में न हो, ऐसा प्रत्येक उद्योग अथवा औद्योगिक क्षेत्र प्रबंधन उद्योग अथवा औद्योगिक क्षेत्र प्रबंधन के कार्यक्षेत्र में इस आदेश के लागू होने की तारीख से राष्ट्रीय स्वच्छ गंगा मिशन द्वारा विनिर्दिष्ट अवधि में व्यावसायिक बहिस्राव, औद्योगिक अपशिष्ट के एकत्रण, भंडारण, ले जाने एवं निपटान के लिए अवसंरचना विकसित करेगा अथवा ऐसी अवसंरचना प्रचालन में लाएगा।

(3) कोई व्यक्ति गंगा नदी में अथवा गंगा नदी या इसकी उपनदियों के तट अथवा इनके सक्रिय बाढ़ मैदानी क्षेत्र में आवासीय अथवा वाणिज्यिक अथवा औद्योगिक अथवा अन्य किसी प्रयोजन से स्थायी अथवा अस्थायी संरचना का निर्माण नहीं करेगा;

बशर्ते कि, अपवाद की स्थितियों जैसे प्राकृतिक आपदा अथवा पारंपरिक स्थलों पर धार्मिक आयोजनों के लिए राज्य गंगा समिति और जिला गंगा समिति के माध्यम से राष्ट्रीय स्वच्छ गंगा मिशन की पूर्व अनुमति से अस्थायी संरचनाएं बनायी जा सकती है;

बशर्ते यह भी कि इस आदेश के लागू होने से पहले गंगा नदी अथवा इसकी उपनदियों के तट अथवा सक्रिय बाढ़ मैदान में यदि कोई ऐसी संरचना बनाई गई है तो राष्ट्रीय स्वच्छ गंगा मिशन ऐसी संरचनाओं की समीक्षा करेगा ताकि यह जांच की जा सके कि ऐसी संरचनाएं गंगा नदी अथवा इसकी उपनदियों में जल के सतत प्रवाह को बाधित नहीं कर रही अथवा नदी में प्रदूषण नहीं फैला रही और यदि ऐसा है तो यह उन्हें हटाने की कार्रवाई कर सकता है।

(4) कोई व्यक्ति ऐसा कोई क्रियाकलाप अथवा किसी परियोजना अथवा प्रक्रिया अथवा क्रियाकलाप नहीं करेगा अथवा जारी रखेगा। जिससे गंगा नदी में प्रदूषण हो, चाहे यह क्रियाकलाप इस आदेश में उल्लिखित हो या न हो।

(5) राष्ट्रीय स्वच्छ गंगा मिशन का यह कर्तव्य होगा कि प्रत्येक <u>विनिर्दिष्ट राज्य गंगा समिति अथवा विनिर्दिष्ट जिला गंगा</u> <u>संरक्षण समिति.</u> स्थानीय प्राधिकरण और सभी अन्य प्राधिकरण तथा व्यक्ति गंगा नदी और इसकी उपनदियों के आस-पास के प्रत्येक गांव/नगर, शहर तथा अन्य क्षेत्रों में स्थानीय भाषा में रिपोर्टों में दी गई सूचना तथा उपर्युक्त उपायों का विभिन्न माध्यमों से व्यापक प्रचार करेंगे तथा जनता के ध्यान में लाएंगे।

7. गंगा नदी और इसकी सहायक नदियों के प्रदूषण के मामले में आपातकालीन उपाय- किसी दुर्घटना अथवा अनदेखे कार्य अथवा घटना के कारण गंगा नदी में कोई भी विषैला हानिकारक अथवा प्रदूषक कारक पाया जाता है अथवा प्रवेश किया है, और तत्काल कार्रवाई करने की आवश्यकता होती है, तो ऐसे कार्यों को करने के लिए तत्काल कार्रवाई शुरू करनी होगी अथवा विनिर्दिष्ट राज्य गंगा समिति अथवा विनिर्दिष्ट जिला गंगा समिति अथवा स्थानीय प्राधिकरण अथवा कोई अन्य प्राधिकरण अथवा बोर्ड अथवा निगम द्वारा ऐसे कार्यों को करने हेतु निर्देश दिया जाएगा, चूंकि इसे निम्नलिखित सभी अथवा किसी उद्देश्य के लिए आवश्यक समझा जाए। अर्थात्

(क) प्रदूषक की उपस्थिति के कारण किसी प्रदूषण के उपशमन अथवा निपटान के लिए इस ढंग से जैसा कि विनिर्दिष्ट किया गया है, गंगा नदी से प्रदूषक सामग्री को हटाने की पद्धति और निपटाना के साथ साथ ऐसे कार्यों को करने के लिए यथा उपयुक्त समझा जाता है।

(ख) गंगा नदी में किसी भी विषैले, हानिकारक अथवा प्रदूषक सामग्री को छोड़ने से किसी व्यक्ति अथवा स्थानीय प्राधिकरण अथवा संबंधित अन्य प्राधिकरण अथवा बोर्ड अथवा निगम को नियंत्रित करने अथवा निषेध करने संबंधी निर्देश जारी करना।

(ग) इस प्रकार की आपातकालीन समस्या के समाधान के लिए कोई अतिरिक्त कार्य अथवा कार्य पद्धति शुरू करना जैसा भी आवश्यक हो।

8. निर्देश जारी करने की शक्ति- राष्ट्रीय स्वच्छ गंगा मिशन, इस आदेश के तहत अपनी शक्तियों और निष्पादन अथवा अपने कार्य पद्धतियों का प्रयोग कर सकता है, जिसे प्रदूषण का निवारण और गंगा नदी के संरक्षण, संरक्षा एवं प्रबंधन के लिए आवश्यक समझा जाए। संबंधित प्राधिकरण अथवा स्थानीय प्राधिकरण अथवा अन्य प्राधिकरणों अथवा बोर्ड अथवा निगम अथवा व्यक्ति को लिखित में अधिनियम के तहत ऐसे निर्देश जारी करना और वे ऐसे निर्देशों का पालन करने के लिए बाध्य होंगे।

व्याख्या- संदेह के निवारण के लिए एतद द्वारा घोषित किया जाता है कि इस धारा के तहत निर्देश जारी करने की शक्ति शामिल की जाती है लेकिन निर्देश देने की शक्ति को सीमित नहीं किया जाता है-

(क) किसी उद्योग, प्रचालन अथवा प्रक्रिया को बंद करना, निषेध अथवा विनियमन; अथवा

(ख) विद्युत अथवा जल की आपूर्ति अथवा अन्य किसी सेवा को रोकना अथवा विनियमन

(ग) इस आदेश अथवा उल्लिखित अधिनियम अथवा बनाए गए नियम अथवा इसके तहत जारी निर्देशों के विरोधी किसी कार्य को रोकना अथवा बंद करना।

(घ) इस आदेश अथवा उल्लिखित अधिनियम में विनिनिर्देष्ट उपायों का प्रभावी कार्यान्वयन

9. गंगा सुरक्षा लेखा परीक्षा- प्रत्येक विनिर्दिष्ट जिला गंगा समिति वार्षिक समय ढांचा के भीतर और ऐसे जिला के लिए गंगा नदी के क्षेत्र हेतु राष्ट्रीय स्वच्छ गंगा मिशन द्वारा विनिर्दिष्ट किए जाने वाले प्रोटोकॉल के अनुसार गंगा सुरक्षा लेखा परीक्षकों द्वारा गंगा सुरक्षा लेखा परीक्षा करवाई जाएगी और विनिर्दिष्ट राज्य गंगा समिति तथा राष्ट्रीय स्वच्छ गंगा मिशन को इस संबंध में शुरू की गई सुधारात्मक कार्रवाई सहित इस सुरक्षा लेखा परीक्षा की रिपोर्ट की प्रति अग्रेषित करेगी, जिस पर उपयक्त कार्रवाई की जाएगी. यदि आवश्यक हो।

10. गंगा नदी तथा इसकी सहायक नदियों में प्रदूषण की निगरानी किया जाना- (1) गंगा नदी तथा इसकी सहायक नदियों में प्रदूषण की निगरानी राष्ट्रीय स्वच्छ गंगा मिशन द्वारा स्वयं अथवा उपग्रह के चित्रों तथा अन्य दूरसंवेदी प्रौद्योगिकियों के उपयोग द्वारा विभिन्न राज्य और केन्द्र सरकारी अभिकरणों के साथ-साथ इसके द्वारा विनिर्दिष्ट किए जाने वाले आवधिक आधार पर वास्तविक केन्द्रों, ऑनलाइन निगरानी और स्वतंत्र अभिकरणों के माध्यम से निर्देशों द्वारा की जाएगी।

(2) उप-पैराग्राफ के प्रावधानों के बावजूद (1) केन्द्र सरकार गंगा तथा इसकी सहायक नदियों में ऊपर उल्लिखित प्रदूषण की निगरानी के लिए किसी अन्य तकनीक अथवा पद्धति, जिसे निर्देशों में विनिर्दिष्ट किया जा सके, को अपनाकर गंगा तथा इसकी सहायक नदियों में प्रदूषण की निगरानी के कार्य को किसी अन्य अभिकरण अथवा निकाय अथवा सीधे, प्रौद्योगिकी को अद्यतन करने के उद्देश्य से, सौंप सकती है।

11. गंगा नदी के संरक्षण, सुरक्षा और प्रबंधन संबंधी राष्ट्रीय परिषद का गठन - इस आदेश को लागू करने की तिथि से अधिनियम के उद्देश्यों तथा इस आदेश और उल्लिखित अधिनियम के तहत यथा विनिर्दिष्ट शक्तियों का उपयोग करने तथा कार्यों को करने के लिए गंगा नदी के संरक्षण, संरक्षा, प्रबंधन संबंधी राष्ट्रीय परिषद के नाम से (जिसे इस आदेश में इसके पश्चात् राष्ट्रीय गंगा परिषद कहा जाएगा) एक प्राधिकरण का गठन किया जाएगा।

<b>12. राष्ट्रीय गंगा परिषद की संरचना-</b> राष्ट्रीय गंगा परिषद में निम्नलिखित सदस्य शामिल होंगे, नामत:-	
(क) प्रधानमंत्री	अध्यक्ष, पदेन
(ख) केन्द्रीय जल संसाधन, नदी विकास और गंगा संरक्षण मंत्री	उपाध्यक्ष, पदेन
(ग) केन्द्रीय पर्यावरण वन एवं जलवायु परिवर्तन मंत्री	सदस्य, पदेन
(घ) केन्द्रीय वित्त मंत्री	सदस्य, पदेन
(ङ) केन्द्रीय शहरी विकास मंत्री	सदस्य, पदेन
(च) केन्द्रीय विद्युत मंत्री	सदस्य, पदेन
(छ) केन्द्रीय विज्ञान एवं प्रौद्योगिकी मंत्री	सदस्य, पदेन
(ज) केन्द्रीय ग्रामीण विकास मंत्री	सदस्य, पदेन
(झ) केन्द्रीय पेयजल एवं स्वच्छता मंत्री	सदस्य, पदेन
(ञ) केन्द्रीय पोत परिवहन मंत्री	सदस्य, पदेन
(ट) केन्द्रीय पर्यटन राज्य मंत्री	सदस्य, पदेन
(ठ) उपाध्यक्ष, नीति आयोग	सदस्य, पदेन
(ड) मुख्यमंत्री, बिहार	सदस्य, पदेन
(ढ) मुख्यमंत्री, झारखंड	सदस्य, पदेन
(ण) मुख्यमंत्री, उत्तराखंड	सदस्य, पदेन
(त) मुख्यमंत्री, उत्तर प्रदेश	सदस्य, पदेन
(थ) मुख्यमंत्री, पश्चिम बंगाल	सदस्य, पदेन
(द) सचिव, जल संसाधन, नदी विकास और गंगा संरक्षण मंत्रालय-	सदस्य, पदेन
(ध) महानिदेशक, राष्ट्रीय स्वच्छ गंगा मिशन	सदस्य-सचिव, पदेन

(2) राष्ट्रीय गंगा परिषद सदस्य के रूप में राष्ट्रीय गंगा परिषद में प्रतिनिधित्व नहीं करने वाले ऐसे राज्य के एक अथवा एक से अधिक मुख्यमंत्रियों को शामिल कर सकती है जहां गंगा नदी की प्रमुख सहायक नदियां है, जिससे गंगा नदी के जल की गुणवत्ता प्रभावित होने की संभावना है।

(3) राष्ट्रीय गंगा परिषद यदि आवश्यक समझे तो एक अथवा अधिक केन्द्रीय मंत्रियों को भी शामिल कर सकती है।

(4) राष्ट्रीय गंगा परिषद नदी संरक्षण, नदी पारिस्थितिकी और नदी प्रबंधन, जल विज्ञान, पर्यावरण अभियांत्रिकी, सामाजिक जागरूकता के क्षेत्र में तथा अन्य संबंधित क्षेत्रों के विशेषज्ञों तथा विशेषज्ञ संगठनों अथवा संस्थानों के साथ परामर्श कर सकती है।

(5) राष्ट्रीय गंगा परिषद का मुख्यालय नई दिल्ली में अथवा ऐसे किसी अन्य स्थान पर होगा, जैसा निर्धारित किया जाए।

(6) राष्ट्रीय गंगा परिषद का सचिवालय राष्ट्रीय स्वच्छ गंगा मिशन में होगा।

(7) केन्द्र सरकार में जल संसाधन, नदी विकास और गंगा संरक्षण मंत्रालय नोडल मंत्रालय के रूप में कार्य करेगा।

13. राष्ट्रीय गंगा नदी बेसिन प्राधिकरण का विघटन- (1) पैराग्राफ 11 में राष्ट्रीय गंगा परिषद के गठन की तिथि को और से, जल संसाधन, नदी विकास और गंगा संरक्षण मंत्रालय, नई दिल्ली की अधिसूचना का.आ. 2539(अ), दिनांक 29 सितम्बर, 2014 के द्वारा गठित राष्ट्रीय गंगा नदी बेसिन प्राधिकरण को विघटित माना जाएगा। (2) विघटन से पहले राष्ट्रीय गंगा नदी बेसिन प्राधिकरण द्वारा किए गए अथवा छोड़े गए सभी कार्य अथवा शुरू की गई कार्रवाई अथवा खर्च की गई अथवा खर्च किए जाने हेतु प्राधिकृत किसी राशि को इस आदेश के समान प्रावधानों के तहत किया हुआ अथवा शुरू किया जाना माना जाएगा।

14. गंगा नदी के पर्यवेक्षण, निर्देशन और नियंत्रण का कार्य राष्ट्रीय गंगा परिषद को सौंपना- गंगा नदी के पर्यवेक्षण, निर्देशन, विकास और नियंत्रण तथा गंगा नदी में पर्यावरण प्रदूषण के संरक्षण, रोकथाम, नियंत्रण और निवारण के लिए संपूर्ण नदी बेसिन (वित्तीय एवं प्रशासनिक मामलों सहित) तथा इसकी प्राकृतिक और मूल स्थिति का संरक्षण नदी में जल के पर्याप्त बहाव की निरंतरता और इसके साथ जुड़े मामलों के लिए राष्ट्रीय गंगा परिषद, इस आदेश में शामिल किसी भी चीज के बावजूद, संपूर्ण रूप से जिम्मेवार मानी जाएगी।

15. राष्ट्रीय गंगा परिषद का क्षेत्राधिकार- गंगा नदी के संरक्षण, संरक्षा और प्रबंधन संबंधी राष्ट्रीय परिषद का क्षेत्राधिकार पैराग्राफ 2 में दिए गए क्षेत्र तक होगा।

16. गंगा नदी के संरक्षण, संरक्षा और प्रबंधन संबंधी राष्ट्रीय परिषद की बैठक-

(1) राष्ट्रीय गंगा परिषद अपनी बैठकों सहित अपने कार्य को करने के लिए अपनी स्वयं की प्रक्रिया का विनियमन कर सकती है।

(2) राष्ट्रीय गंगा परिषद के अध्यक्ष बैठक की अध्यक्षता करेंगे और उनकी अनुपस्थिति में राष्ट्रीय गंगा परिषद की बैठकों की अध्यक्षता उपाध्यक्ष करेंगे और इसके कार्यव्यवहार को आगे बढ़ाएंगे।

(3) उपाध्यक्ष के पास अगली बैठक में संपुष्टि के शर्ताधीन परिषद की दो बैठकों के आयोजन के बीच में परिषद के उद्देश्य को प्राप्त करने हेतु राष्ट्रीय गंगा परिषद के लिए आवश्यक निर्णय लेने की शक्ति होगी।

(4) राष्ट्रीय गंगा परिषद अपने विवेक से प्रत्येक वर्ष कम से कम एक अथवा अधिक बैठकें आयोजित कर सकती है।

17. प्राधिकरण के रूप में गंगा नदी संबंधी अधिकार प्राप्त कार्यबल का गठन- (1) इस आदेश को जारी करने की तिथि से अधिनियम के उद्देश्यों तथा इस आदेश और उल्लिखित अधिनियम के तहत यथा विनिर्दिष्ट शक्तियों का उपयोग करने तथा कार्यों को करने के लिए गंगा नदी संबंधी अधिकार प्राप्त कार्यबल के नाम से एक प्राधिकरण का गठन किया जाएगा।

2 गंगा नदी संबंधी अधिकार प्राप्त कार्यबल में निम्नलिखित शामिल हैं, नामत:-		
(क) केन्द्रीय जल संसाधन, नदी विकास और गंगा संरक्षण मंत्री अध्यक्ष, पदेन		
(ख) केन्द्रीय जल संसाधन, नदी विकास और गंगा संरक्षण राज्य मंत्री  उपाध्यक्ष, पदेन		
(ग) सचिव, जल संसाधन, नदी विकास और गंगा संरक्षण सदस्य, पदेन		
(घ) सचिव, वित्त मंत्रालय (व्यय विभाग)	सदस्य, पदेन	
(ङ) सीईओ, नीति आयोग	सदस्य, पदेन	
(च) मुख्य सचिव, उत्तराखंड राज्य	सदस्य, पदेन	
(छ) मुख्य सचिव, उत्तर प्रदेश राज्य	सदस्य, पदेन	
(ज) मुख्य सचिव, बिहार राज्य	सदस्य, पदेन	
(झ) मुख्य सचिव, झारखंड राज्य	सदस्य, पदेन	
(ञ) मुख्य सचिव, पश्चिम बंगाल राज्य	सदस्य, पदेन	
(ट) महानिदेशक, राष्ट्रीय स्वच्छ गंगा मिशन	सदस्य, सचिव	

(3) गंगा नदी संबंधी अधिकार प्राप्त कार्यबल, एक अथवा एक से अधिक केन्द्रीय मंत्रालयों के सचिवों अथवा संबंधित अन्य किसी राज्य के मुख्य सचिव को सदस्य के रूप में शामिल कर सकती है, यदि आवश्यक समझा जाए। (4) गंगा नदी संबंधी अधिकार प्राप्त कार्यबल अपने विवेकानुसार कम से कम प्रत्येक तीन महीने में एक अथवा इससे अधिक बैठकें आयोजित करेगा।

(5) केन्द्र सरकार, जल संसाधन, नदी विकास और गंगा संरक्षण मंत्रालय में गंगा संबंधी अधिकार प्राप्त कार्यबल को प्रशासनिक और तकनीकी सहायता उपलब्ध कराएगी और यह मंत्रालय ऐसी प्रशासनिक और तकनीकी सहायता देने के उद्देश्य हेतु नोडल मंत्रालय होगा।

### (18) गंगा नदी संबंधी अधिकार प्राप्त कार्यबल के कार्य और शक्तियां-

(1) गंगा नदी संबंधी अधिकार प्राप्त कार्यबल गंगा नदी और इसकी सहायक नदियों के संरक्षण, संरक्षा और प्रबंधन से संबंधित सभी मामलों में समन्वय करेगा और सलाह देगा।

(2) खासकर और उप-पैराग्राफ (1) के प्रावधानों के पूर्वाहग्रह के बिना गंगा नदी संबंधी अधिकार प्राप्त कार्यबल के कार्य और शक्तियों में गंगा नदी के संरक्षण, सुरक्षा और प्रबंधन से संबंधित निम्नलिखित मामलों में से सभी अथवा किसी एक के संबंध में उपायों को शामिल किया जा सकता है। अर्थात्-

(क) यह सुनिश्चित करना कि संबंधित मंत्रालय, विभागों और राज्य सरकारों के पास-

(i) गंगा नदी के संरक्षण और परिरक्षण के उद्देश्य को प्राप्त करने के लिए खास गतिविधियों, उद्देश्यों और समयबद्धता सहित एक कार्य योजना है

(ii) इसकी कार्य योजनाओं के कार्यान्वयन की निगरानी हेतु एक तंत्र है

(ख) समयबद्ध आधार पर इसकी कार्य योजनाओं के कार्यान्वयन के लिए संबंधित मंत्रालयों, विभागों और राज्य सरकारों के बीच समन्वय।

(ग) कार्यान्वयन प्रक्रिया की निगरानी, बाधाओं को को दूर करना, शीघ्र कार्यान्वयन सुनिश्चित करने के लिए आवश्यक सुझाव और निर्णय लेना।

(घ) घरेलू और विदेशी सहायता के माध्यम से वित्त पोषित परियोजनाओं सहित नमामि गंगे

(ङ) गंगा नदी के संरक्षण और संरक्षा तथा प्रबंधन के उद्देश्य को प्राप्त करने के लिए यथा आवश्यक समझे गए ऐसे अन्य कार्यों को करना अथवा यथा आवश्यक समझी गई शक्तियों का प्रयोग करना अथवा केन्द्र सरकार द्वारा सौंपा गया हो अथवा राष्ट्रीय गंगा परिषद द्वारा विनिर्दिष्ट कार्यों को करना।

## 19. एक हजार करोड़ रूपए के मूल्य से अधिक की परियोजनाओं के लिए अनुमोदन

(1) गंगा नदी संबंधी अधिकार प्राप्त कार्यबल, एक हजार करोड़ रूपए के मूल्य से अधिक की प्रत्येक परियोजना के अनुमोदन हेतु जिम्मेवार होगा, समय-समय पर यथा संशोधित।

(2). गंगा नदी संबंधी अधिकार प्राप्त कार्यबल उप-पैराग्राफ (1) के उद्देश्य हेतु इनके सदस्यों के बीच एक अधिकारियों की उप-समिति गठन कर सकता है।

20. विनिर्दिष्ट राज्य गंगा संरक्षण संरक्षा एवं प्रबंधन समितियों का प्राधिकरणों के रूप में गठन तथा इनका संघठन- इस आदेश के लागू होने की तारीख से पैरा 2 में दिए गए अनुसार प्रत्येक राज्य में राज्य गंगा संरक्षण, संरक्षा एवं प्रबंधन समिति नामक एक प्राधिकरण गठित किया जाएगा। जिसमें इस आदेश तथा अधिनियम विनिर्दिष्ट शक्तियों का प्रयोग करने तथा कार्यों का निष्पादन करने के लिए अनुसूची में विनिर्दिष्ट किए गए अनुसार एक अध्यक्ष और सदस्य शामिल होंगे।

**21. राज्य गंगा समिति की बैठकें–** (1) **प्रत्येक** विनिर्दिष्ट राज्य गंगा समिति अपनी बैठकों सहित अपने कार्यों को करने के लिए अपनी स्वयं की प्रक्रिया का विनियमन कर सकती है।

(2) प्रत्येक राज्य गंगा समिति 3 महीने की अवधि में कम से कम अपनी एक बैठक करेगी।
(3) विनिर्दिष्ट राज्य गंगा समिति के अध्यक्ष इसकी बैठकों की अध्यक्षता करेंगे और उनकी अनुपस्थिति में उल्लिखित समिति अपना उपाध्यक्ष का चुनाव करेंगे, जो विनिर्दिष्ट राज्य गंगा समिति की बैठकों की अध्यक्षता करेंगे और इसके कार्य व्यवहार को आगे बढ़ाएंगे।

22. समिति का अधीक्षण, निर्देशन एवं नियंत्रण- गंगा नदी और इसकी सहायक नदियों में संरक्षण, संरक्षा पर्यावरणीय प्रदूषण

की रोकथाम, नियंत्रण एवं कमी लाने के उद्देश्य से इस आदेश में किए गए किसीभी प्रावधान के बावजूद जिला गंगा समितियों का अधीक्षण निर्देशन एवं नियंत्रण राज्य गंगा समिति के पास होगा जिससे गंगा नदी प्राकृतिक एवं मूल स्थिति का संरक्षण किया जा सके और संबंधित राज्यों में गंगा नदी के संरक्षण एवं प्रबंधन के लिए गंगानदी में जल का सतत एवं पर्याप्त प्रवाह सुनिश्चित किया जा सके।

23. राज्य समिति के निर्णय बाध्यकारी होंगे--- विनिर्दिष्ट राज्य गंगा समिति की बैठकों में लिए गए निर्णय इस आदेश में निहित किसी भी मामले के बावजूद प्रत्येक जिला गंगा समिति और प्रत्येक स्थानीय प्राधिकरण अथवा अन्य प्राधिकरण अथवा बोर्ड अथवा ऐसे निर्णय में संदर्भित व्यक्ति पर लागू होंगे और वे राज्य गंगा समिति के निर्णयों का अनुपालन करेंगे।

24. राज्य गंगा समितियों के अधिकार, कर्तव्य और कार्य- (1) प्रत्येक राज्य गंगा समिति को इस अधिनियम के प्रावधानों तथा उसके तहत बनाए गए नियमों अथवा उसके तहत जारी निर्देशों तथा इस आदेश के प्रावधानों में निर्धारित नियमों के शर्ताधीन पैरा 6, 7 और 8 में उल्लिखित उपायों सहित ऐसे सभी उपायों जो वह गंगा नदी में प्रभावी प्रदूषण निवारण और नदी के संरक्षण हेतु तथा राष्ट्रीय गंगा परिषद तथा राष्ट्रीय स्वच्छ गंगा मिशन के निर्णयों को लागू करने हेतु आवश्यक अथवा अनिवार्य समझे, को करने का अधिकार होगा।

(2) राज्य गंगा समिति राष्ट्रीय गंगा परिषद और राष्ट्रीय स्वच्छ गंगा मिशन द्वारा विभिन्न कार्यक्रम और परियोजनाएं कार्यान्वित करेगी।

(3) विशेषकर और उप-पैरा (1) और (2) के प्रावधानों की सामान्यता के पूर्वाग्रह के बिना इन उपायों में निम्नलिखित सभी अथवा इनमें से कोई मामला शामिल किया जा सकता है अर्थात्:-

(क) सीवरेज अवसंरचना के संवर्धन, आवाह क्षेत्र सुधार, बाढ़ मैदानों की सुरक्षा, जन जागरूकता फैलाने तथा राज्य स्तरीय अन्य उपायों और गंगा नदी में उसकी जल गुणवत्ता बरकरार करने के लिए उसमें प्रदूषण निवारण, नियंत्रण और कम करने सहित गंगा नदी के संरक्षण संबंधी कार्यों का समन्वय और कार्यान्वयन, तथा नदी इकोलॉजी और संबंधित राज्य में प्रबंधन संबंधी अन्य उपाय करना;

(ख) संबंधित राज्य में नदी बेसिन प्रबंधन योजना का कार्यान्वयन

(ग) संबंधित राज्य में गंगा नदी में न्यूनतम इकोलॉजी प्रवाह को बरकरार रखना और तत्संबंधी कार्य।

(घ) इस आदेश के तहत अपने अधिकारों के प्रयोग और कार्यों के निष्पादन हेतु अधिनियम की धारा 10 के अंतर्गत प्रवेश एवं निरीक्षण तथा धारा 11 के अंतर्गत नमूना लेने का अधिकार;

(4) राज्य गंगा समिति को पैरा 7 में रेखांकित मुद्दों पर निर्देश देने का अधिकार होगा।

(5) राज्य गंगा समिति को पैरा समिति को अधिनियम की धारा 5 के तहत निर्देश देने का अधिकार होगा।

(6) राज्य गंगा समिति के अधिकार और कार्य अधिनियम, के प्रावधानों के अनुरूप न होते पर, किसी केन्द्रीय अथवा राज्य अधिनियम के तहत राज्य सरकार को सौंपे गए किसी अधिकार के पूर्वाग्रह से मुक्त होंगे।

25. जिला गंगा समितियों की योजनाओं और कार्यक्रमों के निष्पादन की निगरानी- प्रत्येक विनिर्दिष्ट राज्य गंगा समिति अपनी सभी जिला गंगा सुरक्षा समितियों तथा अन्य प्राधिकारियों की योजनाओं, कार्यक्रमों और परियोजनाओं के निष्पादन की निगरानी करेगी और तत्संबंधी प्रगति रिपोर्ट राष्ट्रीय स्वच्छ गंगा मिशन को सौंपेगी। 26. सभी जिला गंगा समितियों की समेकित रिपोर्टें तैयार करना और तत्संबंधी सुधारात्मक उपाय करना--- (i) प्रत्येक राज्य गंगा समिति सभी जिला गंगा सुरक्षा समितियों, स्थानीय प्राधिकरणें अथवा अन्य प्राधिकरणों अथवा बोर्ड अथवा निगम अथवा व्यक्ति द्वारा प्रस्तुत प्रत्येक तिमाही की समेकित रिपोर्ट तैयार करेगी जिसमें गंगा नदी और उसकी सहायक नदियों की सीमा में आने वाले प्रत्येक विनिर्दिष्ट जिले का उल्लेख होगा।

(क) उनके द्वारा कार्यान्वित की जा रही योजनाओं की स्थिति और उनके द्वारा किए गए उपाय तथा गंगा नदी और उसकी सहायक नदियों की दशा के विषय में कोई अन्य कार्य;

(ख) प्रत्येक विनिर्दिष्ट जिले में गंगा नदी और उसकी सहायक नदियों में जल गुणवत्ता तथा तत्संबंधी सुधारात्मक कार्रवाई;

(ग) प्रत्येक विनिर्दिष्ट जिले में गंगा नदी में प्रवाह में कोई अवरोध तथा तत्संबंधी कारण;

(घ) जिला गंगा समिति अथवा स्थानीय प्राधिकरणों अथवा अन्य प्राधिकारियों को की गई शिकायतों के समाधान के लिए किए गए उपाय;

(ङ) प्रत्येक विनिर्दिष्ट जिले में गंगा सुरक्षा लेखापरीक्षा द्वारा की गई कोई प्रतिकूल रिपोर्ट;

(च) गंगा नदी उसकी सहायक नदियों की दशा के संबंध में कोई अन्य सूचना।

(2) उप-पैरा (1) में उल्लिखित रिपोर्ट तत्संबंधी सुधारात्मक उपायों सहित वर्ष की समाप्ति के एक माह के भीतर राष्ट्रीय स्वच्छ गंगा मिशन को सौंपी जाएगी।

27. गंगा सुरक्षा लेखा परीक्षा का आयोजन और राज्य समितियों द्वारा ऐसी लेखा परीक्षा रिपोर्ट प्रस्तुत करना--- (1) राज्य गंगा समितियों का यह कर्तव्य होगा कि वे जिला गंगा सुरक्षा समितियों द्वारा गंगा लेखा परीक्षा की रिपोर्ट तत्संबंधी की गई सुधारात्मक कार्रवाई सहित राष्ट्रीय स्वच्छ गंगा मिशन को प्रस्तुत करें तथा उसे सार्वजनिक क्षेत्र में उपलब्ध भी कराएं और अपनी वेबसाइट पर भी दर्शाएं।

(2) गंगा सुरक्षा लेखा परीक्षा में ये विवरण शामिल किए जाएंगे और राष्ट्रीय स्वच्छ गंगा मिशन द्वारा जारी अधिसूचना के अनुसार विनिर्दिष्ट अंतरालों (इस आदेश में उल्लिखित अन्यथा सुरक्षित) पर यथा निर्धारित ढंग से लेखा परीक्षा की जाएगी।

**28. राज्य गंगा समिति का नोडल अभिकरण होना---** राज्य गंगा समिति, राज्य में इस आदेश के प्रावधानों के कार्यान्वयन तथा गंगा नदी और उसकी सहायक नदियों में प्रदूषण के प्रभावी निवारण तथा नदी का संरक्षण, सुरक्षा एवं प्रबंधन के लिए राज्य व्यापी नोडल अभिकरण होगी।

29. राष्ट्रीय गंगा परिषद तथा राष्ट्रीय स्वच्छ गंगा मिशन के निर्देश राज्य गंगा समिति पर बाध्यकारी होंगे---- प्रत्येक राज्य गंगा समिति इस आदेश के प्रावधानों को अनदेखा करने के पूर्वाग्रह के बिना इस आदेश के तहत अपने अधिकारों का प्रयोग अथवा कार्यों का निष्पादन करते समय वह ऐसे निर्णयों अथवा निर्देशों (तकनीकी और प्रशासनिक मामलों से संबंधित होने वाले निर्देशों सहित) जो राष्ट्रीय परिषद तथा राष्ट्रीय स्वच्छ गंगा मिशन समय-समय पर गंगा नदी में प्रदूषण निवारण तथा उसके संरक्षण, सुरक्षा एवं प्रबंधन के लिए उसे लिखित में दिए जाएं, का पालन करेगी।

**30. राज्य गंगा नदी संरक्षण प्राधिकरणों और राज्य कार्यकारी समितियों का विघटन**— (1) राज्य गंगा समितियों के गठन की तारीख से, इस आदेश के लागू होने से पहले गठित संबंधित गठित संबंधित राज्य गंगा नदी संरक्षण प्राधिकरणों के साथ-साथ राज्य कार्यकारी समितियों को विघटित हो गया माना जाएगा।

(2) ऐसे विघटन से पहले, उप-पैराग्राफ (1) के अंतर्गत प्राधिकरणों और समितियों द्वारा किए गए अथवा हटा दिए जाने वाले सभी कार्यों अथवा की गई कार्रवाई अथवा खर्च की गई राशि अथवा खर्च के लिए प्राधिकृत राशि को निष्पादन कर लिया माना जाएगा अथवा इस आदेश के संगत प्रापधानों के तहत ले लिया गया माना जाएगा।

**31. एक प्राधिकरण के रूप में राष्ट्रीय स्वच्छ गंगा मिशन का गठन-** (1) इस आदेश के लागू होने के तारीखसे सोसाइटी पंजीकरण अधिनियम, 1860 (1860 का 21) के अंतर्गत पंजीकृत एक सोसाइटी राष्ट्रीय स्वच्छ गंगा मिशन अधिनियम के उद्देश्य से और इस आदेश तथा अधिनियम और इसके तहत बनाए गए नियमों अथवा जारी किए गए निर्देशों के अंतर्गत विनिर्दिष्ट किए गए अनुसार शक्तियों का प्रयोग करने तथा कार्यो का निष्पादन के करने के लिए इस अधिनियम के अंतर्गत इसी गयि के प्राप्त के प्राप्त के प्राप्त के संतर्गत विनिर्दिष्ट किए गए अनुसार शक्तियों का प्रयोग करने तथा कार्यो का निष्पादन के करने के लिए इस अधिनियम के अंतर्गत इसी नाम से गठित एक प्राधिकरण होगा।

(2) राष्ट्रीय स्वच्छ गंगा मिशन का संघटन पैरा 35 में दिए गए अनुसार होगा।

**32. राष्ट्रीय स्वच्छ गंगा मिशन के प्रचालन का क्षेत्र-** राष्ट्रीय स्वच्छ गंगा मिशन के प्रचालन का क्षेत्र पैराग्राफ 2 में रूपरेखा दिया गया क्षेत्र होगा ।

**33. राष्ट्रीय स्वच्छ गंगा मिशन नोडल एजेंसी होगा** --- इस आदेश के प्रावधानों के राष्ट्र व्यापी कार्यान्वयन तथा प्रदूषण के प्रभावी उपशमन और गंगा नदी तथा उसकी उप-नदियों के पुनरूद्धार, संरक्षण और प्रबंधन के लिए राष्ट्रीय स्वच्छ गंगा मिशन एक नोडल एजेंसी होगा ।

**34**. एक अधिकार प्राप्त संगठन के रूप में राष्ट्रीय स्वच्छ गंगा मिशन- राष्ट्रीय स्वच्छ गंगा मिशन दो स्तरीय प्रबंधन के साथ एक अधिकार प्राप्त संगठन होगा जिसके पास इस आदेश में विनिर्दिष्ट किए गए अनुसार प्रशासनिक, मूल्यांकन एवं अनुमोदन की शक्तियां होंगी और कर्तव्य कार्य तथा शक्तियां होगी।

**35. राष्ट्रीय स्वच्छ गंगा मिशन का संघटन:-** राष्ट्रीय स्वच्छ गंगा मिशन टू-टीयर निगरानी संरचना होगी और इसमें गर्वनिंग परिषद और कार्यकारी समितियां शामिल होंगी

(क)	राष्ट्रीय स्वच्छ गंगा मिशन के महा निदेशक	अध्यक्ष पदेन
(ख)	संयुक्त सचिव, जल संसाधन, नदी विकास और गंगा संरक्षण मंत्रालय	सदस्य पदेन
(ग)	संयुक्त सचिव, शहरी विकास मंत्रालय	सदस्य पदेन
(घ)	संयुक्त सचिव, पर्यावरण, वन और जलवायु परिवर्तन मंत्रालय	सदस्य पदेन
(ङ)	संयुक्त सचिव, व्यय विभाग	सदस्य पदेन
(च)	नीति आयोग के प्रतिनिधि (संयुक्त सचिव के स्तर से कम कम न हो)	सदस्य पदेन
(छ)	अध्यक्ष, केन्द्रीय प्रदूषण नियंत्रण बोर्ड	सदस्य पदेन
(ज)	प्रधान सचिव, शहरी विकास, बिहार सरकार	सदस्य पदेन
(झ)	प्रधान सचिव, शहरी विकास, झारखंड सरकार	सदस्य पदेन
(স)	प्रधान सचिव, शहरी विकास, उत्तर प्रदेश सरकार	सदस्य पदेन
(ट)	प्रधान सचिव, पेयजल, उत्तराखंड सरकार	सदस्य पदेन
(ठ)	प्रधान सचिव, शहरी विकास, पश्चिम बंगाल सरकार	सदस्य पदेन
(ड)	ऐक्जीक्यूटिव ऑफिसर (डिप्टी डीजी), राष्ट्रीय स्वच्छ गंगा मिशन	सदस्य पदेन
(ढ)	ऐक्जीक्यूटिव डायरेक्टर (तकनीकी), राष्ट्रीय स्वच्छ गंगा मिशन	सदस्य पदेन
(ण)	ऐक्जीक्यूटिव डायरेक्टर (वित्त), राष्ट्रीय स्वच्छ गंगा मिशन	सदस्य पदेन
(त)	ऐक्जीक्यूटिव डायरेक्टर (परियोजना), राष्ट्रीय स्वच्छ गंगा मिशन	सदस्य पदेन
(थ)	ऐक्जीक्यूटिव डायरेक्टर (प्रशासन), राष्ट्रीय स्वच्छ गंगा मिशन	सदस्य-सचिव

(1) गवर्निंग परिषद में निम्नलिखित सदस्य शामिल होंगे नामत:

(2) गर्वनिंग परिषद में से गठित की गई कार्यकारिणी समिति में निम्नलिखित सदस्य शामिल होंगे नामत:-

(क) महानिदेशक, राष्ट्रीय स्वच्छ गंगा मिशन-अध्यक्ष पदेन

(ख) संयुक्त सचिव, व्यय विभाग-सदस्य पदेन

- (ग) नीति आयोग के प्रतिनिधि (संयुक्त सचिव के स्तर का) -सदस्य पदेन
- (घ) संबंधित राज्य (राज्यों) के प्रधान सचिव-सदस्य पदेन
- (ङ) ऐक्जीक्यूटिव अधिकारी (डिप्टी डीजी), राष्ट्रीय स्वच्छ गंगा मिशन सदस्य पदेन
- (च) ऐक्जीक्यूटिव डायरेक्टर (वित्त) -सदस्य पदेन
- (छ) ऐक्जीक्यूटिव डायरेक्टर (तकनीकी) -सदस्य पदेन
- (ज) ऐक्जीक्यूटिव डायरेक्टर (परियोजनाएं) -सदस्य पदेन

(3) महानिदेशक, राष्ट्रीय स्वच्छ गंगा मिशन यदि आवश्यक समझते हैं तो कार्यकारी समिति, गर्वनिंग परिषद के अन्य कोई सदस्य के साथ काम कर सकते है।

(4) गर्वनिंग परिषद अपने सदस्यों में से एक उप-समिति का गठन कर सकती है और परियोजना के मूल्यांकन हेतु कुछ तकनीकी विशेषज्ञों के साथ भी कार्य कर सकते हैं।

- (5) संबंधित राज्यों के प्रतिनिधि उप-समिति के सदस्य होंगे।
- (6) गवर्निंग काउंसिल के पास आधे सदस्यों का कोरम होना चाहिए ।

**36.** (1) 1000 करोड़ रूपये तक के सभी अनुमोदन ईसी में निहित होंगे । इसके बदले में ईसी तीन महीने में कम से कम एक बार जीसी को रिपोर्ट करेंगे ।

(2) तकनीकी विशेषज्ञों/या मान्यता प्राप्त संस्थाना या भारतीय तकनीकी संस्थानों के कंसॉर्टियम द्वारा परियोजना के तृतीय पक्ष मूल्यांकन के पूर्ण होने के पश्चात जीसी की उप समिति परियोजना का मूल्यांकन करेगी ।

(3) तृतीय पक्ष, तकनीकी मूल्यांकन उनके मूल्य को ध्यान में न रखते हुए सभी परियोजनाओं के लिए होगा।

# 37. राष्ट्रीय स्वच्छ गंगा मिशन के महानिदेशक और कार्यकारी निदेशक की नियुक्ति

(1) राष्ट्रीय स्वच्छ गंगा मिशन के महानिदेशक की नियुक्ति केन्द्र सरकार द्वारा की जाएगी। महानिदेशक का पद भारत सरकार के अपर सचिव अथवा सचिव के समकक्ष होगा। नियुक्ति की शर्तें केन्द्र सरकार द्वारा निर्धारित की जाएंगी।

(2) कार्यकारी निदेशक, वित्त की नियुक्ति निर्धारित भर्ती नियमों के अनुसार प्रतिनियुक्ति के आधार पर केन्द्र सरकार की संगठित लेखा सेवाओं के अधिकारियों में से की जाएगी जिसका पद भारत सरकार के संयुक्त सचिव के समकक्ष होगा।

(3) राष्ट्रीय स्वच्छ गंगा मिशन में प्रशासन और परियोजनाओं के लिए अलग-अलग कार्यकारी निदेशक का कम से कम एक पद होगा जिसका ओहदा भारत सरकार के संयुक्त सचिव के समकक्ष।

(4) कार्यकारी निदेशको में से एक को राष्ट्रीय स्वच्छ गंगा मिशन को उप महानिदेशक के रूप में पदनामित किया जाएगा, जिसकी नियुक्ति केन्द्र सरकार द्वारा की जाएगी।

- (5) कार्यकारी समिति को कोई भी मनोनीत सदस्य का स्तर भारत सरकार के संयुक्त सचिव की श्रेणी से कम नहीं होगा।
- 38. (1) राष्ट्रीय स्वच्छ गंगा मिशन के कर्त्तव्य : राष्ट्रीय स्वच्छ गंगा मिशन के निम्नलिखित कर्त्तव्य होंगे-

(i) इस आदेश के पैराग्राफ 5 में दिए गए सिद्धांतों और उसमें दिए गए प्रावधानों का अनुसरण करना,

(ii) राष्ट्रीय गंगा परिषद के निर्णयों और निदेशों का अनुपालन करना और इसके द्वारा अनुमोदित गंगा बेसिन प्रबंधन योजना का राष्ट्रीय गंगा परिषद के निर्देशानुसार कार्यान्वयन करना,

(iii) समयबद्ध तरीके से नदी गंगा परिषद के पुनरूद्धार और संरक्षण के लिए सभी कार्यकलापों को समन्वित करना ।

(iv) सभी अन्य कार्य करना अथवा कुछ कार्यों को नहीं करना जो गंगा नदी और इसकी उप नदियों के पुनरूद्धार और संरक्षण के लिए आवश्यक हों । **39. राष्ट्रीय स्वच्छ गंगा मिशन के कार्य.......** (1) इस आदेश के प्रावधानों के पूर्वाग्रह के बिना राष्ट्रीय स्वच्छ गंगा मिशन निम्नलिखित की पहचान करेगी अथवा पहचान का कारण बनेगी ।

(क) सीवरेज और औद्योगिक अपशिष्ट, शवों को जलाने और गाड़ने तथा पशुओं के अवशेषों के निपटान और वाणिज्यिक, मनोरंजन और धार्मिक कार्यकलापों से खतरे सहित गंगा और उसकी उप नदियों के पास जिले के प्रत्येक गांव और कस्बे में गंगा नदी के लिए विशिष्ट खतरे ।

(ख) गंगा नदी और इसकी उप-नदियों के पास ऐसे सभी जिलों के प्रत्येक गांव और कस्बे में प्रत्येक गांव में ऐसे खतरों का सामना करने के लिए अपेक्षित उपायों के प्रकार ।

(ग) वे विशिष्ट क्षेत्र जहां गंगा नदी और इसकी उप-नदियों के संरक्षण और संरक्षा के लिए ऐसे उपचारात्मक कार्रवाई की जानी अपेक्षित है ।

(घ) वे उपाय, जो शोधित जल के पुन: उपयोग के लिए आवश्यक होंगे तथा केन्द्र सरकार के मंत्रालयों जैसे रेलवे, पॉवर और पेट्रोलियम, प्राकृतिक गैस आदि राज्य सरकारों, केन्द्र और राज्य सरकार के स्वायत्त निकायों, मान्यता प्राप्त संस्थानों और सभी अन्य संगठनों के साथ समझौता ज्ञापन करना, जो राष्ट्रीय स्वच्छ गंगा मिशन सही समझे ।

(2) राष्ट्रीय स्वच्छ गंगा मिशन, गंगा नदी और इसकी उप-नदियों के पास ऐसे विनिर्दिष्ट जिलों के प्रत्येक गांव और कस्बे में गंगा नदी और इसकी उप-नदियों के संरक्षण और संरक्षा के लिए अन्य वस्तुओं में लागत, समयबद्धता और उत्तरदायित्वों के आवंटन के साथ गंगा नदी बेसिन प्रबंधन योजना बनाएगा अथवा बनाने का कारण, बनेगा और इसके लिए परियोजनाओं का कार्यान्वयन करेगा।

(3) राष्ट्रीय स्वच्छ गंगा मिशन निम्नलिखित कार्य करेगा :-

(क) जल गुणवत्ता सुनिश्चित करने तथा पर्यावरण रूप से स्थायी संरक्षण, गंगा नदी और उसकी उप-नदियों का संरक्षण और प्रबंधन और इसे अधिसूचित करना तथा पर्याप्त पारिस्थितिकीय प्रवाह को बनाए रखने के लिए आवश्यक सभी उपायों को लेने अथवा निर्देशित करने के लिए सभी समयों पर विभिन्न क्षेत्रों में विभिन्न बिंदुओं पर रखे जाने के लिए अपेक्षित गंगा नदी और उसकी उप-नदियों में पारिस्थितिकीय प्रवाह और परिणाम के निर्धारण का कारण बनेगा।

(ख) ऐसे स्थानों को पहचानने का कारण बनना; जहां गंगा नदी के जल के पर्यावरणीय प्रवाह को आशोधित किया गया है तथा इसके सुधार के लिए उपाय करना ताकि गंगा नदी और इसकी उप-नदियों के संरक्षण, संरक्षा और प्रबंधन के लिए जल के सतत प्रवाह को बनाए रखा जा सके ।

(ग) जल के इंजीनियर्ड डाइवर्जन अथवा जल के भंडारण अथवा किसी अन्य साधन के कारण गंगा नदी और इसकी उप-नदियों में जल के अंतराल के स्थान पहचानना और इनके संबंध में योजनाएं लागू करना अथवा इसके लिए उपचारात्मक कार्रवाई करना ।

(घ) गंगा नदी और इसकी उप-नदियों में जल के प्रवाह और प्रदूषण के स्तर की लगातार निगरानी करने के लिए एक प्रणाली तैयार करना ।

(ड.) ऐसे सभी उपाय करना, जो राष्ट्रीय गंगा परिषद के निर्णय को लागू करने के लिए आवश्यक हों ताकि गंगा नदी और इसकी उप-नदियों में पर्याप्त पारिस्थितिकीय प्रवाह बनाये रखा जा सके ।

(च) राज्य सरकारों, विशिष्ट राज्य गंगा समितियों, विनिर्दिष्ट जिला गंगा समितियों अथवा स्थानीय प्राधिकारियों अथवा किसी व्यक्ति अथवा निकाय, किसी प्राधिकरण, बोर्ड या निगम को प्रदूषण के उपशमन और संरक्षण गंगा नदी और इसकी उप-नदियों के संरक्षण और प्रबंधन के लिए विस्तृत परियोजना रिपोर्ट तैयार करने अथवा परियोजनाओं के कार्यान्वयन के लिए किसी एजेंसी द्वारा सहायता प्रदान करना अथवा सहायता का कारण बनना । (छ) प्रदूषण के उपशमन तथा गंगा नदी और इसकी उप-नदियों के संरक्षण, संरक्षा और प्रबंधन के संबंध में ज्ञान आधार तथा विश्लेषणात्मक उपकरणों के शोध, विकास और प्रसार के लिए एक या अधिक मौजूदा केंद्रों की स्थापना करना या स्थापना को सुकर बनाना अथवा नामोद्दिष्ट और निर्देशित करना ।

(ज) कोई अन्य उपाय करना, जो जल के सतत प्रवाह और गंगा और इसकी उप-नदियों में प्रदूषण के उपशमन के लिए आवश्यक हो ।

(4) राष्ट्रीय स्वच्छ गंगा मिशन पैराग्राफ 7 में बताए गए सभी ऐसे अन्य आपात उपाय करेगा।

40. गंगा नदी और इसकी उप-नदियों के किनारे किसी उपयुक्त स्थान पर गंगा नदी मॉनीटरिंग केन्द्र की स्थापना-----राष्ट्रीय स्वच्छ गंगा मिशन गंगा नदी बेसिन से स्थानों को पहचानेगा अथवा ऐसे स्थानों पर स्थापना करेगा अथवा किसी मौजूदा प्रयोगशाला अथवा केन्द्र अथवा संस्थान को केन्द्र के रूप में नामोद्दिष्ट करेगा जिसे 'रिवर गंगा मॉनीटरिंग सेंटर' कहा जाएगा, जो अन्य बातों में इस आदेश के अंतर्गत यथापेक्षित जल के लगातार प्रवाह और प्रदूषण के स्तर को मॉनीटर करेंगे और वहां उपचारात्मक कार्रवाई करने के लिए राष्ट्रीय स्वच्छ गंगा मिशन को तुरंत रिपोर्ट करेंगे ।

41. राष्ट्रीय स्वच्छ गंगा मिशन की शक्तियां------ (1) राष्ट्रीय गंगा परिषद के पर्यवेक्षण और निदेश के अंतर्गत गंगा नदी और उसकी उप-नदियों के संरक्षण, संरक्षा और प्रबंधन के कार्य को सुकर बनाने की भूमिका, उत्तरदायित्व और शक्तियों से युक्त राष्ट्रीय एजेंसी होने के कारण राष्ट्रीय स्वच्छ गंगा मिशन गंगा नदी के संरक्षण, संरक्षा और प्रबंधन के लिए राष्ट्रीय परिषद अथवा केन्द्र सरकार को सिफारिश करेगा अथवा स्वयं ही राज्य गंगा समितियों अथवा जिला गंगा समितियों अथवा स्थानीय प्राधिकरण अथवा किसी अन्य प्राधिकरण अथवा किसी व्यक्ति संस्था, समूह अथवा एजेंसी को अपने निर्णयानुसार निदेश जारी करेगा तथा इसके पास ऐसे सभी उपाय करने और कार्य करने की शक्तियां होंगी, जो यह गंगा नदी तथा इसकी उप-नदियों में पर्यावरणीय प्रदूषण के निषेध, नियंत्रण और उपशमन के लिए आवश्यक अथवा उचित समझे, जिनसे गंगा नदी को इसकी प्राकृतिक तथा पुरातन स्थिति तक संरक्षित किया जा सके तथा गंगा नदी तथा इससे संबंधित मामलों के संरक्षण और

 विशेष रूप से तथा उप-पैराग्राफ 1 के प्रावधानों की सामान्यतया के पूर्वाग्रह के बिना तथा इस आदेश में यथा अन्यथा उपबंधित ऐसे निदेश गंगा नदी के प्रबंधन के सभी अथवा किसी मामले को शामिल कर सकती है, नामत:-

(क) पैराग्राफ 4 में दिए गए सिद्धांतों के अनुसार में इस आदेश के पैराग्राफ 55 में उल्लिखित कार्यों को पूरा करना;

(ख) केन्द्र सरकार के अनुमोदन से प्रदूषण के उपशमन तथा गंगा नदी के संरक्षण, संरक्षा और प्रबंधन के लिए राष्ट्रीय नीति बनाना ।

(ग) गंगा नदी और इसकी उप-नदियों में संरक्षण, संरक्षा, प्रदूषण के निषेध, नियंत्रण और उपशमन के लिए गंगा बेसिन प्रबंधन योजना के प्रभावी कार्यान्वयन के लिए केन्द्र सरकार के अनुमोदन से किसी देश अथवा विदेशी एजेंसी के साथ समझौता ज्ञापन करना।

 (घ) आशोधनों के साथ अथवा उसके बिना नदी गंगा बेसिन प्रबंधन योजना को अनुमोदित करना और सीधे संशोधन, यदि कोई हो, उस पर करना;

(ड.) प्रगति रिपोर्ट का पर्यवेक्षण करना, समीक्षा करना और राज्य गंगा समितियों, जिला गंगा संरक्षण समितियों अथवा स्थानीय प्राधिकरणों और अन्य प्राधिकरणों को बुनियादी प्रबंधन योजना और गंगा नदी और इसकी उप-नदियों के मामलों से संबंधित किसी अन्य मामले पर निर्देश जारी करना ।

(च) सीवरेज के बढ़ने और बहिस्राव शोधन अवसंरचना, आवाह क्षेत्र उपचार, बाढ़ मैदानों के संरक्षण, जन-जागरूकता सृजन करना, जलीय और राइपेरियन जीवन और जैव विविधता के संरक्षण और पर्यावरणीय रूप से स्थायी नदी संरक्षण के संवर्धन के लिए ऐसे अन्य उपायों सहित गंगा नदी में प्रदूषण के उपशमन के लिए कार्यक्रमों की योजना बनाना, वित्तपोषण और कार्यान्वयन अनुमोदित करना।  (छ) प्रदूषण के निषेध, नियंत्रण और उपशमन तथा गंगा नदी और इसकी उप-नदियों के संरक्षण और प्रबंधन के लिए आरंभ किए गए विभिन्न कार्यक्रमों अथवा कार्यकलापों के कार्यान्वयन का समन्वय, मॉनीटरिंग और समीक्षा करना ।

(ज) नदी की पारिस्थितिकी को पुन: बहाल करने और नदी गंगा बेसिन राज्यों के प्रबंधन से संगत उपायों को करने के लिए किसी व्यक्ति अथवा प्राधिकरण को निर्देश देना ।

(झ) स्पेशल पर्पज वेहिकल के सृजन के लिए केन्द्र सरकार को सिफारिश करना (चाहे कंपनी अधिनियम, 2013 (2013 का 18) अथवा सोसाइटी पंजीकरण अधिनियम, 1860 (1860 का 21) के अंतर्गत एक कंपनी के रूप में अथवा भारतीय न्यास अधिनियम, 1882 (1882 का 2) के अधीन एक न्यास के रूप में) जैसाकि इस आदेश अथवा उक्त आदेश के प्रयोजन के कार्यान्वयन के लिए उपयुक्त हो।

(ञ) प्रदूषण के प्रभावी निषेध, नियंत्रण और उपशमन, गंगा नदी और इसकी उप-नदियों में संरक्षण और संरक्षा और प्रबंधन को सुनिश्चित करने के लिए नीति और कार्य के बेहतर समन्वय के लिए ऐसे उपाय करना, जिसे आवश्यक समझा जाए।

(ट) परियोजनाओं के उपयुक्त तथा शीघ्र कार्यान्वयन के लिए किसी संगत व्यक्ति अथवा प्राधिकारी को ऐसे निदेश जारी करना अथवा ऐसी परियोजनाओं को निरस्त करना अथवा निधियों के जारी रखने को रोकना अथवा पहले से जारी की गई धनराशि को सीधे रिफंड करना और किसी अन्य व्यक्ति अथवा बोर्ड अथवा कॉरपोरेशन को इसे शीघ्र कार्यान्वयन हेतु सौंपना ।

(ठ) पहले से जारी किसी भी कानून के प्रति पूर्वाग्रह रखे बिना लेखों या अन्य दस्तावेजों के रख-रखाव से किसी संबंधित या प्राधिकरण को निर्देश देना जैसा कि राष्ट्रीय स्वच्छ गंगा मिशन द्वारा विनिर्दिष्ट किया जाए;

(ड) ऐसे अन्य उपाय करना जो कि गंगा नदी और उसकी सहायक नदियों में प्रदूषण के बचाव, नियंत्रण और उपशमन की उपलब्धि, संरक्षण और निवारण और प्रबंधन के लिए आवश्यक है;

(3) राष्ट्रीय स्वच्छ गंगा मिशन को मुद्दों पर निर्देशों को जारी करने की शक्ति होगी जोकि अधिनियम की धारा 5 में निर्धारित किए गए हैं।

(4) राष्ट्रीय स्वच्छ गंगा मिशन अपने निर्णयों के कार्यान्वयन हेतु तथा राष्ट्रीय गंगा परिषद के निर्णयों के लिए उपयुक्त प्रणाली तैयार करे।

(42) कतिपय मामलों में पूर्व अनुमोदन देना---- प्रत्येक व्यक्ति राज्य गंगा समितियां, जिला गंगा संरक्षण समितियां और स्थानीय प्राधिकरण तथा अन्य प्राधिकारी गंगा नदी से संबंधित तथा गंगा नदी या इसकी सहायक नदियों के दायरे में आने वाले क्षेत्र से संबंधित निम्नलिखित मामलों पर, यदि राष्ट्रीय गंगा नदी के निर्णयों को कार्यान्वित करना अपेक्षित है, तो राष्ट्रीय स्वच्छ गंगा मिशन का पूर्व अनुमोदन प्राप्त करना होगा। नामत:-

(क) गंगा नदी के डाउन स्ट्रीम जल के प्रवाह को प्रभावित किए बिना गंगा नदी में जल के भण्डारण के डाइवर्जन की प्रणाली;

(ख) गंगा नदी या नदी के तट पर या इसके बाढ़ योजना क्षेत्रों पर पुलों और सहायक सड़कों तथा तटों का निर्माण;

(ग) घाटों का निर्माण अथवा किसी भी मौजूदा घाट का विस्तार;

(घ) घाटों का निर्माण;

(ड.) जल के संग्रह अथवा डाइवर्जन या नियंत्रण के लिए स्थायी जलीय संरचनाओं का निर्माण अथवा गंगा नदी अथवा इसकी सहायक नदियों का चैनलीकरण;

(च) पहाड़ी ढलानों और अधिसूचित वन तथा अन्य पर्यावरणीय दृष्टि से संवेदी क्षेत्रों का वन कटाव;

(छ) कोई अन्य कार्यकलाप जो कि पैराग्राफ 4 में सिद्धांतों के विपरीत निर्धारित किए गए हैं उन्हें राष्ट्रीय स्वच्छ गंगा मिशन द्वारा विनिर्दिष्ट किया जाए। **43. वित्तीय ढांचा** ---- (1) राष्ट्रीय स्वच्छ गंगा मिशन द्वारा बजटीय आवंटन अपने कार्यों, लक्ष्यों और उद्देश्यों को पूरा करने से संबंधित व्यय तथा स्थापना व्यय को वहन करने हेतु उपयोग किया जाएगा। इसके लिए शर्त यह है कि अनुदान, ऋण और

उधार के रूप में प्राप्त धन उन्हीं में विनिर्दिष्ट उद्देश्यों के लिए वहन किया जाएगा जिनके लिए यह अनुदान, ऋण और उधार प्राप्त हुआ है।

(2) राष्ट्रीय स्वच्छ गंगा मिशन लेखों तथा अन्य संबद्ध रिकार्डों का उपयुक्त रूप से रख-रखाव रखेगा और वार्षिक व्यय विवरण तैयार करेगा।

(3) राष्ट्रीय स्वच्छ गंगा मिशन के लेखों की सांविधिक लेखा परीक्षा भारत के नियंत्रक और महालेखा परीक्षक द्वारा की जाएगी और वार्षिक लेखा परीक्षा पूरी होने के पश्चात लेखा परीक्षा एजेंसी वार्षिक लेखा परीक्षा प्रमाण पत्र भेजेगी।

(4) राष्ट्रीय स्वच्छ गंगा मिशन के कार्य केन्द्रीय सतर्कता आयोग के नियंत्रण में हैं और सतर्कता संबंधी मामलों की देख रेख के लिए एक सतर्कता अधिकारी होगा।

(5) लेखा परीक्षा रिपोर्ट के साथ वार्षिक व्यय विवरण प्रति वर्ष अधिकार प्राप्त कार्यबल को भेजा जायेगा और केन्द्र सरकार इसे संसद के दोनों सदनों में प्रस्तुत करेगी।

**44. कानून विशेषज्ञों को कार्य पर लगाना** राष्ट्रीय स्वच्छ गंगा मिशन के पास एक उपयुक्त विधायी व्यवस्था होगी जिसके लिए राष्ट्रीय स्वच्छ गंगा मिशन कानूनी विशेषज्ञ परामर्शदाता और विधायी फर्म की सेवाएं लेगी जो कि राष्ट्रीय स्वच्छ गंगा मिशन को विधायी मामलों पर सलाह देने के लिए तथा अपने कर्तव्यों का निर्वाह करने के लिए राष्ट्रीय स्वच्छ गंगा मिशन को सहयोग प्रदान करने के लिए आवश्यक है।

45. रिपोर्टों की समीक्षा इसके कार्यकलापों से संबंधित सभी रिपोर्टें तथा राज्य गंगा समिति, जिला गंगा समिति या स्थानीय प्राधिकरण या बोर्ड या निगम या किसी अन्य व्यक्ति से प्राप्त रिपोर्टों की राष्ट्रीय स्वच्छ गंगा मिशन द्वारा समीक्षा की जायेगी और इन रिपोर्टों में बताए गए मामलों पर अपने विचारों के साथ यह रिपोर्ट राष्ट्रीय गंगा परिषद के सम्मुख दिशा-निर्देश हेतु प्रस्तुत की जायेगी, यदि ऐसा आवश्यक है।

**46. गंगा सुरक्षा लेखा परीक्षा रिपोर्टों का समेकन** ----- राष्ट्रीय स्वच्छ गंगा मिशन गंगा नदी की गंगा सुरक्षा लेखा परीक्षा की समेकित रिपोर्ट तैयार करेगा तथा उसे राष्ट्रीय गंगा परिषद को उन पर उपचारात्मक कार्रवाई के साथ प्रस्तुत करेगा तथा इसे सार्वजनिक क्षेत्र में भी उपलब्ध कराया जायेगा और इसे वेबसाइट पर दर्शाया जायेगा।

**47. सूचना, निरीक्षण आयोजित करने , रिपोर्टें प्रकाशित करने इत्यादि के संबंध में राष्ट्रीय स्वच्छ गंगा मिशन की शक्तियां** -------- (1) जहां राष्ट्रीय स्वच्छ गंगा मिशन अधिनियम की धारा 5 के तहत इसे आवश्यक समझें उसे वह लिखित में आदेश देकर यह कह सकता है-----

(ए) किसी भी राज्य गंगा समितियों, जिला गंगा संरक्षण समितियों या स्थानीय प्राधिकरण या अन्य प्राधिकरण या बोर्ड या निगम या व्यक्ति जिसे भी किसी भी परियोजना के कार्यनिष्पादन या ऐसी परियोजना से संबंधित कोई कार्य सौंपा गया है या किसी भी समय निधियों के उपयोग के बारे में सूचना या परियोजना के कार्य निष्पादन के लिए आवंटित ऐसी परियोजना से संबंधित स्पष्टीकरण या कार्यनिष्पादन या आवंटित निधि के उपयोग के बारे में सूचना को लिखित में या सार्वजनिक रूप से प्रचार-प्रसार करने हेत पछा जा सकता है जैसा भी राष्टीय स्वच्छ गंगा मिशन अपेक्षित समझे; अथवा

(बी) एक या एक से अधिक व्यक्ति या किसी प्राधिकरण को नियुक्त करना जो कार्य करने अथवा कार्यनिष्पादन के लिए आवंटित परियोजना तथा आवंटित निधि के उपयोग के संबंध में पूछताछ कर सके।

(सी) अपने किसी भी अधिकारी या कर्मचारी अथवा केन्द्र सरकार या राज्य सरकार अथवा किसी अन्य प्राधिकरण के अधिकारियों और कर्मचारियों को किसी भी आवंटित परियोजना के कार्यकरण अथवा कार्यनिष्पादन अथवा निधि के उपयोग के संबंध में राज्य गंगा समितियों, जिला गंगा संरक्षण समितियों अथवा अन्य प्राधिकरण अथवा बोर्ड अथवा निगम अथवा संबंधित व्यक्ति से उनके लेखों और अन्य दस्तावेजों के निरीक्षण हेतु निर्देश देना। (डी) ऐसा कोई व्यक्ति, अधिकारी, राज्य सरकार या प्राधिकरण अपेक्षित है जो इसे संबंधित किसी भी प्रकार की रिपोर्ट, रिटर्न, सांख्यिकी और अन्य सूचना भेजे और ऐसा व्यक्ति, अधिकारी, राज्य सरकार अथवा अन्य प्राधिकरण को यह कार्य करना बाध्य होगा।

**48. वित्त पोषण और कार्यान्वयन मॉडल** – (1) राष्ट्रीय स्वच्छ गंगा मिशन का विकास होगा और यह निरंतर अपने वित्तीय मॉडलों को संशोधित करेगा जिससे परियोजनाओं के कार्यनिष्पादन और सततता में सुधार होगा और जिसे प्रदूषण के उपशमन और गंगा नदी के पुनरुद्धार और संरक्षण तथा प्रबंधन के लिए राज्य गंगा समितियों, जिला गंगा संरक्षण समितियों अथवा अन्य प्राधिकरण अथवा व्यक्ति द्वारा अपनाया जा सकता है।

49. समेकित रिपोर्टों को तैयार करना --- (1) राष्ट्रीय स्वच्छ गंगा मिशन विनिर्दिष्ट राज्य गंगा समितियों, विनिर्दिष्ट जिला गंगा समितियों, स्थानीय प्राधिकरणों, अन्य प्राधिकरण, बोर्ड, निगम अथवा व्यक्ति द्वारा भेजी गयी रिपोर्टों और अन्य सूचना के आधार पर एक समेकित रिपोर्ट तैयार करेगा जिसमें प्रत्येक जिले के द्वारा गंगा नदी और उसकी सहायक नदियों के आस-पास के क्षेत्रों के संबंध में सूचना दी जायेगी।

(ए) उनके द्वारा कार्यनिष्पादित की जा रही योजनाओं की स्थिति और उनके द्वारा किए गए उपाय तथा गंगा नदी और उसकी सहायक नदियों की स्थिति से संबंधित अन्य कार्यकलाप की स्थिति;

(बी) गंगा नदी और उसकी सहायक नदियों में जल की गुणवत्ता और इस संबंध में उपचारात्मक कार्रवाई;

(सी) गंगा नदी में जल की किसी भी रूप में रूकावट और उसके कारण;

(डी) विनिर्दिष्ट जिले में नदी तट और बाढ़ मैदान और आवास की स्थिति;

(अ) जिला गंगा समिति या स्थानीय प्राधिकरणों द्वारा जनता से प्राप्त शिकायतों पर किए गए उपचारात्मक उपाय;

(एफ) प्रस्तावित उपचारात्मक कार्रवाई के साथ आने वाले शेष बाधाओं का पता लगाना;

(जी) रिपोर्ट यदि कोई है, जैसा कि गंगा सुरक्षा लेखा परीक्षकों द्वारा सूचित किया गया है;

(एच) गंगा नदी और उसकी सहायक नदियों की दशा के बारे में संबंधित अन्य सभी सूचना;

(2) राष्ट्रीय स्वच्छ गंगा मिशन उपपैराग्राफ -1 में उल्लिखित समेकित रिपोर्ट की समीक्षा करने के पश्चात कार्यबल को उपचारात्मक कार्रवाई के साथ उसे प्रस्तुत करेगा ।

50. वार्षिक रिपोर्ट----- (1) राष्ट्रीय स्वच्छ गंगा मिशन अगले वर्ष से तुरंत पहले अपने द्वारा और गंगा नदी के संबंध में अधिकार प्राप्त कार्यबल, विनिर्दिष्ट राज्य गंगा समितियों, विनिर्दिष्ट जिला गंगा संरक्षण समितियों, संबंधित स्थानीय प्राधिकरणों अथवा अन्य प्राधिकरण अथवा बोर्ड अथवा निगम अथवा व्यक्तियों द्वारा किए गए सभी कायों की समेकित वार्षिक रिपोर्ट प्रत्येक वर्ष के अंत के 3 माह में तैयार करेगा।

(2) राष्ट्रीय स्वच्छ गंगा मिशन अपने द्वारा किए गए तथा गंगा नदी संबंधी अधिकार प्राप्त कार्यबल, राज्य सरकारों, विनिर्दिष्ट राज्य गंगा समितियों, विनिर्दिष्ट जिला गंगा संरक्षण समितियों, संबंधित स्थानीय प्राधिकरणों अथवा अन्य प्राधिकरण अथवा बोर्ड अथवा निगम अथवा व्यक्तियों द्वारा किए गए सभी कार्यों उपपैरा-1 में उल्लिखित इसकी समेकित वार्षिक रिपोर्ट में अलग-अलग भागों के तहत शामिल करेगी और इस समेकित वार्षिक रिपोर्ट को राष्ट्रीय गंगा परिषद और केन्द्रीय सरकार को प्रेषित करेगी तथा इसे सार्वजनिक क्षेत्र में भी उपलब्ध कराया जायेगा। इसे वेबसाइट पर भी दर्शाया जायेगा।

**51. समितियों का गठन –** राष्ट्रीय स्वच्छ गंगा मिशन अपने सदस्यों में से एक या ज्यादा गंगा नदी प्रबंधन समितियां बनाना' और नदियों अथवा जल के क्षेत्र में ऐसे विशेषज्ञ इस आदेश के तहत अपने कार्यों के कुशल निर्वहन के लिए उपयुक्त कदम उठाए। 52. मार्गदर्शन प्राप्त करना- राष्ट्रीय गंगा परिषद के निर्णयों अथवा इस आदेश के प्रावधानों के कार्यान्वयन में यदि कोई समस्या उत्पन्न होती है, तो यह राष्ट्रीय स्वच्छ गंगा मिशन का कर्तव्य होगा कि राष्ट्रीय गंगा परिषद का मार्ग दर्शन प्राप्त करें और तदनुसार उपयुक्त कार्रवाई करें।

53. जिला गंगा संरक्षण समितियों का गठन ---(1) केन्द्र सरकार गंगा नदी में पर्यावरणीय प्रदूषण को रोकने, नियंत्रित करने और समाप्त करने के लिए इस आदेश के प्रारम्भ से एक निश्चित समय के भीतर अधिसूचना द्वारा विनिर्दिष्ट राज्य गंगा समिति के परामर्श से हिमाचल प्रदेश, उत्तराखंड, उत्तर प्रदेश, मध्य प्रदेश, छत्तीसगढ़, बिहार, झारखंड, हरियाणा, राजस्थान, पश्चिम बंगाल और राष्ट्रीय राजधानी क्षेत्र दिल्ली तथा ऐसे अन्य राज्यों में , जहां गंगा नदी की प्रमुख सहायक नदियां हैं, प्रत्येक जिले में (इस आदेश में इसके बाद विनिर्दिष्ट जिला कहा गया है) उक्त अधिनियम की धारा 23 की उपधारा(3) के अंतर्गत '' जिला गंगा संरक्षण समितियों'' के नाम से एक प्राधिकरण का गठन करेगी।

(2) प्रत्येक विनिर्दिष्ट गंगा जिले में प्रत्येक जिला गंगा समिति में निम्नलिखित सदस्य होंगे, नामत:
(ए) विनिर्दिष्ट जिले में जिला कलेक्टर। अध्यक्ष, पदेन
(बी) विनिर्दिष्ट जिले नगर पालिकाओं और ग्राम पंचायतों से राज्य सरकार द्वारा नामित दो से अधिक प्रतिनिधि सदस्य
(सी) राष्ट्रीय नदी गंगा के साथ लगने वाले विनिर्दिष्ट जिले में कार्यरत लोक निर्माण, सिंचाई, जन स्वास्थ्य, इंजीनियरिंग और
ग्रामीण पेयजल विभाग, और राज्य प्रदूषण नियंत्रण बोर्ड प्रत्येक का एक प्रतिनिधि जो जिला कलेक्टर द्वारा नामित किया
जाएगा। सदस्य, पदेन
(डी) विनिर्दिष्ट जिले में जिला कलेक्टर द्वारा नामित गंगा संरक्षण कार्यकलापों से संबद्ध दो पर्यावरणविद और स्थानीय उद्योग संघ का एक प्रतिनिधि। सदस्य
(ई) विनिर्दिष्ट जिले का एक डिविजनल वन अधिकारी । सदस्य, पदेन
(एफ) एक जिला अधिकारी जिसे जिला कलेक्टर लिए नामित करे।
सदस्य

(2) जिला कलेक्टर जिला गंगा समिति के अध्यक्ष होंगे और डिवीजनल वन अधिकारी जिला गंगा समिति के संयोजक होंगे।

(3) जिला गंगा समितियों की बैठक का समय और स्थान का निर्धारण उस समिति के अध्यक्ष करेंगे और इस आदेश के तहत प्रदत्त की गई शक्तियों और कार्यों का प्रयोग करेंगे।

बशर्ते कि जिला गंगा समिति की कम से कम एक बैठक प्रत्येक तीन माह में आयाजित की जाएगी।

(4) कोई गैर पदेन सदस्य सरकार को अथवा संबंधित जिला कलेक्टर के, जैसा भी मामला हो, लिखित नोटिस देते हुए अपने पद से त्यागपत्र दे सकता है और सरकार द्वारा अथवा जिला कलेक्टर द्वारा , जैसा भी मामला हो, उसका त्यागपत्र स्वीकार किए जाने के बाद सदस्य नहीं रहेगा।

54. जिला गंगा संरक्षण समिति का अधीक्षण, निर्देशन और नियंत्रण – जिला गंगा संरक्षण समिति के प्रबंधन (वित्तीय और प्रशासनिक मामलों सहित ) प्रबंधन का अधीक्षण निर्देशन और नियंत्रण इस आदेश में किसी बात के होते हुए राष्ट्रीय स्वच्छ गंगा मिशन में विहित होगा, जो इसके द्वारा प्रत्यक्ष रूप से अथवा विनिर्दिष्ट राज्य गंगा समिति अथवा इसके किसी अधिकारी अथवा इसके द्वारा विनिर्दिष्ट अन्य किसी प्राधिकारी के माध्यम से प्रयोग किया जाएगा।

55. जिला समितियों के कार्य और शक्तियां- (1) प्रत्येक जिला गंगा समिति पैराग्राफ चार में बताए गए सिद्धांतों के अनुसार पैराग्राफ छः और सात में विनिर्दिष्ट किए गए अनुसार प्रत्येक विनिर्दिष्ट जिले में गंगा नदी और इसकी सहायक नदियों के पुनरुद्धार, संरक्षण, मरम्मत और पुनर्वासन के लिए कार्यों का निर्वहन और शक्तियों का प्रयोग करेगी। (2) विशेष रूप से गंगा नदी और इसकी सहायक नदियों के साथ लगने वाले डिग्रेडेड क्षेत्रों के पुनरुद्धार, संरक्षण, मरम्मत और पुनर्वासन के लिए उप-पैराग्राफ 1 के सामान्य प्रावधानों के अलावा और इस आदेश और अधिनियम के अन्य प्रावधानों तथा इनके अंतर्गत बनाए गए नियमों के अधीन प्रत्येक गंगा समिति को विनिर्दिष्ट जिले में गंगा नदी और इसकी सहायक नदियों के संबंध में निम्नलिखित शक्तियां और अधिकार प्राप्त होंगे नामत :-

(ए) गंगा नदी अथवा इसकी सहायक नदियों अथवा रिवर बेड के संरक्षण के लिए गंगा नदी के साथ लगने वाले विनिर्दिष्ट जिले के क्षेत्रों में संभावित खतरों की पहचान करना और उसके संबंध में सुधारात्मक कार्रवाई की योजना बनाना और कार्रवाई करना।

(बी) विनिर्दिष्ट जिले में गंगा नदी और इसकी सहायक नदियों अथवा इसके रीवर बेड के संरक्षण के लिए अपनी ओर से सुधारात्मक कार्रवाई करना (इस आदेश के प्रावधानों को छोड़कर)।

(सी) उपचारात्मक कार्रवाई करने की स्थिति में सक्षम न होने पर राष्ट्रीय स्वच्छ गंगा मिशन और संबंधित राज्य सरकार, गंगा

राज्य समिति, जैसा भी मामला हो, को गंगा नदी के बचाव के लिए निर्देश जारी करने हेतु रिर्पोटिंग (इलैक्ट्रोनिक और लिखित में हार्ड कापी भेजकर) और उपयुक्त प्रबंधन अथवा उपचारात्मक कार्रवाई तैयार करना।

(डी) इस आदेश के प्रावधानों को प्रभावी बनाने के लिए उपयुक्त प्रशासनिक और अन्य उपाय करना ताकि इस आदेश के प्रावधानों से अलग न होते हुए या किसी भी कानून को कुछ समय के लिए लागू करने की बजाए गंगा नदी और इसकी सहायक नदियों में पर्यावरणीय प्रदूषण को रोका जा सके।

(3) यदि जिला गंगा संरक्षण समिति का यह मत है कि इस अधिनियम के तहत विसंगतियां की गयी हैं या कोई अन्य कानून कुछ समय के लिए लागू किया जा रहा है या इस आदेश के प्रावधानों से अलग है तो इसे कुछ समय के लिए कानून के अनुरूप करके उपयुक्त कार्रवाई करेगी।

(4) जिला गंगा संरक्षण समिति पैराग्राफ 7 में विनिर्दिष्ट ऐसे सभी आपातकालीन उपाय करेगी।

56. नोडल अधिकारी का पदनाम----- (1) प्रत्येक जिला गंगा समिति निम्नलिखित को नोडल अधिकारी के रूप में नामित करेगी--

(ए) गंगा नदी और इसकी सहायक नदियों के आसपास के क्षेत्रों में प्रत्येक गांव के ग्राम सभा के सरपंच

(बी) ऐसे मामले में जो गांव गंगा नदी से सटे हुए नहीं हैं, नगरपालिका योजना समिति या महानगर योजना समिति के अध्यक्ष

या किसी स्थानीय प्राधिकरण के अध्यक्ष को इस आदेश के प्रयोजनों हेतु, जिला गंगा संरक्षण समिति के अध्यक्ष के रूप में मनोनीत किया जा सकता है।

(2) प्रत्येक नोडल अधिकारी जो उप-पैराग्राफ के तहत मनोनीत हुआ है (1) गंगा नदी की और उसकी सहायिकाओं में प्रदूषण को रोकने हेतु कदम उठा सकते और स्वयं गंगा नदी और उसकी सहायिकाओं के संरक्षण हेतु उपचारात्मक उपाय कर सकते या उनके नदी तटों जो ऐसे गांवों के साथ सटे हुए हैं या अन्य क्षेत्र, जैसा भी मामला हो, जिसके लिए वह नोडल अधिकारी है और यदि वह ऐसा नहीं कर पाते हैं तो वे इस आदेश की अवहेलना को उपचारात्मक कार्रवाई हेतु जिला गंगा समिति के अध्यक्ष के ध्यान में ला सकते हैं।

(3) उप-पैराग्राफ (2) के तहत रिपोर्ट की प्राप्ति के पश्चात जिला गंगा समिति का अध्यक्ष गंगा नदी या इसके नदी तटों से सटे विनिर्दिष्ट जिलों के संरक्षण हेतु उपचारात्मक कदम उठा सकते हैं।

**57. योजनाओं की तैयारी---** (1) प्रत्येक जिला गंगा संरक्षण समिति गंगा नदी और उसकी सहायिकाओं और उनके नदी तटों से सटे विनिर्दिष्ट जिलों के संरक्षण हेतु अपनी आयोजना की तैयारी करेगा और उक्त को उसके बाद एवं राष्ट्रीय स्वच्छ गंगा मिशन के अनुमोदन के लिए प्रस्तुत करेगा।

(2) उप-पैराग्राफ (1) के तहत योजना में विनिर्दिष्ट जिला गंगा संरक्षण समिति द्वारा गंगा नदी और उसकी सहायिकाओं और उनके नदी तटों से सटे विनिर्दिष्ट जिलों से पर्यावरणीय प्रदूषण से संरक्षण, नियंत्रण और उसे हटाने हेतु उठाए गए कार्यकलाप शामिल होंगे, जिसे राज्य सरकार, राज्य गंगा समितियों या राष्ट्रीय स्वच्छ गंगा मिशन या कोई अन्य प्राधिकरण या बोर्ड और ऐसी योजना हेतु शामिल व्यय संस्तुत किया जा सकता है और समय जिसमें ऐसे कार्यकलापों को पूर्ण किया जाएगा। (58) बजट की तैयारी और लेखों का रखरखाव---- प्रत्येक जिला गंगा संरक्षण समिति प्रत्येक वित्त वर्ष में अपेक्षित फंडों को और उन उद्देश्यों जिसके लिए फंड खर्च किया जाएगा, और समय सीमा जिसके भीतर बजट में उल्लेख किए गए कार्यकलाप को पूरा किया जाएगा को दर्शाते हुए अपने बजट को तैयार करेगी और संबंधित राष्ट्रीय स्वच्छ गंगा मिशन को सूचना देते हुए संबंधित राज्य गंगा समिति को प्रस्तुत करेगी और यह समिति, भारत सरकार के नियंत्रक एवं महालेखा परीक्षक (सीएजी) द्वारा अथवा सीएजी द्वारा नियुक्त किसी अन्य अभिकरण द्वारा लेखा परीक्षा के लिए, राष्ट्रीय स्वच्छ गंगा मिशन द्वारा निर्धारित लेखों का उपयुक्त रखरखाव सुनिश्चित करेगी और यह लेखे राष्ट्रीय गंगा परिषद, राष्ट्रीय स्वच्छ गंगा मिशन राज्य गंगा समिति अथवा उनके द्वारा नियुक्त किसी संस्था द्वारा निरीक्षण के शर्ताधीन होंगे।

**(59) मासिक और वार्षिक रिपोर्टें---** (1) प्रत्येक गंगा संरक्षण समिति, राष्ट्रीय स्वच्छ गंगा मिशन और राज्य समितियों जैसा कि राष्ट्रीय स्वच्छ गंगा मिशन द्वारा विनिर्दिष्ट समय सीमा के भीतर निर्धारित किया गया है, राष्ट्रीय गंगा परिषद को मासिक और वार्षिक रिपोर्टे प्रस्तुत करेगी।

(2) उप पैरा (1) में उल्लेख की गई वार्षिक रिपोर्ट के अतिरिक्त जिला गंगा संरक्षण समिति राष्ट्रीय स्वच्छ गंगा मिशन को ऐसे समय और ऐसे फोर्म और तरीके से रिपोर्ट प्रस्तुत करेगी जिससे विनिर्दिष्ट जिले में उसके आसपास के क्षेत्र में गंगा नदी बेसिन योजना हेतु अन्य रिटर्न, विवरण और कोई प्रस्तावित या मौजूदा कार्यक्रम के संबंध में अन्य ब्यौरे हेतु निर्देश दें।

**60. बजट आवंटन----** राष्ट्रीय स्वच्छ गंगा मिशन बजट आवश्यकता को समेकित और तैयार कर सकता है और उक्त जल संसाधन मंत्रालय, नदी विकास और गंगा संरक्षण मंत्रालय को प्रस्तुत कर सकता है।

61. केंद्रीय सरकार द्वारा निर्देश--- इस आदेश में दी गई किसी भी बात के बावजूद, केंद्रीय सरकार के लिए यह विधिपूर्ण हो कि वे मंत्रालय या भारत सरकार के विभागों या राज्य सरकारों तथा राज्य गंगा समितियों, राष्ट्रीय स्वच्छ गंगा मिशन या जिला गंगा समितियों या स्थानीय प्राधिकरण या अन्य प्राधिकरण तथा सांविधिक निकायों या उनके अधिकारी या कर्मचारी, जैसा भी मामला हो लिखित में निर्देश जारी करे जिससे वे गंगा नदी और उसके सहायिकाओं के पुनरुद्धार, संरक्षण और प्रबंधन में सहायता प्रदान कर सके और ऐसा मंत्रालय या विभाग या प्राधिकरण या मिशन या बोर्ड या सरकार और सांविधिक निकाय, अधिकारी या कर्मचारी ऐसे निर्देशों के अनुपालन हेतु बाध्य होंगे।

62. अधिनियम की धारा 19 के तहत शिकायत करना--- इस आदेश के तहत गठित सभी प्राधिकरण या ऐसे प्राधिकरणों द्वारा प्राधिकृत किए गए उनके अधिकारी कोर्ट के समक्ष उक्त धारा के अंतर्गत किसी उल्लंघन को संज्ञान में रखते हुए उक्त अधिनियम की धारा 19 के तहत शिकायत कर सकते हैं।

63. अन्य दायित्वों के अतिरिक्त आदेश—इस आदेश के प्रावधान किसी स्थानीय प्राधिकरण या अन्य प्राधिकरण या बोर्ड या कॉरपोरेशन या किसी व्यक्ति द्वारा गंगा नदी में कुशल प्रदूषण नियंत्रण और पुनरुद्धार के प्रयोजन से उपाय करने हेतु अपने कार्यों के निर्वाह में और उसके संरक्षण और प्रबंधन और अभी लागू कोई अन्य कानून में अपने कार्यों के बिना किसी पक्षपात के है।

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अनसचा	

(पैराग्राफ 20 देखें)

राज्य और प्रबंधन समितियों की संरचना

क्र.सं.	विनिर्दिष्ट राज्य गंगा संरक्षण और प्रबंधन का नाम	राज्य गंगा संरक्षण और प्रबंधन समितियों की संरचना
(1)	(2)	(3)
1.	(नाम) राज्य गंगा संरक्षण और प्रबंधन समिति	(क) मुख्य सचिव, राज्य सरकार (नाम) पदेन सदस्य
		(ख) प्रधान सचिव, वित्त विभाग राज्य सरकार (नाम) सदस्य, पदेन
		(ग) प्रधान सचिव, शहरी विकास और आवास विभाग,  (नाम) सरकार- सदस्य, पदेन
		(घ) प्रधान सचिव, पर्यावरण एवं वन विभाग, राज्य सरकार (नाम)- सदस्य, पदेन
		(ङ) प्रधान सचिव, जल संसाधन विभाग, राज्य सरकार (नाम)- सदस्य, पदेन

	(च) प्रधान सचिव, सार्वजनिक स्वास्थ्य इंजीनियरिंग विभाग, राज्य सरकार (नाम) सदस्य, पदेन
	(छ) अध्यक्ष (नाम)   राज्य प्रदूषण नियंत्रण बोर्ड -सदस्य, पदेन
	(झ) (नाम) राज्य में कार्यान्वयन एजेंसी के चीफ ऐक्जीक्यूटिव अधिकारी- सदस्य, पदेन
	(ञ) वनों के प्रधान मुख्य संरक्षक, राज्य सरकार (नाम) -सदस्य, पदेन
	(ट) सरकार (नाम) द्वारा संबंधित क्षेत्रों से पांच विशेषज्ञों से अधिक मनोनीत नहीं किए जाएंगे।-सदस्य

[फा. सं. स्था.-01/2016-17/111/एनएमसीजी]

संजय कुंडू, संयुक्त सचिव

# MINISTRY OF WATER RESOURCES, RIVER DEVELOPMENT, AND GANGA REJUVENATION NOTIFICATION

#### New Delhi, the 7th October, 2016

**S.O. 3187(E).**—Whereas it is necessary to constitute authorities at Central, State and District levels to take measures for prevention, control and abatement of environmental pollution in River Ganga and to ensure continuous adequate flow of water so as to rejuvenate the River Ganga to its natural and pristine condition and for matters connected therewith or incidental thereto;

And whereas the River Ganga is of unique importance ascribed to reasons that are geographical, historical, socio-cultural and economic giving it the status of a National River;

And whereas the River Ganga has been facing serious threat due to discharge of increasing quantities of sewage, trade effluents and other pollutants on account of rapid urbanisation and industrialisation;

And whereas, the demand for water of River Ganga is growing for irrigation, drinking water supplies, industrial use and hydro-power due to increase in population, urbanisation, industrialisation, infrastructural development and taking into account the need to meet competing demands;

And whereas there is an urgent need-

- (a) to ensure effective abatement of pollution and rejuvenation of the River Ganga by adopting a river basin approach to promote inter-State and inter-sectoral co-ordination for comprehensive planning and management;
- (b) to maintain ecological flows in the River Ganga with the aim of ensuring continuous flows throughout its length so as to restore its ecological integrity that enables it to self rejuvenate;
- (c) for imposing restrictions in areas abutting the River Ganga in which industries, operations or processes, or class of industries, operations or processes shall not be carried out or shall be carried out subject to certain safeguards;
- (d) to make provision for inspection of any premises, plants, equipment, machineries, manufacturing or other processes, materials or substances and giving direction to the authorities, officers and persons as may be necessary to take steps, for prevention, control and abatement of environmental pollution in the River Ganga;

(e) for carrying out and sponsoring investigations and research relating to problems of environmental pollution in the River Ganga and examination of such manufacturing processes, material and substance as are likely to cause environmental pollution;

(f) for collection and dissemination of information in respect of matters relating to environmental pollution in the River Ganga and preparation of manual, codes or guide relating to the prevention, control and abatement of environmental pollution;

And whereas the State Governments concerned, being equally responsible for Ganga rejuvenation, are required to coordinate and implement the river conservation activities at the State level, and to take steps for comprehensive management of the River Ganga in their States; And whereas it is required to have planning, financing, monitoring and coordinating authorities for strengthening the collective efforts of the Central Government and the State Governments and authorities under this Order for effective abatement of pollution and rejuvenation, protection and management of the River Ganga;

Now, therefore, in exercise of the powers conferred by sub-section (1), read with clauses (i), (ii), (v), (vi), (vii), (ii), (ix), (x), (xii) and (xiii) of sub-section (2) and (3) of section 3 and sections 4,5,9,10,11, 19, 20 and 23 of the Environment (Protection) Act, 1986 (29 of 1986) (hereinafter referred to as the Act) and in supersession of the notifications of the Government of India in the erstwhile Ministry of Environment and Forests numbers S.O.1111(E), dated the 30<sup>th</sup> September, 2009, S.O. 2493 (E), dated the 30<sup>th</sup> September, 2009, S.O. 2494 (E), dated the 30<sup>th</sup> September 2009, S.O. 2495 (E), dated the 30<sup>th</sup> September 2009, S.O. 287 (E) dated the 8<sup>th</sup> February, 2010 and in the Ministry of Water Resources, River Development and Ganga Rejuvenation No. S.O. 2539 (E), dated the 29<sup>th</sup> September 2014, except as respects things done or omitted to be done before such supersession, the Central Government hereby------

(i)constitutes the authorities by the names mentioned in this Order for the purpose of exercising and performing such of the powers and functions (including the power to issue directions under section 5 of the Act and for taking measures with respect to the matters as mentioned in this Order;

(ii))directs, subject to the supervision and control of the Central Government and the provisions of this Order, such authority or authorities as specified in this Order that shall exercise the powers or perform the functions or take the measures so mentioned in this Order as if such authorities had been empowered by the Act to exercise those powers, perform those functions, or take such measures;

(iii)directs that all its powers and functions (except the power to constitute any authority under sub-section (3) of section 3 and to make rules under the sections 6 and 25 of the Act) under any provision of the Act shall, in relation to River Ganga and matters connected therewith, be exercisable and discharged also by the authorities constituted by this Order and by the officers specified in this Order, subject to such conditions and limitations and to the extent as specified in this Order.

**1.Short title and commencement.** – (1) This Order may be called the River Ganga (Rejuvenation, Protection and Management) Authorities Order, 2016.

(2) It shall come into force on the date of its publication in the Official Gazette.

**2. Applicability.-** This Order shall apply to the States comprising River Ganga Basin, namely, Himanchal Pradesh, Uttarakhand, Uttar Pradesh, Madhya Pradesh, Chhattisgarh, Bihar, Jharkhand, Haryana, Rajasthan, West Bengal and the National Capital Territory of Delhi and such other States, having major tributaries of the River Ganga as the National Council for Rejuvenation, Protection and Management of River Ganga may decide for the purpose of effective abatement of pollution and rejuvenation, protection and management of the River Ganga.

3.Definitions.- (1) In this Order, unless the context otherwise requires, -

(a) "Act" means the Environment (Protection) Act, 1986 (29 of 1986);

(b)"Basin" means the entire catchment of a water body or water course including the soil, water, vegetation and other natural resources in the area and includes land, water, vegetation and other natural resources on a catchment basis;

(c)"Buffer Area" means an area which extends beyond the flood plain of a stream;

(d)"catchment" or ""catchment area "includes the entire land area whose runoff from rain, snow or ice drains into a water body or a water course, before the water course joins River Ganga or its tributaries or discharges water into River Ganga or its tributaries;

(e)"commercial fishing" means large scale fishing for commercial purposes by nets, poisoning, or other modern fishing gear or methods in River Ganga or its tributaries;

(f) Competent authority means "Central Government"

(g)"deforestation" means removal or reduction of forest cover, especially when caused by anthropogenic activities or removal of trees and other vegetation of a forest excluding a planned clearance for scientific management of forest in particular in the catchment area of River Ganga;

(h)"degraded forest" means a forest having loss or reduction of native forest cover or vegetation density in the catchment area abutting River Ganga or its tributaries;

(i)"direction" shall mean direction issued under section 5 of the Act and the expression "direct" shall be construed accordingly;

(j) "District Ganga Committee" means the District Ganga Protection Committee mentioned in paragraph 53;

(k)"engineered diversion" means a structure or device constructed or installed to transfer the water of River Ganga or its tributaries into canals or other engineering structures;

(1)"flood plain" means such area of River Ganga or its tributaries which comes under water on either side of it due to floods corresponding to its greatest flow or with a flood of frequency once in hundred years;

(m)"Ghat" means sloping part at Bank of River Ganga or its tributaries with artificially constructed steps or sloping piece of land used for providing easy human access to water of River Ganga or its tributaries and includes usage of such parts for religious or other related purposes;

(n)"local authority" includes Panchayati raj institutions, municipalities, a district board, cantonment board, town planning authority or Zila Parishad or any other body or authority, by whatever name called, for the time being invested by law, for rendering essential services or with the control and management of civic services, within a specified local area;

(o)"National Mission for Clean Ganga" means the authority mentioned in paragraph 31.

(p) "notification" means a notification published in the Official Gazette and the expression 'notifying' shall be construed accordingly;

(q)"offensive matter" consists of solid waste which includes animal carcasses, kitchen or stable refuse, dung, dirt, putrid or putrefying substances and filth of any kind which is not included in the sewage;

(r)"person" include ----

(i)an individual or group or association of individuals whether incorporated or not;

(ii)a company established under the Companies Act, 2013 (18 of 2013);

(iii)any corporation established by or under any Central or State Act;

(iv)a local authority;

(v) every juridical person not falling within any of the preceding sub-clauses;

(s)"River Bed" means the dried portion of the area of River Ganga or its tributaries and includes the place where the River Ganga or its tributaries run its course when it fills with water and includes the land by the side of River Ganga or its tributaries which retains the water in its natural channel, when there is the greatest flow of water;

(t) "River Bed Farming" includes seasonal agriculture or farming on the River Bed of River Ganga or its tributaries during low flows of water;

(u)"River Ganga" means the entire length of six head-streams in the State of Uttarakhand namely, Rivers Alakananda, Dhauli Ganga, Nandakini, Pinder, Mandakini and Bhagirathi starting from their originating glaciers up to their respective confluences at Vishnu Prayag, Nand Prayag, Karn Prayag, Rudra Prayag, and Dev Prayag as also the main stem of the river thereafter up to Ganga Sagar including Prayag Raj and includes all its tributaries;

(v) "rubbish" means ashes, broken brick, mortar, broken glass, dust or refuse of any kind and includes filth;

(w) "sand mining" means large scale removal of river sand from the dried channel belt, flood plain or a part of River Ganga or its tributaries;

(x) "sewage effluent" means effluent from any sewerage system or sewage disposal works and includes sewage from open drains;

(y) "sewerage scheme" means any scheme which a local authority may introduce for removal of sewage by flushing with water through underground closed sewers;

(z) "Schedule" means Schedule appended to this Order;

(za) "specified District" means an area of every District abutting the River Ganga, being within a radius of fifteen kilometers of the Ganga River Bank or its tributaries in the States of Himachal Pradesh, Uttarakhand, Uttar Pradesh, Madhya Pradesh, Chhattisgarh, Bihar, Jharkhand, Haryana, Rajasthan, West Bengal and the National Capital Territory of Delhi and such other States, having major tributaries of the River Ganga as referred to in this Order;

(zb) "State Ganga Committee" means the State Ganga Rejuvenation, Protection and Management Committee constituted under this Order for each of the States mentioned in paragraph 2.

(zc) State Ganga River Conservation Authority means an authority earlier constituted in each State under the Act as follows, namely:-

- the Bihar State Ganga River Conservation Authority constituted by the notification of the Government of India in the Ministry of Environment and Forests number S.O287 (E), dated 8<sup>th</sup> February 2010;
- (ii) the Jharkhand State Ganga River Conservation Authority constituted by the notification of the Government of India in the Ministry of Environment and Forests number S.O2495(E), dated 30<sup>th</sup> September 2009;

- (iii) the Uttarakhand State Ganga River Conservation Authority constituted by the notification of the Government of India in the Ministry of Environment and Forests number S.O 1111 (E), dated 30<sup>th</sup> September 2009;
- (iv) the Uttar Pradesh State Ganga River Conservation Authority constituted by the notification of the Government of India in the Ministry of Environment and Forests number S.O2493 (E), dated 30<sup>th</sup> September 2009; and
- (v) the West Bengal State Ganga River Conservation Authority constituted by the notification of the Government of India in the Ministry of Environment and Forests number S.O2494 (E), dated 30<sup>th</sup> September 2009.

(zd) "stream" includes river, water course (whether flowing or for the time being dry), inland water (whether natural or artificial ) and sub-terrain waters;

(ze) "tributaries of River Ganga" means those rivers or streams which flow into River Ganga and includes Yamuna River, Son River, Mahananda River, Kosi River, Gandak River, Ghaghara River and Mahakali River and their tributaries or such other rivers which National Council for Rejuvenation Protection and Management of River Ganga may, by notification, specify for the purposes of this Order.

2. The words and expressions used herein and not defined but defined in the Environment (Protection) Act, 1986 (29 of 1986) shall have the meanings respectively assigned to them in the Act.

4. Principles to be followed for rejuvenation, protection and management of River Ganga. -(1) The following principles shall be followed in taking measures for the rejuvenation, protection and management of River Ganga, namely:-

- (i) the River Ganga shall be managed as a single system;
- (ii) the restoration and maintenance of the chemical, physical, and biological quality of the waters of River Ganga shall be achieved in a time bound manner;
- (iii) the River Ganga shall be managed in an ecologically sustainable manner;
- (iv) the continuity of flow in the River Ganga shall be maintained without altering the natural seasonal variations;
- (v) the longitudinal, lateral and vertical dimensions (connectivities) of River Ganga shall be incorporated into river management processes and practices;
- (vi) the integral relationship between the surface flow and sub-surface water (ground water) shall be restored and maintained;
- (vii) the lost natural vegetation in catchment area shall be regenerated and maintained;
- (viii) the aquatic and riparian biodiversity in River Ganga Basin shall be regenerated and conserved;
- (ix) the bank of River Ganga and its flood plain shall be construction free Zone to reduce pollution sources, pressures and to maintain its natural ground water recharge functions;
- (x) the public participation in rejuvenation, protection and management, revision and enforcement of any regulation, standard, effluent limitation plan, or programme for rejuvenation, protection and management shallbe encouraged and made an integral part of processes and practices of

River Ganga rejuvenation, protection and management.

(2)National Mission for Clean Ganga may, having regard to the needs of the people of the country, advances in technology and socio economic conditions of the people and to preserve the rich heritage of national composite culture, specify additional principles in addition to the principles specified under sub-paragraph (1).

**5.Ecological flow of water in River Ganga to be maintained**. -(1) Every State Government, shall endeavor to ensure that uninterrupted flows of water are maintained at all times in River Ganga as required under clause (iv) of paragraph (4).

(2) Every State Government shall also endeavor to maintain adequate flow of water in River Ganga in different seasons to enable River Ganga to sustain its ecological integrity and to achieve the goal, all concerned authorities shall take suitable actions in a time bound manner.

(3) For the purposes of this paragraph, the average flow of water shall be determined by such Hydrology Observation Stations at such points of the River Ganga, as may be specified by the National Mission for Clean Ganga:

Provided that the average flow of water in River Ganga may, having regard to ecology, be determined by the National Mission for Clean Ganga for different points of River Ganga.

**6.** Prevention, control and abatement of environmental pollution in River Ganga and its tributaries.- (1) No person shall discharge, directly or indirectly, any untreated or treated sewage or sewage sludge into the River Ganga or its tributaries or its banks:

Provided that where a local authority does not have, on the date of commencement of this Order, sewerage scheme or infrastructure for collection, storage, transportation and disposal of sewage or sewage sludge or such infrastructure is not functional on the said date in an area abutting the River Ganga or its tributaries, every such local authority shall, within a period, specified by National Mission for Clean Ganga from the date of commencement of this Order, develop such infrastructure or make such infrastructure functional, as the case may be, for collection, storage, transportation and disposal of sewage in the territorial area of the local authority.

(2) No person shall discharge, directly or indirectly, any untreated or treated trade effluent and industrial waste, biomedical waste, or other hazardous substance into the River Ganga or its tributaries or on their banks:

Provided further that where an industry or industrial area management does not have, on the date of commencement of this Order, industrial effluent treatment scheme or infrastructure for collection, storage, transportation and disposal of trade effluents industrial waste, bio-medical waste, or other hazardous substance, etc. or such infrastructure is not functional on the said date in an area abutting the River Ganga or its tributaries, every such industry or industrial area management shall, within a period so specified by the National Mission for Clean Ganga from the date of commencement of this Order, develop such infrastructure or make such infrastructure functional, as the case may be, for collection, storage, transportation and disposal of trade effluent and industrial waste, bio-medical waste, or other hazardous substance in the jurisdiction of the industry or industrial area management.

(3) No person shall construct any structure, whether permanent or temporary for residential or commercial or industrial or any other purposes in the River Ganga, Bank of River Ganga or its tributaries or active flood plain area of River Ganga or its tributaries:

Provided that in exceptional circumstances like natural calamities or religious events at traditional locations, temporary structures can be raised after prior permission of the National Mission for Clean Ganga acting through the State Ganga Committee and the District Ganga Committee:

Provided further that in case any such construction has been completed, before the commencement of this Order, in the River Bank of River Ganga or its tributaries or active flood plain area of River Ganga or its tributaries, the National Mission for Clean Ganga shall review such constructions so as to examine as to whether such constructions are causing interruption in the continuous flow of water or pollution in River Ganga or its tributaries, and if that be so, it shall cause for removing them.

(4) No person shall do any act or carry on any project or process or activity which, notwithstanding whether such act has been mentioned in this Order or not, has the effect of causing pollution in the River Ganga.

(5) It shall be the duty of the National Mission for Clean Ganga, every Specified State Ganga Committee or specified District Ganga Protection Committee, local authority and all other authorities and persons to disseminate widely and bring to public notice, using various means, information captured in reports and the aforesaid measures in the local language in every village, town, city and other areas abutting River Ganga and its tributaries.

**7. Emergency measures in case of pollution of River Ganga or its tributaries** --- If any poisonous, noxious or polluting matter is present or has entered into the River Ganga due to any accident or other unforeseen act or event, and it is necessary or expedient to take immediate action, the National Mission for Clean Ganga shall take immediate action for carrying out such operations or direct for carrying out such operations by the specified State Ganga Committee or specified District Ganga Committee or local authority or any other authority or Board or Corporation, as it may consider necessary for all or any of the following purposes, namely; -

(a)the manner of removing the matter from River Ganga and disposing it off in such a manner as it may specify, as also, for carrying out such operations as is considered appropriate for mitigation or removal of any pollution caused by such matter;

(b) issuing directions restraining or prohibiting any person concerned from discharging any poisonous, noxious or polluting matter in the River Ganga;

(c) undertaking any additional work or functions as may be necessary to address such emergency.

**8.** Power to issue directions. - The National Mission for Clean Ganga shall, in the exercise of its powers and performance or its functions under this Order, issue such directions in writing as it may consider necessary for abatement of pollution and rejuvenation, protection and management of the River Ganga to the concerned authority or local authority or other authorities or Board or Corporation or person and they shall be bound to comply with such directions.

**9.** Ganga safety audit.- Every District Ganga Committee shall cause the Ganga safety audit to be carried out by such Ganga Safety Auditors within such time frame and in accordance with such protocols as may be specified by the

National Mission for Clean Ganga for the area of the River Ganga abutting such district and forward the copy of the report of such safety audit along with remedial action taken thereon to the concerned State Ganga Committee and the National Mission for Clean Ganga, which shall take appropriate action thereon, if required.

**10.** Pollution in River Ganga and its tributaries to be monitored.- (1) The pollution in River Ganga and its tributaries shall be monitored by the National Mission for Clean Ganga on its own or by directions through various State and Central Government agencies by use of satellite imagery and other remote sensing technologies as well as physical stations, online monitoring and independent agencies at a periodicity to be specified by it.

(2) Notwithstanding the provisions of sub-paragraph (1), the Central Government may assign the function of monitoring of pollution in River Ganga and its tributaries to any other agency or body or direct, having regard to advances in technology, to monitor the aforesaid pollution in River Ganga and its tributaries by adopting any other technique or method, as may be specified in the direction.

**11. Constitution of National Council for Rejuvenation, Protection and Management of River Ganga. -** With effect from the date of commencement of this Order, there shall be constituted an authority by the name to be called the National Council for Rejuvenation, Protection and Management of River Ganga, (hereinafter in this Order called as the National Ganga Council) for the purposes of the Act and to exercise powers and discharge functions as specified in this Order and the Act.

**12.Composition of National Ganga Council.**-The National Ganga Council shall consist of the following members, namely:-

(a)Prime Minister	-Chairperson ,ex-officio	
(b) Union Minister for Water Resources,		
River Development and Ganga Rejuvenation	- Vice-Chairperson, ex-officio	
(c)Union Minister for Environment, Forests		
and Climate Change	- Member, ex-officio;	
(d)Union Minister for Finance	- Member, ex-officio;	
(e)Union Minister for Urban Development	- Member, ex-officio;	
(f) Union Minister for Power	- Member, <i>ex-officio</i> ;	
(g)Union Minister for Science and Technology	- Member, ex-officio;	
(h)Union Minister for Rural Development	- Member, ex-officio;	
(i)Union Minister for Drinking Water and Sanitati	on - Member, <i>ex-officio</i> ;	
(j) Union Minister for Shipping	- Member, <i>ex-officio</i> ;	
(k) Union Minister of State for Tourism	- Member, <i>ex-officio</i> ;	
(1) Vice Chairman, NITI Aayog	- Member, ex-officio;	
(m)Chief Minister, Bihar	- Member, <i>ex-officio</i> ;	
(n) Chief Minister, Jharkhand	- Member, <i>ex-officio</i> ;	
(o) Chief Minister, Uttarakhand	- Member, <i>ex-officio</i> ;	
(p) Chief Minister, Uttar Pradesh	- Member, ex-officio;	
(q) Chief Minister, West Bengal	- Member, <i>ex-officio</i> ;	
(r) Secretary, Ministry of Water Resources,		
River Development and Ganga Rejuvenation	- Member, ex-officio;	
(s)Director General, National Mission for		
Clean Ganga	– Member Secretary, ex-officio.	

(2) The National Ganga Council may co-opt one or more Chief Ministers from the States not represented in the National Ganga Council having major tributaries of River Ganga, which are likely to affect the water quality in the River Ganga, as Member.

(3) The National Ganga Council may also co-opt one or more Union Ministers, if it considers necessary, as Member.

(4) The National Ganga Council may consult experts and expert organisations or institutions in the field of river rejuvenation, river ecology and river management, hydrology, environmental engineering, social mobilisation and other relevant fields.

(5) The Headquarter of the National Ganga Council shall be at New Delhi or at such other place as it may decide.

(6) The National Ganga Council shall have its Secretariat in the National Mission for Clean Ganga.

(7) The Central Government in the Ministry of Water Resources, River Development and Ganga Rejuvenation shall serve as the nodal Ministry.

**13**. **Dissolution of National Ganga River Basin Authority** --- (1) On and from the date of constitution of the National Ganga Council in paragraph 11, the National Ganga River Basin Authority constituted by Notification of the Ministry of Water Resources, River Development and Ganga Rejuvenation, number S.O 2539 (E), dated the 29<sup>th</sup> September 2014 shall stand dissolved.

(2) All things done or omitted to be done or actions taken or any money spent or authorised to be spent by the National Ganga River Basin Authority before such dissolution shall be deemed to have been done or taken under the corresponding provisions of this Order.

**14.Superintendence, direction and control of management of River Ganga to vest in National Ganga Council.** The National Ganga Council shall, notwithstanding anything contained in this Order, be overall responsible for the superintendence, direction, development and control of River Ganga and the entire River Basin (including financial and administrative matters) for the protection, prevention, control and abatement of environmental pollution in River Ganga and its rejuvenation to its natural and pristine condition and to ensure continuous adequate flow of water in the River Ganga and for matters connected therewith.

**15. Jurisdiction of National Ganga Council.-** The jurisdiction of the National Ganga Council shall extend to the areas mentioned in paragraph 2.

**16. Meetings of National Ganga Council.-** (1) National Ganga Council may regulate its own procedure for transacting its business including its meetings.

(2) The Chairperson of the National Ganga Council shall preside over its meetings and in his absence, its Vice-Chairperson shall, preside over the meetings of the National Ganga Council and conduct its business.

(3) The Vice-Chairperson shall have the power to take decisions necessary for the National Ganga Council to achieve its objectives, in between the conduct of the two meetings of the Council subject to ratification in the next meeting.

(4) The National Ganga Council shall meet at least once every year or more as it may deem necessary.

**17. Constitution of Empowered Task Force on River Ganga as authority.-** (1) With effect from the date of commencement of this Order, there shall be constituted an authority by the name to be called the Empowered Task Force on River Ganga for the purposes of the Act and to exercise powers and discharge functions as specified in this Order and the Act.

(2) The Empowered Task Force on River Ganga shall consist of the following members, namely:-			
(a)Union Minister for Water Resources,			
River Development and Ganga Rejuvenation -	Chairperson, <i>ex-officio</i> ;		
(b) Union Minister of State for Water Resources,			
River Development and Ganga Rejuvenation -	Vice-Chairperson, ex-officio;		
(c)Secretary in the Ministry of Water Resources,			
River Development and Ganga Rejuvenation -	Member, ex-officio		
(d) Secretary in the Ministry of Finance			
(Department of Expenditure)	- Member, ex-officio;		
(e) Chief Executive Officer, Niti Ayog	- Member, ex-officio;		
(f) Chief Secretary, State of Uttrakhand	- Member, ex-officio;		
(g) Chief Secretary, State of Uttar Pradesh	- Member, ex-officio;		
(h)Chief Secretary, State of Bihar	- Member, ex-officio;		
(i) Chief Secretary, State of Jharkhand	- Member, ex-officio;		
(j) Chief Secretary, State of West Bengal	- Member, ex-officio;		
(k) Director General, National Mission for Clean Gan	ga - Member-Secretary		

(3) The Empowered Task Force on River Ganga may also co-opt one or more Secretary in the Union Ministries or the Chief Secretary of any other State concerned, if it considers necessary, as member

(4) The Empowered Task Force on River Ganga shall meet at least once every three months or more as it may deem necessary.

(5) The administrative and technical support to the Empowered Task Force on River Ganga shall be provided by the Central Government in the Ministry of Water Resources, River Development and Ganga Rejuvenation which shall be the nodal Ministry for the purposes of such administrative and technical support.

#### 18. Functions and powers of Empowered Task Force on River Ganga. -

(1) The Empowered Task Force on River Ganga shall co-ordinate and advise on matters relating to rejuvenation, protection and management of River Ganga and its tributaries.

(2) In particular and without prejudice to the generality of the provisions of sub-paragraph (1), the functions and powers of the Empowered Task Force on River Ganga may include measures with respect to all or any of the following matters in rejuvenation, protection and management of River Ganga, namely:-

- (a) ensuring that the Ministries, Departments and State Governments concerned have -
  - (i) an action plan with specific activities, milestones, and timelines for

achievement of the objective of rejuvenation and protection of River Ganga;

(ii) a mechanism for monitoring implementation of its action plans;

(b) co-ordination amongst the Ministries and Departments and State Governments concerned for implementation of its action plans in a time bound manner;

(c) to monitor the implementation process, address bottlenecks, suggest and take such decisions as may be necessary to ensure speedy implementation;

(d) all projects under the ambit of Namami Gange including ongoing projects funded domestically and through external assistance;

(e) discharge of such other functions or exercise of such powers as may be considered necessary for achievement of the objective of rejuvenation, protection and management of River Ganga or as may be assigned to it by the Central Government or specified by the National Ganga Council;

#### 19. Approval for projects exceeding value of rupees one thousand crore.-

- (1) The Empowered Task Force on River Ganga shall be responsible for the approval of every project exceeding a value of rupees one thousand crore, as amended from time to time.
- (2) The Empowered Task Force on River Ganga may constitute a sub-committee of officials amongst its members for the purpose of sub-paragraph (1)

**20.** Constitution and Composition of Specified State Ganga Rejuvenation, Protection and Management Committees as authorities.- With effect from the date of commencement of this Order, these shall be constituted, in each State as specified in paragraph 2, an authority to be called the State Ganga Rejuvenation, Protection and Management Committee, which shall consist of a Chairperson and other members as specified in the Schedule to exercise powers and discharge functions as specified in this Order and the Act.

**21. Meetings of State Ganga Committee.** – (1) Every State Ganga Committee may regulate its own procedure for transacting its business including its meetings.

(2)Every State Ganga Committee shall convene its meetings at least once in every three months' time.

(3) The Chairperson of the State Ganga Committee shall preside over its meetings and in his absence, the said Committee shall elect its Vice-Chairperson who shall, preside over the meetings of the State Ganga Committee and conduct its business.

**22.** Superintendence, direction and control over Committee.- The superintendence, direction and control of the District Ganga Committees shall, notwithstanding anything contained in this Order, vest in the State Ganga Committee, for the purposes of rejuvenation, protection, prevention, control and abatement of environmental pollution in River Ganga and its tributaries so as to rejuvenate the River Ganga to its natural and pristine condition and ensure continuous and adequate flow of water in River Ganga and for protection and management of River Ganga in the States concerned.

**23.** Decisions of State Ganga Committee to be binding.- The decision taken at the meetings of the State Ganga Committee shall, notwithstanding anything contained in this Order, be binding upon every District Ganga Committee and every local authority or other authority or Board or person referred to in such decision and they shall comply with the decisions of the State Ganga Committee.

**24.** Powers, duties and functions of State Ganga Committees.– (1) Every State Ganga Committee shall, subject to the provisions of the Act and rules made or directions issued thereunder, have the power to take all such measures, including those in paragraphs 6, 7 and 8, as it deems necessary or expedient for effective abatement of pollution and conservation

of the River Ganga and for implementing the decisions or directions of the National Ganga Council and National Mission for Clean Ganga.

(2) The State Ganga Committee shall implement various programmes and projects of the National Ganga Council and National Mission for Clean Ganga.

(3) In particular and without prejudice to the generality of the provisions of sub-paragraphs (1) and (2), such measures may include all or any of the following matters, namely:-

(a) coordination and implementation of the conservation activities relating to River Ganga including augmentation of sewerage infrastructure, catchment area treatment, protection of flood plains, creating public awareness and such other measures at the State level and regulation of activities aimed at the prevention, control and abatement of pollution in the River Ganga to maintain its water quality, and to take such other measures relevant to river ecology and management in the State concerned;

(b) implementation of the river basin management plan in the concerned State;

(c) maintenance of minimum ecological flows in the River Ganga in the concerned State and actions thereon;

(d) entry and inspection under section 10 and power to take sample under section 11 of the Act for the purpose of exercising and performing its functions under this Order.

(4) The State Ganga Committee shall undertake all the emergency measures mentioned in paragraph 7.

(5) The State Ganga Committee shall have the powers to issue directions under section 5 of the Act.

(6) The powers and functions of the State Ganga Committee shall be without prejudice to any of the powers conferred upon the State Government under any Central or State Act, being not inconsistent with the provisions of the Act.

**25. Monitoring execution of plans and programmes of District Ganga Committees.-** Every State Ganga Committee shall monitor the execution of plans, programmes, and projects of all their District Ganga Protection Committees and those of other authorities and submit progress in respect thereof to the National Mission for Clean Ganga.

**26.** Preparation of consolidated reports of all District Ganga Committees and taking remedial measures in respect thereof.- (1) Every State Ganga Committee shall prepare a consolidated report of all District Ganga Protection Committees, local authorities or other authorities or Board or Corporation or person for every quarter indicating therein in respect of each specified District abutting River Ganga and its tributaries, ----

(a) the status of the plans being executed and measures taken by them and any other activity relating to the health of River Ganga and its tributaries;

(b) the quality of water in River Ganga and its tributaries in each specified District and remedial action in respect thereof;

(c) any interruption of flow in the River Ganga in each specified District and reasons therefor;

(d) remedial measures taken on the complaints made to the District Ganga Committee or local authorities or other authorities;

(e) adverse report as reported by Ganga safety auditors in each specified District;

(f) any other information relevant to the health of River Ganga and its tributaries.

(2) The report referred to in sub-paragraph (1) shall be submitted within one month at the end of each year to the State Ganga Committee and National Mission for Clean Ganga along with remedial action thereof.

**27.** Conducting of Ganga safety audit and submission of such audit reports by State Ganga Committees.- (1) It shall be the duty of the State Ganga Committees to conduct or causes to be conducted, through the District Ganga Committees, the Ganga safety audit and submit report of the Ganga safety audit to the National Mission for Clean Ganga along with the remedial action taken thereon and also make available the same in public domain and exhibit the same at its website.

(2) The Ganga safety audit shall include such particulars and be done at such intervals (save as otherwise provided in this Order) and in such manner as may be specified, by notification, by the National Mission for Clean Ganga.

**28.** State Ganga Committee to be nodal agency.- The State Ganga Committee shall be the State-wide nodal agency in the State for the implementation of the provisions of this Order and for effective abatement of pollution and rejuvenation, protection and management of the River Ganga and its tributaries.

**29.** State Ganga Committees to be bound by direction of National Ganga Council and National Mission for Clean Ganga.- Every State Ganga Committee, without prejudice to the foregoing provisions of this Order, shall, in exercise of its powers or the performance of its functions under this Order, be bound by the decisions or such directions (including those relating to technical and administrative matters) as the National Ganga Council and the National Mission for Clean

Ganga may give in writing to it from time to time for abatement of pollution and rejuvenation, protection and management of the River Ganga.

**30.** Dissolution of State Ganga River Conservation Authorities and State Executive Committees.- (1) With effect from the date of constitution of the State Ganga Committees, the respective State Ganga River Conservation Authorities and the respective State Executive Committees constituted before the commencement of this Order shall stand dissolved.

(2)All things done or omitted to be done or actions taken or any money spent or authorised to be spent by the authorities and committees under sub-paragraph (1) before such dissolution shall be deemed to have been done or taken under the corresponding provisions of this Order.

**31.** Constitution of National Mission for Clean Ganga as an authority.-(1) With effect from the date of commencement of this Order, the National Mission for Clean Ganga, a society registered under the Societies Registration Act, 1860 (21 of 1860), shall be an authority constituted under the Act, by the same name for the purposes of the Act and to exercise powers and discharge functions as specified under this Order and the Act and the rules made or directions issued thereunder.

(2) The composition of the National Mission for Clean Ganga shall be as specified in paragraph 35.

**32. Area of operation of National Mission for Clean Ganga.-** The area of operation of the National Mission for Clean Ganga shall be the areas mentioned in paragraph 2.

**33.** National Mission for Clean Ganga to be nodal agency.- The National Mission for Clean Ganga shall be the nodal agency for the nationwide implementation of the provisions of this Order and for effective abatement of pollution and rejuvenation, protection and management of the River Ganga and its tributaries.

**34.** National Mission for Clean Ganga to be an empowered organization.- The National Mission for Clean Ganga shall be an empowered organisation with two tier management having administrative, appraisal and approval powers and duties, functions and powers as specified in this Order.

**35.** Composition of National Mission for Clean Ganga.- The National Mission for Clean Ganga shall have a two-tier management structure and it shall comprise of the Governing Council and the Executive Committee.

(a)	Director General of National Mission for Clean Ganga	Chairman, ex-officio
(b)	Joint Secretary, Ministry of Water Resources, River Development and Ganga Rejuvenation	Member, ex-officio
(c)	Joint Secretary, Ministry of Urban Development	Member, ex-officio
(d)	Joint Secretary, Ministry of Environment, Forests and Climate Change	Member, ex-officio
(e)	Joint Secretary, Department of Expenditure	Member, ex-officio
(f)	Representative of NITI Aayog (not below Joint Secretary)	Member, ex-officio
(g)	Chairman, Central Pollution Control Board	Member, ex-officio
(h)	Principal Secretary, Urban Development, Government of Bihar	Member, ex-officio
(i)	Principal Secretary, Urban Development, Government of Jharkhand	Member, ex-officio
(j)	Principal Secretary, Urban Development, Government of Uttar Pradesh	Member, ex-officio
(k)	Principal Secretary, Peyjal, Government of Uttarakhand	Member, ex-officio
(1)	Principal Secretary, Urban Development, Government of West Bengal	Member, ex-officio
(m)	Executive Director(Deputy Director General), National Mission for Clean Ganga	Member, ex-officio
(n)	Executive Director (Technical), National Mission for Clean Ganga	Member, ex-officio

(1) The Governing Council shall consist of the following members, namely:-

(0)	Executive Director (Finance), National Mission for Clean Ganga		Member, ex-officio	
(p)	Executive Director (Projects), National Mission for Clean Ganga		Member, ex-officio	
(q)	Executive Director(Administration), National Mission for Clean Ganga		Member- Secretary.	
(2) The Executive Committee constituted out of the Governing Council, shall consist of the following members, namely:-				
(a)	) Director General, National Mission for Clean Ganga – Chairperson, ex-officio;			
(b)	(b) Joint Secretary, Department of Expenditure – Member, ex-officio;			
(c)	Representative of NITI Aayog (not below Joint Secretary) – Member, ex-officio;			
(d)	Principal Secretary of the State concerned – Member, ex-officio;			
(e)	Executive Director (Deputy Director General)			
	National Mission for Clean Ganga	– Member, ex-officio;		
(f)	Executive Director (Finance)			
	National Mission for Clean Ganga	– Member, ex-officio;		
(g)	Executive Director (Technical)			
	National Mission for Clean Ganga	– Member, ex-officio;		
(h)	Executive Director (Projects)			
	National Mission for Clean Ganga	– Member, ex-officio;		

(i) Executive Director (Administration)<br/>National Mission for Clean Ganga– Member, ex-officio;

(3) The Director General, National Mission for Clean Ganga may, if he considers necessary, may associate with the Executive Committee, any other member from the Governing Council.

(4) The Governing Council may constitute a sub-committee from out of its members and also by associating some technical experts for appraisal of the projects.

(5) The representative of the State concerned shall also be one of the members of sub-committee.

(6) Half of the members of the Governing Council shall form the quorum.

**36.** (1) All approvals up to one thousand crores rupees shall be granted by the Executive Committee and it shall report to the Governing Council at least once in three months.

(2) The Sub-Committee of the Governing Council shall appraise the project only after completion of Third Party Appraisal of the project by technical experts or consortium of recognized institutes or Indian Institutes of Technology, as the case may be.

(3) The Third Party Appraisal shall be for all projects irrespective of their value.

#### 37. Appointment of Director General and Executive Directors of National Mission for Clean Ganga.-

- (1) Director General, National Mission for Clean Ganga shall be appointed by the Central Government who shall be equivalent to the rank of Additional Secretary or Secretary to the Government of India and his terms and conditions of services shall be determined by Central Government.
- (2) The Executive Director (Finance) shall be appointed on deputation from any of the organised accounts services in the Central Government in the rank equivalent to Joint Secretary to Government of India in accordance with the recruitment rules of the said services.
- (3) National Mission for Clean Ganga shall have at least one position for each of the Executive Directors in the rank of Joint Secretary to Government of India.
- (4) One of the Executive Directors shall be designated as Deputy Director General of the National Mission for Clean Ganga and he shall be appointed by the Central Government.
- (5) None of the nominated members of the Executive Committee shall be below the rank of Joint Secretary in Government of India.

38. Duty of National Mission for Clean Ganga.- It shall be the duty of the National Mission for Clean Ganga to -

(i) follow the principles laid down in paragraph 4

(ii) comply with the decisions and directions of the National Ganga Council and implement the Ganga Basin Management Plan approved by it;

(iii) co-ordinate all activities for rejuvenation and protection of River Ganga in a time bound manner as directed by the National Ganga Council;

(iv) do all other acts or abstain from doing certain act which may be necessary for rejuvenation and protection of River Ganga and its tributaries.

**39.** Functions of National Mission for Clean Ganga.- (1) Without prejudice to the provisions of this Order, the National Mission for Clean Ganga shall identify or cause to be identified -

- (a) the specific threats to the River Ganga in areas in each village and town of such specified District abutting River Ganga and its tributaries, including sewerage and industrial waste, cremation and burial of corpses and disposal of animal carcasses, and threats from commercial, recreational and religious activities;
- (b) the type of measures required to address such threat in each village and town of all districts abutting River Ganga and its tributaries;
- (c) the specific areas where such remedial actions are required to be taken for rejuvenation and protection of River Ganga and its tributaries.
- (d) the measures which may be necessary for reuse of treated water and enter in to Memorandum of Understanding in this regard with the Ministries of the Central Government like Railways, Power, Petroleum and Natural Gas etc., State Governments, autonomous bodies at the Central and State level, recognized Institutes and organizations which the National Mission for Clean Ganga may deem fit.

(2) The National Mission for Clean Ganga shall make or cause to make the River Ganga Basin Management Plan along with cost, timelines and allocation of responsibilities, among other things, for rejuvenation and protection of River Ganga and its tributaries in each village and town of specified District abutting River Ganga and its tributaries and execute projects there for.

(3) The National Mission for Clean Ganga shall -----

- (a) cause to be determined the magnitude of ecological flows in the River Ganga and its tributaries required to be maintained at different points in different areas at all times with the aim of ensuring water quality and environmentally sustainable rejuvenation, protection and management of River Ganga and its tributaries and notifying the same and take or direct all such measures necessary to maintain adequate ecological flows;
- (b) cause to be identified places where the environmental flow of water of River Ganga has been modified and take measures for correction thereof to maintain the continuous flow of water for rejuvenation, protection and management of River Ganga and its tributaries;
- (c) identify places of discontinuity of water in River Ganga and its tributaries due to engineered diversion of water or storage of water or by any other means and execute plans in respect thereof or take remedial action therefor;
- (d) devise a system to be put in place for continuous monitoring of flow of water and pollution levels in River Ganga and its tributaries;
- (e) take all such measures which may be necessary to give effect to the decisions of the National Ganga Council so as to maintain adequate ecological flows in the River Ganga and tributaries;
- (f) render assistance or cause them to be rendered by any agency for preparation of detailed project reports or execution of projects for abatement of pollution and rejuvenation, protection and management of the River Ganga and its tributaries to the State Governments, the State Ganga Committees, District Ganga Committees or local authorities or any person or body, any authority, Board or Corporation;
- (g) set up or facilitate setting up or designate and direct one or more existing centers to research, develop and disseminate knowledge base and analytical tools on abatement of pollution and rejuvenation, protection and management of River Ganga and its tributaries;
- (h) take any other measures which may be necessary for continuous flow of water and abatement of pollution in River Ganga and its tributaries

(4) The National Mission for Clean Ganga shall take all such other emergency measures as outlined in paragraph 7.

**40.** Establishment of River Ganga Monitoring Centres at suitable locations along River Ganga and its tributaries.- The National Mission for Clean Ganga may identify the places in the River Ganga Basin and establish at such places or designate any existing laboratory or station or institute as Centres to be called the "River Ganga

Monitoring Centre" for monitoring amongst other things, continuous flow of water and pollution levels as required under this Order and such Centre shall report immediately to the National Mission for Clean Ganga for taking remedial action therefor.

**41. Powers of National Mission for Clean Ganga.** (1) The National Mission for Clean Ganga being the national agency charged with the role, responsibility and powers to facilitate the task of rejuvenation, protection and management of River Ganga and its tributaries, under the supervision and direction of the National Ganga Council, shall recommend to the National Ganga Council or Central Government for issuing directions or issue directions itself, to the State Ganga Committees or District Ganga Committees or local authority or any other authority or any person, institution, consortium or agency, as it may decide, for the rejuvenation, protection and management of River Ganga and have the power to take all such measures and discharge such functions as it may deem necessary or expedient for prevention, control and abatement of environmental pollution in River Ganga and its tributaries so as to rejuvenate the River Ganga to its natural and pristine condition and ensure continuous and adequate flow of water in River Ganga and for protection and management of River Ganga and for protection and management of River Ganga and for matters connected therewith.

(2) In particular and without prejudice to the generality of the provisions of sub-paragraph (1), and save as otherwise provided in this Order, such directions may include all or any of the following matters in the management of River Ganga, namely:-

(a) fulfillment of the functions mentioned in paragraph 55 in accordance with the principles in paragraph 4;

(b) formulate, with the approval of the Central Government, the National policy for effective abatement of pollution and rejuvenation, protection and management of River Ganga;

(c) enter into memorandum of understanding, with the approval of the Central Government, with any country or foreign agency for effective implementation of the River Ganga Basin Management Plan for rejuvenation, protection, prevention, control and abatement of pollution in the River Ganga and its tributaries;

(d) approve, with or without modifications, the River Ganga Basin Management Plan and direct amendments, if any, to be made therein;

(e) supervise and review the progress reports, and issue directions to the State Ganga Committees, District Ganga Committees or local authorities and other authorities in the implementation of the River Ganga Basin Management Plan and any other matter connected with affairs of the River Ganga and its tributaries;

(f) approve the planning, financing and execution of programmes for abatement of pollution in the River Ganga including augmentation of sewerage and effluent treatment infrastructure, catchment area treatment, protection of flood plains, creating public awareness, conservation of aquatic and riparian life and biodiversity and such other measures for promoting environmentally sustainable river rejuvenation;

(g) coordination, monitoring and review of the implementation of various programmes or activities taken up for prevention, control and abatement of pollution and protection and management in the River Ganga and its tributaries;

(h) direct any person or authority to take measures for restoration of river ecology and management in the River Ganga Basin States;

(i) recommend to the Central Government, for creation of special purpose vehicles (whether as a company under the companies Act, 2013(18 of 2013) or Societies Registration Act, 1860 (21 of 1860) or a Trust under the Indian Trust Act, 1882 (2 of 1882)), as may be considered appropriate, for implementation of this Order and for the purposes of the Act;

(j) take such measures as may be necessary for the better co-ordination of policy and action to ensure effective prevention, control and abatement of pollution, rejuvenation and protection and management in the River Ganga and its tributaries;

(k) issue such directions to any person or authority, as it may consider necessary, for proper or prompt execution of the projects or cancel such projects or stop release of funds or direct refund of amount already released and assign the same to any other person or authority or Board or Corporation for prompt execution thereof;

(l) direct any person or authority to maintain such books of account or other documents, without prejudice to any law for the time being in force, as may be specified by the National Mission for Clean Ganga;

(m) take such other measures which may be necessary for achievement of prevention, control and abatement of pollution, rejuvenation and protection and management in the River Ganga and its tributaries;

(3)The National Mission for Clean Ganga shall have the power to issue directions mentioned under section 5 of the Act.

(4) The National Mission for Clean Ganga may evolve an appropriate mechanism for implementation of its decisions and the decisions of the National Ganga Council.

**42.** Giving of prior approval in certain matters.- Every person, the State Ganga Committees, District Ganga Protection Committees, local authorities and other authorities shall obtain prior approval of the National Mission for Clean Ganga, on the following matters, relating to River Ganga and any area abutting River Ganga or its tributaries, if required to implement the decisions of the National Ganga Council, namely:-

(a) engineered diversion and storage of water in River Ganga without affecting the flow of water downstream of the River Ganga;

(b) construction of bridges and associated roads and embankments over the River Ganga or at its River Bank or its flood plain area;

(c) construction of Ghats or extension of any existing Ghat;

(d) construction of jetties;

(e) construction of permanent hydraulic structures for storage or diversion or control of waters or channelisation of River Ganga or its tributaries;

(f) deforestation of hill slopes and notified forest and other eco-sensitive areas;

(g) any other activity which contravenes the principles laid out in paragraph 4 which the National Mission for Clean Ganga may specify.

**43. Financial framework.-** (1) The budgetary allocation shall be utilised by the National Mission for Clean Ganga for meeting expenses in connection with the discharge of its functions, objects and purposes and establishment expenditure: Provided that the money received by way of grants, loans and borrowings shall be expended for the specific purpose for which such grants, loans and borrowings have been received.

(2) The National Mission for Clean Ganga shall maintain proper accounts and other relevant records and prepare an annual expenditure statement.

(3)The audit of National Mission for Clean Ganga accounts shall be done by the Comptroller and Auditor-General of India and after completion of annual audit, the audit agency shall furnish annual audit certificate.

(4)The affairs of National Mission for Clean Ganga shall be subject to the control of Central Vigilance Commission and there shall be a Vigilance Officer to look after vigilance related matters.

(5) The annual expenditure statement with the audit report shall be forwarded annually to the Empowered Task Force, and the Central Government for being laid before each House of Parliament.

**44. Engagement of legal experts.-** The National Mission for Clean Ganga shall have proper legal set up for which it may engage legal experts, consultants and legal firms as may be necessary for advising it on legal matters and providing support for discharging its duties.

**45.** Scrutiny of reports.- All the reports relating to its activities and reports received from the State Ganga Committees, District Ganga Committees, local authority, Board, Corporation or any person shall be scrutinised by the National Mission for Clean Ganga and placed by it along with its views on the matters mentioned in such report before the National Ganga Council for soliciting its guidance thereon, if required.

**46.** Consolidated report of Ganga Safety audit.- The National Mission for Clean Ganga shall prepare and submit a consolidated report of the Ganga safety audits of River Ganga to the National Ganga Council along with the remedial action taken thereon and also make available the same in public domain and exhibit the same at its website.

**47.** Powers of National Mission for Clean Ganga to call for information, conduct inspection, publish reports, etc.-(1) Where the National Mission for Clean Ganga considers it expedient so to do under section 5 of the Act, it may, by order in writing.-

(a) call upon any State Ganga Committees, District Ganga Protection Committees, local authority, other authority, Board, Corporation or person, who has been allotted any project for execution or connected with such project or utilisation of funds, at any time, to furnish in writing or make public for dissemination such information or explanation relating to such project allotted for execution or executed or utilisation of fund allotted as the National Mission for Clean Ganga may require; or

(b)appoint one or more persons or any authority to make an inquiry in relation to project allotted for execution or executed or utilisation of fund allotted; or

(c) direct any of its officers or employees or the officers or employees of the Central Government or State Government or any other authority to inspect the books of account or other documents of the State Ganga Committees, District Ganga

Committees, local authority, other authority, Board, Corporation or person related to any project allotted for execution or executed or utilisation of funds; or

(d) require any person, officer, State Government or authority to furnish to it any reports, returns, statistics, accounts and other information and such person, officer, State Government or other authority shall be bound to do so.

**48. Financing and implementation model.** The National Mission for Clean Ganga shall develop and constantly refine financial models that would improve the performance and sustainability of projects, and which can be adopted by the State Ganga Committees, District Ganga Committees, local authority, other authority or person for abatement of pollution and rejuvenation, protection and management of the River Ganga.

**49. Preparation of consolidated reports.-** (1) The National Mission for Clean Ganga shall, on the basis of the reports and other information forwarded by the State Ganga Committees, District Ganga Committees, local authorities, other authorities, Board, Corporation or person, prepare a consolidated report every year indicating therein in respect of each specified District abutting River Ganga and its tributaries.-

(a) the status of the plans being executed and measures taken by them and any other activity relating to the health of River Ganga and its tributaries;

(b) the quality of water in River Ganga and its tributaries and remedial action in respect thereof;

(c) any interruption of water in the River Ganga and reasons therefor;

(d) condition of River Bed and flood plains and habitat in the specified District;

(e) remedial measures taken on the complaints received from public by the District Ganga Committee or local authorities;

(f) threats remaining to be addressed by then with remedial action proposed therefor;

(g) report if any as reported by Ganga safety auditors;

(h) all other information relevant about the health of River Ganga and its tributaries.

(2) The National Mission for Clean Ganga shall submit a consolidated report referred to in sub-paragraph (1) after review thereof to the Empowered Task Force along with remedial action thereof.

**50. Annual report.-** (1) The National Mission for Clean Ganga shall, within three months of the end of every year, prepare an annual report of all work undertaken by it and by the Empowered Task Force on River Ganga, the State Ganga Committees, District Ganga Committees, concerned local authorities, other authorities, Board, Corporation or persons during the immediately preceding year.

(2) The National Mission for Clean Ganga shall include under separate parts in its annual report referred to in subparagraph (1), all works undertaken by it and the Empowered Task Force on River Ganga, the State Governments, the State Ganga Committees, District Ganga Committees, concerned local authorities, other authorities, Board, Corporation or person, and forward the said annual report to the National Ganga Council and the Central Government and also make available in public domain and exhibit at its website.

**51.** Constitution of Committees.- The National Mission for Clean Ganga may, constitute one or more River Ganga Management Committees from amongst its members and such experts in the field of rivers or water as it may consider appropriate for the efficient discharge of its functions under this Order.

**52.** Soliciting guidance.- In case any difficulty arises in implementing decisions of the National Ganga Council or the provisions of this Order, it shall be duty of the National Mission for Clean Ganga to solicit the guidance of the National Ganga Council and take appropriate action accordingly.

**53.** Constitution of District Ganga Protection Committees.- (1) The Central Government shall immediately after the commencement of this Order, in consultation with concerned State Ganga Committee, by notification constitute, in every specified District abutting River Ganga and its tributaries in the States mentioned in paragraph 2, the "District Ganga Committees" for the prevention, control and abatement of environmental pollution in the River Ganga.

(2) Every District Ganga Committee in each specified District shall consist of the following members, namely:-

(a) the District Collector in the specified District;

- Chairperson, ex-officio;

(b) not more than two nominated representatives from Municipalities and Gram Panchayats of the specified District nominated by the State Government. - Members;

- Member, ex-officio

(c) one representative each of the Public Works, Irrigation, Public Health Engineering, and Rural Drinking Water Departments, and State Pollution Control Board working in the specified District abutting River Ganga to be nominated by the District Collector - Member, ex-officio;

(d) two environmentalists associated with River Ganga protection activities and one representative of local industry association in the specified District to be nominated by the District Collector - Members,;

(e) one Divisional Forest Officer of the specified District

(f) one District official to be nominated by the District Collector. - Member;

(2) The District Collector shall be the Chairperson of the District Ganga Committee and the Divisional Forest Officer shall be the Convener of the District Ganga Committee.

(3) The District Ganga Committees shall meet at such times and at such places as the Chairperson of that Committee may decide and exercise such powers and functions as may be conferred under this Order:

Provided that at least one meeting of the District Ganga Committee shall be held every three months.

(4) A non ex-officio member may resign his office by giving notice in writing thereof to the Central Government or to the District Collector concerned, as the case may be, and shall cease to be a member on his resignation being accepted by the Government or the District Collector concerned, as the case may be.

**54.** Superintendence, direction and control of District Ganga Committee.- The superintendence, direction and control of the management of the District Ganga Committee (including financial and administrative matters) shall, notwithstanding anything contained in this Order, vest in the National Mission for Clean Ganga which may be exercised by it either directly or through the State Ganga Committee or any of its officer or any other authority specified by it.

**55.** Functions and powers of District Ganga Committees.- (1) Every District Ganga Committee shall discharge functions and exercise powers for rejuvenation, protection, restoration and rehabilitation of River Ganga and its tributaries in each specified District as laid out in paragraph 6 and 7 as per the principles specified in paragraph 4.

(2) In particular, and without prejudice to the generality of the provisions of sub-paragraph (1) for rejuvenation and protection and restoration or rehabilitation of degraded areas abutting River Ganga and its tributaries and subject to other provisions of this Order and rules made thereunder, every District Ganga Committee shall have the following powers and functions in relation to River Ganga and its tributaries abutting in the area in specified District, namely:-

(a) identifying activities which may be threats in the area of specified District abutting the River Ganga for protection of River Ganga and its tributaries or its River bed and making a plan for remedial action and take remedial action in respect thereof;

(b) taking remedial action at its own end for protection of River Ganga and its tributaries or its River bed abutting in the specified District (excluding enforcement of the provisions of this Order)

(c) in the event of its inability to take remedial action, reporting (electronically as well as by sending written communication in hard copy) to the National Mission for Clean Ganga and concerned State Government, the State Ganga Committee, as the case may be, for issue of direction for protection of River Ganga and to formulate appropriate management or remedial actions.

(d) taking suitable administrative and other measures, to give effect to the provisions of this Order so as to prevent the environmental pollution in the River Ganga and its tributaries, not being inconsistent with the provisions of this Order, or any law for the time being in force.

(3) In case, the District Ganga Committee is of the opinion that any contravention has been made of any other law for the time being in force or in respect of provisions of this Order, it shall take appropriate action in accordance with the law for the time being in force.

(4) The District Ganga Committee shall take all such emergency measures as specified in paragraph 7.

**56. Designation of Nodal Officer.-** (1) Every District Ganga Committee shall nominate as Nodal Officer for the purposes of this Order -

(a) the Sarpanch of Gram Sabha of every village in the areas abutting the River Ganga and its tributaries;

(b) in case of an area, not being village abutting the River Ganga, the Chairperson of Municipality Planning Committee or Metropolitan Planning Committee or Chairperson of any local authority, as the Chairperson of the District Ganga Committee.

(2) Every Nodal Officer nominated under sub-paragraph (1) shall take measures to prevent the pollution of River Ganga and its tributaries and take remedial action for protection of River Ganga and its tributaries or their River bed abutting in such village or other area, as the case may be, of which he is the Nodal Officer and in case of his failure to do so, he shall report the violation of this Order to the Chairperson of the District Ganga Committee for remedial action.

(3) After receipt of the report under sub-paragraph (2), the Chairperson of the District Ganga Committee shall take remedial action for protection of River Ganga or its River bed abutting the specified District.

**57. Preparation of plans.-** (1) Every District Ganga Committee shall prepare its plan for protection of River Ganga and its tributaries and their River bed abutting the specified District and submit the same to the National Mission for Clean Ganga for its approval.

(2) The plan under sub-paragraph (1) shall include the activities to be undertaken by the District Ganga Committee for protection, control and abatement of environmental pollution in River Ganga and its tributaries and their River Bed area abutting the specified District which may be recommended by the State Government, State Ganga Committees, the National Mission for Clean Ganga, any other authority or Board and the expenditure involved for such plan and time within which such activities shall be completed.

**58. Preparation of budget and maintenance of accounts.-** Every District Ganga Committee shall prepare its budget for every financial year indicating therein the funds required and purposes for which such funds shall be spent and the time limit within which the activity mentioned in the budget shall be completed and submit to concerned State Ganga Committee under intimation to National Mission for Clean Ganga and such Committee shall ensure proper maintenance of accounts as directed by National Mission for Clean Ganga, for audit by the Comptroller and Auditor-General of India or any other agency appointed by the Comptroller and Auditor-General of India and such accounts shall be subject to inspection by National Ganga Council, National Mission for Clean Ganga, State Ganga Committee or any of their appointed entities.

**59. Monthly and annual reports.-** (1) Every District Ganga Committee shall, submit monthly and annual reports to the National Ganga Council, National Mission for Clean Ganga and State Ganga Committee as directed by National Mission for Clean Ganga within specified timelines.

(2) In addition to the annual report referred to in sub-paragraph (1), the District Ganga Committee shall furnish to the National Mission for Clean Ganga at such time and in such form and manner it may direct to furnish such other returns, statements and other particulars in regard to any proposed or existing programme for the River Ganga Basin Plan for the abutting area in the specified District.

**60. Budget allocation.-** The National Mission for Clean Ganga shall consolidate and prepare the budget requirement and submit the same to the Ministry of Water Resources, River Development and Ganga Rejuvenation.

**61. Direction by Central Government.-** Notwithstanding anything contained in this Order, it shall be lawful for the Central Government to issue directions in writing to the Ministries or Departments of the Government of India, or the State Government or the State Ganga Committees, the National Mission for Clean Ganga or District Ganga Committees, or local authority or other authority or statutory bodies or any of its officers or employees, as the case may be, to facilitate or assist in the rejuvenation, protection and management of River Ganga and its tributaries in such manner as it may direct, and such Ministry or Department or Authority or Mission or Board, Committee or Government or statutory body, officer or employee shall be bound to comply with such directions.

**62.** Making of complaint under section 19 of the Act.- All the authorities constituted under this Order or their officers authorised by such authorities may make complaint before the court under section 19 of the Act for taking cognizance of any offence under the said section.

**63.** Order to be in addition to other laws.- The provisions of this Order are without prejudice to the discharge of functions by any local authority or other authority or Board or corporation or any person for taking measures for the purposes of effective abatement of pollution and rejuvenation of the River Ganga and its protection and management and any other law for the time being in force.

#### SCHEDULE

[See paragraph 20]

# COMPOSITION OF STATE GANGA COMMITTEES

Serial No.	Name of the State Ganga Committee	Composition of the State Ganga Committees	
(1)	(2)	(3)	
1.	(Name) State Ganga Protection	(a)Chief Secretary, Government of State of	
	and Management Committee	(Name) - Chairp	person, ex-officio;
		<ul><li>(b) Principal Secretary, Department of Finance, Government of State of (Name)</li><li>Member, ex-officio;</li></ul>	
		(c) Principal Secretary, Department of Urban Development and Housing, Government of (Name)	
		- Member, ex-officio;	
		(d Principal Secretary, Department of Environment and Forests, Government of State of	
		(Name)       - Member, ex-officio         (e)Principal Secretary, Department of Water Resources, Government of State of	
		(Name) - Mer	nber, ex-officio;
		(f) Principal Secretary, Department of Public Health Engineering, Government of State of	
		(Name) - Mer	nber, ex-officio
		(g) Chairman, (Name) State Pollution	
		Control Board - Member, ex-officio;	
		<ul><li>(h)Chief Executive Officer of executing agency in the State of (Name)</li><li>Member, ex-officio;</li></ul>	
		(i)Principal Chief Conservator of Forests,	
		Government of State of (Name) – Member, ex-officio;	
		(j) not more than five experts from relevant fields to be nominated by the Government of	
		(Name) - M	embers

[F. No. Estt-01/2016-17/111/NMCG]

SANJAY KUNDU, Jt. Secy.

Annex 8

रजिस्ट्री सं० डी० एल०-33004/99

**JARG** in **ISU** The Gazette of India

असाधारण

EXTRAORDINARY

भाग II—खण्ड 3—उप-खण्ड (ii)

PART II—Section 3—Sub-section (ii)

प्राधिकार से प्रकाशित

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# जल संसाधन, नदी विकास और गंगा संरक्षण मंत्रालय

आदेश

नई दिल्ली, 7 अप्रैल, 2017

का.आ. 1186(अ).—केंद्र सरकार दिनांक 7 अक्तूबर, 2016 के का.आ. 3187(अ) द्वारा भारत के राजपत्र, असाधारण, भाग-II, खंड 3- उप-खंड (ii) में प्रकाशित अधिसूचना के पैरा 20 के साथ पर्यावरण (संरक्षण) अधिनियम, 1986 (1986 का 29) की धारा 3 की उप-धारा (1) तथा (3) द्वारा प्रदत्त शक्तियों का प्रयोग करते हुये एतद्द्वारा उत्तराखंड राज्य गंगा संरक्षण, सुरक्षा तथा प्रबंधन समिति (जिसे इसके बाद उत्तराखंड गंगा समिति कहा गया है) नामक प्राधिकरण का गठन करती है, जिसमें निम्नलिखित सदस्य शामिल होंगे :

- (i) मुख्य सचिव, उत्तराखंड सरकार– अध्यक्ष, पदेन
- (ii) प्रधान सचिव/सचिव , वित्त, उत्तराखंड सरकार सदस्य, पदेन
- (iii) प्रधान सचिव/सचिव, शहरी विकास, उत्तराखंड सरकार सदस्य, पदेन
- (iv) प्रधान सचिव/ सचिव, पर्यावरण एवं वन, उत्तराखंड सरकार सदस्य, पदेन
- (v) प्रधान सचिव / सचिव, सिंचाई, उत्तराखंड सरकार सदस्य, पदेन
- (vi) प्रधान सचिव/ सचिव , पेयजल, उत्तराखंड सरकार सदस्य, पदेन
- (vii) अध्यक्ष, उत्तराखंड पर्यावरण संरक्षण एवं प्रदूषण नियंत्रण बोर्ड, उत्तराखंड सरकार सदस्य, पदेन
- (viii) प्रधान मुख्य वन संरक्षक, उत्तराखंड सरकार सदस्य, पदेन
- (ix) कार्यक्रम निदेशक, राज्य परियोजना प्रबंधन समूह, उत्तराखंड सदस्य, संयोजक

# नामित सदस्य:

- (x) डॉ. ए. ए. काजमी, प्रोफेसर,भारतीय प्रोद्योगिकी संस्थान, रुड़की (आई.आई.टी.-आर.) 247667,
- (xi) डॉ. ए. के. लोहानी, वैज्ञानिक 'जी' राष्ट्रीय जलविज्ञान संस्थान, रुड़की (एन. आई.एच.) जल विज्ञान भवन रुड़की-247667,

- (xii) डॉ. संतोष राय, वैज्ञानिक 'डी', वाडिया इंस्टीट्यूट ऑफ हिमालयन जिओलोजी (डब्लू.आई.एच.जी.), 33, जनरल महादेव सिंह रोड, देहरादून-248001,
- (xiii) डॉ. अनिल गौतम, पीपुल साइन्स इंस्टीट्यूट (पी.एस.आई.), देहरादून,635, इन्दिरा नगर, देहरादून-248006,
- (xiv) डॉ. विशाल सिंह, सेंटर फॉर इकोलोजीकल डेवलपमेंट एंड रिसर्च (सी.ई.डी.ए.आर.), 201/1, वसंत विहार, फेज -1, देहरादून-248006
- 2. नामित सदस्यों का कार्यकाल इस आदेश की प्रकाशन की तारीख से दो वर्ष की अवधि के लिए होगा।
- उत्तराखंड राज्य गंगा समिति दिनांक 7 अक्तूबर, 2016 की ऊपर उल्लिखित अधिसूचना में दी गई शक्तियों का प्रयोग करेगी और इसमें दिये गए कार्यों का निष्पादन करेगी।
- 4. नामित सदस्यों को यात्रा भत्ता/दैनिक भत्ता और सिटिंग फीस राज्य सरकार के नियमों के अनुसार देय होगी।
- समिति दिनांक 7 अक्तूबर, 2016 की ऊपर उल्लिखित अधिसूचना के अनुसार बैठकें आयोजित करने के लिए प्रक्रिया तथा अवधि के संबंध में निर्णय ले सकती है।

[फा. सं. स्था.-01/2016-17/111/एनएमसीजी (खंड-II)]

राजीव किशोर, कार्यकारी निदेशक (प्रशासन) राष्ट्रीय स्वच्छ गंगा मिशन

# MINISTRY OF WATER RESOURCES, RIVER DEVELOPMENT AND GANGA REJUVENATION ORDER

# New Delhi, the 7th April, 2017

**S.O. 1186(E).**—In exercise of the powers conferred by sub-section (1) and (3) of Section 3 of the Environment (Protection), Act. 1986 (29 of 1986), read with the para 20 of the Notification published in the Gazette of India, Extraordinary, Part-II, Section-III, sub-section (ii) *vide* number S.O. 3187(E), dated the 7<sup>th</sup> October 2016, the Central Government hereby constitutes an authority to be called the State Ganga Rejuvenation, Protection and Management Committee for the State of Uttarakhand (herein after referred to as State Ganga Committee for the State of Uttarakhand), comprising of the following members, namely:—

- a. Chief Secretary, Government of Uttarakhand, Chairperson, Ex-officio
- b. Principal Secretary/Secretary, Finance, Government of Uttarakhand, Member, Ex-officio
- c. Principal Secretary/Secretary, Urban Development, Government of Uttarakhand, Member, Ex-officio
- d. Principal Secretary/Secretary, Environment & Forests, Government of Uttarakhand, Member, Ex-officio
- e. Principal Secretary/Secretary, Irrigation, Government of Uttarakhand, Member, Ex-officio
- f. Principal Secretary/Secretary, Drinking Water, Government of Uttarakhand, Member, Ex-officio
- g. Chairman, Uttarakhand Environment Protection & Pollution Control Board, Government of Uttarakhand, Member, Ex-officio
- h. Principal Chief Conservator of Forests, Government of Uttarakhand, Member, Ex-officio
- i. Program Director, State Programme Management Group, Uttarakhand, Member-Convener

# **Nominated Members:**

- j. Dr. A.A. Kazmi Professor, Indian Institute Technology, Roorkee (IIT-R) 247667,
- k. Dr. A.K. Lohani, Scientist `G' National Institute of Hydrology, Roorkee (NIH), Jalvigyan Bhawan, Roorkee 247667,
- 1. Dr. Santosh Rai, Scientist -'D' Wadia Institute of Himalayan Geology (WIHG), 33, General Mahadeo Singh Road, Dehradun 248001,
- m. Dr. Anil Gautam, People Science Institute (PSI), Dehradun, 635, Indira Nagar, Dehradun 248006,

- n. Dr. Vishal Singh, Center for Ecological Development and Research (CEDAR), 201/1, Vasant Vihar, Phase 1 Dehradun -248006,
- 2. The Nominated Members shall hold office for a term of two years from the date of publication of this order.
- 3. The State Ganga Committee for Uttarakhand shall exercise such powers and perform such functions as stated in the said Notification dated the 7<sup>th</sup> October, 2016.
- 4. Travelling Allowance /Daily Allowance and sitting fees of the nominated members shall be governed by the rules of the State Government.
- 5. The committee may decide the procedure & frequency for holding the meetings as per the said Notification dated the 7<sup>th</sup> October, 2016.

#### [F. No. Est-01/2016-17/111/ NMCG (Vol-II)]

RAJIV KISHORE, Executive Director (Administration) National Mission for Clean Ganga

# आदेश

# नई दिल्ली, 7 अप्रैल, 2017

का.आ. 1187(अ).—केंद्र सरकार दिनांक 7 अक्तूबर, 2016 के का.आ. 3187(अ) द्वारा भारत के राजपत्र, असाधारण, भाग-II, खंड 3- उप-खंड (ii) में प्रकाशित अधिसूचना के पैरा 20 के साथ पर्यावरण (संरक्षण) अधिनियम, 1986 (1986 का 29) की धारा 3 की उप-धारा (1) तथा (3) द्वारा प्रदत्त शक्तियों का प्रयोग करते हुये एतद्वारा उत्तर प्रदेश राज्य गंगा संरक्षण, सुरक्षा तथा प्रबंधन समिति (जिसे इसके बाद उत्तर प्रदेश गंगा समिति कहा गया है) नामक प्राधिकरण का गठन करती है, जिसमें निम्नलिखित सदस्य शामिल होंगे :

- (i) मुख्य सचिव, उत्तर प्रदेश की राज्य सरकार– अध्यक्ष, पदेन
- (ii) प्रधान सचिव/ सचिव, वित्त विभाग, उत्तर प्रदेश की राज्य सरकार सदस्य, पदेन
- (iii) प्रधान सचिव, आवास एवं शहरी नियोजन, उत्तर प्रदेश की राज्य सरकार सदस्य, पदेन
- (iv) प्रधान सचिव / सचिव, पर्यावरण विभाग , उत्तर प्रदेश की राज्य सरकार सदस्य, पदेन
- (v) प्रधान सचिव / सचिव, वन विभाग, उत्तर प्रदेश की राज्य सरकार सदस्य, पदेन
- (vi) प्रधान सचिव, सिंचाई एवं जल संसाधन विभाग, उत्तर प्रदेश की राज्य सरकार सदस्य, पदेन
- (vii) प्रधान सचिव/ सचिव, शहरी विकास विभाग, उत्तर प्रदेश की राज्य सरकार सदस्य, पदेन
- (viii) प्रधान मुख्य वन संरक्षक, उत्तर प्रदेश की राज्य सरकार सदस्य, पदेन
- (ix) अध्यक्ष, उत्तर प्रदेश प्रदूषण नियंत्रण बोर्ड सदस्य, पदेन
- (x) प्रबंध निदेशक, उत्तर प्रदेश जल निगम
- (xi) परियोजना निदेशक, राज्य परियोजना प्रबंधन समूह, उत्तर प्रदेश- सदस्य, संयोजक

# नामित सदस्य:

- (xii) श्रीमती प्रीति चतुर्वेदी, वैज्ञानिक एफ व एच एवं इक्वेटिक ओक्सियोलोजी प्रभाग, आई.टी.आर.सी., लखनऊ ।
- (xiii) प्रोफेसर आर.सी. वैश्य, पर्यावरणीय इंजीनियरिंग, एमएनआईटी, इलाहाबाद।
- (xiv) डॉ. बी.डी. त्रिपाठी, समन्वयक, पर्यावरण विज्ञान एवं प्रोधौगिकी केंद्र, बीएचयू, वाराणसी ।
- (xv) डॉ. सुरेश कुमार रोहिल्ला, साकेत-12-ए, फ्लेट सं. 14-ए, वैशाली अपार्टमेंट, नई- दिल्ली ।
- (xvi) श्री नीरज श्रीवास्तव (गंगा कार्यकर्ता), 7/81-नारायण दीप, एनेक्सी, तिलक नगर, कानपुर ।
- 2. नामित सदस्यों का कार्यकाल इस आदेश की प्रकाशन की तारीख से दो वर्ष की अवधि के लिए होगा ।

- उत्तर प्रदेश राज्य गंगा समिति दिनांक 7 अक्तूबर, 2016 की ऊपर उल्लिखित अधिसूचना में दी गई शक्तियों का प्रयोग करेगी और इसमें दिये गए कार्यों का निष्पादन करेगी।
- 4. नामित सदस्यों को यात्रा भत्ता/दैनिक भत्ता और सिटिंग फीस राज्य सरकार के नियमों के अनुसार देय होगी ।
- समिति दिनांक 7 अक्तूबर, 2016 की ऊपर उल्लिखित अधिसूचना के अनुसार बैठकें आयोजित करने के लिए प्रक्रिया तथा अवधि के संबंध में निर्णय ले सकती है।

[फा. सं. स्था.-01/2016-17/111/एनएमसीजी (खंड-II)]

राजीव किशोर, कार्यकारी निदेशक (प्रशासन)

राष्ट्रीय स्वच्छ गंगा मिशन

# ORDER

# New Delhi, the 7th April, 2017

**S.O. 1187(E).**—In exercise of the powers conferred by sub-section (1) and (3) of Section 3 of the Environment (Protection), Act. 1986 (29 of 1986), read with the para 20 of the notification published in the Gazette of India, Extraordinary, Part-II, Section-III, sub-section (ii) vide number S. 0. 3187 (E), dated the 7<sup>th</sup> October 2016, the Central Government hereby constitutes an authority to be called the State Ganga Rejuvenation, Protection and Management Committee for the State of Uttar Pradesh (herein after referred to as State Ganga Committee for the State of Uttar Pradesh), comprising of the following members, namely:—

- a. Chief Secretary, Government of State of Uttar Pradesh- Chairperson, Ex- officio
- b. Principal Secretary/Secretary, Department of Finance, Government of State of Uttar Pradesh Member, Ex-officio
- c. Principal Secretary, Department of Housing and Urban Planning, Government of State of Uttar Pradesh – Member, Ex-officio
- d. Principal Secretary/Secretary, Department of Environment, Government of State of Uttar Pradesh Member, Ex-officio
- e. Principal Secretary/Secretary, Department of Forest, Government of State of Uttar Pradesh Member, Ex-officio
- f. Principal Secretary, Department of Irrigation and Water Resources, Government of State of Uttar Pradesh Member, Ex-officio
- g. Principal Secretary/Secretary, Department of Urban Development, Government of State of Uttar Pradesh Member, Ex-officio
- h. Principal Chief Conservator of Forests, Government of State of Uttar Pradesh Member, Ex-officio
- i. Chairman, Uttar Pradesh Pollution Control Board Member, Ex-officio
- j. Managing Director, Uttar Pradesh Jal Nigam.
- k. Project Director, State Programme Management Group, Uttar Pradesh, Member-Convener

# Nominated Members:

- 1. Smt. Preeti Chaturvedi, Scientist F & H and Equatic Oxyology Division, I.T.R.C., Lucknow.
- m. Prof. R.C. Vaishya, Environmental Engineering, MNIT, Allahabad.

- n. Shri B.D. Tripathi, Coordinator Centre for Environmental Science & Technology, BHU, Varanasi.
- o. Dr. Suresh Kumar Rohilla, Saket-12-A, Flat No. 14-A, Vaishali Apartment, New Delhi.
- p. Shri Neeraj Srivastava, (Ganga Activist) 7/81-Narayan Deep, Annexe, Tilak Nagar, Kanpur.
- 2. The Nominated Members shall hold office for a term of two years from the date of publication of this order.
- 3. The State Ganga Committee for Uttar Pradesh shall exercise such powers and perform such functions as stated in the said Notification dated the 7<sup>th</sup> October, 2016.
- 4. Travelling Allowance /Daily Allowance and sitting fees of the nominated members shall be governed by the rules of the State Government.
- 5. The committee may decide the procedure & frequency for holding the meetings as per the said Notification dated the 7<sup>th</sup> October, 2016.

[F. No. Est-01/2016-17/111/ NMCG (Vol-II)]

RAJIV KISHORE, Executive Director (Administration) National Mission for Clean Ganga

# आदेश

# नई दिल्ली 7 अप्रैल, 2017

का.आ. 1188(अ).—केंद्र सरकार दिनांक 7 अक्तूबर, 2016 के का.आ. 3187(अ) द्वारा भारत के राजपत्र, असाधारण, भाग-II, खंड 3- उप-खंड (ii) में प्रकाशित अधिसूचना के पैरा 20 के साथ पर्यावरण (संरक्षण) अधिनियम, 1986 (1986 का 29) की धारा 3 की उप-धारा (1) तथा (3) द्वारा प्रदत्त शक्तियों का प्रयोग करते हुये एतद्वारा झारखंड राज्य गंगा संरक्षण, सुरक्षा तथा प्रबंधन समिति (जिसे इसके बाद झारखंड गंगा समिति कहा गया है) नामक प्राधिकरण का गठन करती है, जिसमें निम्नलिखित सदस्य शामिल होंगे :

- (i) मुख्य सचिव, झारखंड सरकार– अध्यक्ष, पदेन ;
- (ii) अतिरिक्त मुख्य सचिव/प्रधान सचिव/सचिव, वित्त विभाग, झारखंड की राज्य सरकार सदस्य, पदेन ;
- (iii) प्रधान सचिव/सचिव, शहरी विकास एवं आवास विभाग, झारखंड की राज्य सरकार सदस्य, पदेन ;
- (iv) अतिरिक्त मुख्य सचिव/प्रधान सचिव/सचिव, पर्यावरण एवं वन विभाग, झारखंड की राज्य सरकार–सदस्य, पदेन ;
- (v) प्रधान सचिव/सचिव, जल संसाधन विभाग, झारखंड की राज्य सरकार सदस्य, पदेन;
- (vi) प्रधान सचिव/सचिव, पेयजल एवं स्वच्छता विभाग, झारखंड की राज्य सरकार सदस्य, पदेन ;
- (vii) अध्यक्ष, झारखंड राज्य प्रदूषण नियंत्रण बोर्ड, झारखंड की राज्य सरकार सदस्य, पदेन ;
- (viii) अध्यक्ष एवं प्रबंध निदेशक, जे. यू. आई. डी. सी. ओ. लिमिटेड सदस्य, पदेन ;
- (ix) प्रधान मुख्य वन संरक्षक, झारखंड सरकार सदस्य, पदेन ;
- (x) परियोजना निदेशक, राज्य परियोजना प्रबंधन समूह, झारखंड सदस्य, संयोजक ;

# नामित सदस्य:

- (xi) डॉ. मकरंद एम. घनग्रेकर, प्रोफेसर, डिपार्टमेंट ऑफ सिविल इंजीनिएरिंग, भारतीय प्रोद्योगिकी संस्थान, खड़गपुर, 721302, भारत
- (xii) डॉ. चिंतालाचेरुवु मधुसूदना राव, असिस्टेंट प्रोफेसर, डिपार्टमेंट ऑफ सिविल इंजीनिएर्रिंग, राष्ट्रीय प्रोद्योगिकी संस्थान, जमशेदपुर, 831014, झारखंड, भारत

- (xiii) डॉ. आलोक सिन्हा, सेंटर ऑफ माइर्निंग एनवायरनमेंट, डिपार्टमेंट ऑफ एनवायरनमेंट साइन्स एंड इंजीनिएर्रिंग, इंडियन स्कूल ऑफ माइंस, धनबाद -826004, डी.16 टीचर्स कॉलोनी, इंडियन स्कूल ऑफ माइंस
- (xiv) डॉ. राम प्रसाद शर्मा, रिटायर्ड, डिपार्टमेंट ऑफ साइन्स एंड टेक्नालजी, झारखंड की राज्य सरकार, सैक्टर-4, आर.एच.-2, ब्लॉक-सी, रो हाउस, नेशनल गेम, हाउसिंग कॉम्प्लेक्स (एन. जी. एच.सी.), होतवार, रांची-835217,
- 2. नामित सदस्यों का कार्यकाल इस आदेश की प्रकाशन की तारीख से दो वर्ष की अवधि के लिए होगा।
- झारखंड राज्य गंगा समिति दिनांक 7 अक्तूबर, 2016 की ऊपर उल्लिखित अधिसूचना में दी गई शक्तियों का प्रयोग करेगी और इसमें दिये गए कार्यों का निष्पादन करेगी।
- 4. नामित सदस्यों को यात्रा भत्ता/दैनिक भत्ता और सिटिंग फीस राज्य सरकार के नियमों के अनुसार देय होगी।
- 5. समिति दिनांक 7 अक्तूबर, 2016 की ऊपर उल्लिखित अधिसूचना के अनुसार बैठकें आयोजित करने के लिए प्रक्रिया तथा अवधि के संबंध में निर्णय ले सकती है।

[फा. सं. स्था.-01/2016-17/111/एनएमसीजी (खंड-II)]

राजीव किशोर, कार्यकारी निदेशक (प्रशासन) राष्ट्रीय स्वच्छ गंगा मिशन

# ORDER

#### New Delhi, the 7th April, 2017

**S.O. 1188(E).**—In exercise of the powers conferred by sub-section (1) and (3) of Section 3 of the Environment (Protection), Act. 1986 (29 of 1986), read with the para 20 of the notification published in the Gazette of India, Extraordinary, Part-II, Section-III, sub-section (ii) vide number S.O. 3187(E), dated the 7<sup>th</sup> October 2016, the Central Government hereby constitutes an authority to be called the State Ganga Rejuvenation, Protection and Management Committee for the State of Jharkhand (herein after referred to as State Ganga Committee for the State of Jharkhand), comprising of the following members, namely:—

- a. Chief Secretary, Government of Jharkhand, Chairperson, Ex-officio;
- b. Addl. Chief Secretary/Principal Secretary/Secretary, Department of Finance, Government of State of Jharkhand -Member, Ex-officio;
- c. Principal Secretary/Secretary, Urban Development & Housing Department, Government of State of Jharkhand -Member, Ex-officio;
- d. Addl. Chief Secretary/Principal Secretary/Secretary, Department of Environment & Forest, Government of State of Jharkhand -Member, Ex-officio;
- e. Principal Secretary/Secretary, Water Resource Department, Government of State of Jharkhand Member, Ex-officio;
- f. Principal Secretary/Secretary, Drinking water & sanitation Department, Government of State of Jharkhand -Member, Ex-officio;
- g. Chairman, Jharkhand State Pollution Control Board, Government of State of Jharkhand -Member, Ex-officio;
- h. Chairman & Managing Director, JUIDCO Ltd-Member, Ex-officio
- i. Principal Chief Conservator of Forest, Government of Jharkhand-Member, Ex-officio;
- j. Project Director, State Programme Management Group, Jharkhand, Member-Convener.
### **Nominated Members:**

- k. Dr. Makarand M. Ghangrekar, Professor, Department of Civil Engineering, Indian Institute of Technology, Kharagpur 721 302. India
- 1. Dr. Chintalacheruvu Madhusudana Rao, Assistant Professor, Department of Civil Engineering, National Institute of Technology Jamshedpur, Jamshedpur-831014, Jharkhand, India
- m. Dr. Alok Sinha, Centre of Mining Environment, Department of Env. Science and Engg., Indian School of Mines, Dhanbad-826004, D-16, Teachers Colony, Indian School of Mines
- n. Dr. Ram Prashad Sharma, Retired Deptt. of Science & Technology, Govt. of Jharkhand, Sector 4, RH-2, Block-C, Row House, National Game, Housing Complex (NGHC), Hotwar, Ranchi – 835 217,

6. The Nominated Members shall hold office for a term of two years from the date of publication of this order.

7. The State Ganga Committee for Jharkhand shall exercise such powers and perform such functions as stated in the said Notification dated the 7<sup>th</sup> October, 2016.

8. Travelling Allowance /Daily Allowance and sitting fees of the nominated members shall be governed by the rules of the State Government.

9. The committee may decide the procedure & frequency for holding the meetings as per the said Notification dated the  $7^{\text{th}}$  October, 2016.

[F. No. Est-01/2016-17/111/ NMCG (Vol-II)]

RAJIV KISHORE, Executive Director (Administration) National Mission for Clean Ganga

Annex 9



# Guidelines for implementing Wetlands (Conservation and Management) Rules, 2017

MINISTRY OF ENVIRONMENT, FOREST AND CLIMATE CHANGE GOVERNMENT OF INDIA

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### I. Guidelines Purpose and Scope

- The Ministry of Environment, Forest and Climate Change (MoEF&CC) has notified Wetlands (Conservation and Management) Rules, 2017 (hereinafter Wetlands Rules) under the provisions of the Environment (Protection) Act, 1986 as regulatory framework for conservation and management of wetlands in India. These guidelines have been drafted to support the State Governments / Union Territory (UT) Administrations in the implementation of the Rules by providing guidance on:
  - a) Preparing a list of wetlands in the State / UT
  - b) Identifying wetlands for notification under Wetlands (Conservation and Management) Rules, 2017
  - c) Delineating wetlands, wetlands complexes and zone of influence
  - d) Preparation of Brief Document
  - e) Determining 'wise use' and ecological character
  - f) Developing a list of activities to be regulated and permitted
  - g) Developing an Integrated Management Plan
  - h) Constitution and operational matters of the Wetlands Authorities
  - i) Overlapping provisions.
- These guidelines were drafted by a committee constituted by the MoEF&CC vide OM dated 2. August 10, 2018. The committee comprised Mr U.A.Vora (former CCF Wildlife, Government of Gujarat), Dr Arvind Kumar (President, India Water Foundation), Dr B.C. Jha (Former Director (Wetlands), Central Inland Fisheries Research Institute), Dr P. S. N. Rao (Director, School of Planning and Architecture), Dr Afroz Ahmad (Member, Environment and Rehabilitation, Narmada Control Authority) and Dr Ritesh Kumar (Director, Wetlands International South Asia). The committee met on five occasions at MoEF&CC, New Delhi for the said purpose, and submitted final version of the guidelines to the Ministry on December 5, 2018. The draft guidelines were subsequently sent for comments to all State Governments / UT Administrations, and have been finalized after due consideration of the comments received. The Committee immensely benefitted from the discussions held with Ms Manju Pandey (Joint Secretary). The Committee also acknowledges the support received from Ms Rita Khanna (Scientist 'F'), Dr M. Ramesh (Scientist 'E'), Mr Chandan Singh (Scientist 'D'), Dr Anu Chetal (Research Assistant) and Ms Pallavi Mukherjee (Research Assistant) during the guidelines preparation process.

### II. Wetlands to be regulated

- 3. The provisions of Wetlands Rules apply to:
  - a) Wetlands designated by the Government of India to the List of Wetlands of International Importance under the provisions of the Convention on Wetlands (Ramsar Convention). [Ref. Rule 3 (a) of Wetlands Rule]
  - b) Wetlands notified under the rules by the Central Government, State Government and UT Administration. [Ref. Rule 3 (b) of Wetlands Rule]

- 4. All wetlands, irrespective of their location, size, ownership, biodiversity, or ecosystem services values, can be notified under the Wetlands Rules, except:
  - a) River channels;
  - b) Paddy fields;
  - c) Human-made waterbodies specifically constructed for drinking water purposes;
  - d) Human-made waterbodies specifically constructed for aquaculture purposes;
  - e) Human-made waterbodies specifically constructed for salt production purposes;
  - f) Human-made waterbodies specifically constructed for recreation purposes;
  - g) Human-made waterbodies specifically constructed for irrigation purposes;
  - h) Wetlands falling within areas covered under the Indian Forest Act, 1927; Forest (Conservation) Act, 1980; State Forest Acts and amendments thereof;
  - i) Wetlands falling within areas covered under the Wildlife (Protection) Act, 1972 and amendments thereof;
  - j) Wetlands falling within areas covered under the Coastal Regulation Zone Notification, 2011 and amendments thereof.

[Ref. Rule 2 (g) and Rule 3 of Wetlands Rules]

- 5. Human-made wetlands are defined as wetlands that are planned, designed and operated to meet a specific purpose (such as providing water for irrigation, producing fish through culture operations, producing salt, recreation, preventing salinity intrusion, flood control etc.). Only those human-made wetlands that have been built for purposes, mentioned at paras 4c) – 4g) above, are excluded from notification under these Rules.
- 6. Natural wetlands, partly or wholly used for purposes as mentioned at 4c) 4g), attract the provisions of the Wetlands Rules.
- 7. Wetlands designated as Ramsar Sites may be notified under the Rules as per the process mentioned in paragraphs 57-65, even when partly or wholly overlapping with areas covered under the Indian Forest Act, 1927; Forest (Conservation) Act, 1980; State Forest Acts and amendments thereof; Wildlife (Protection) Act, 1972 and amendments thereof; Coastal Regulation Zone Notification, 2011 and amendments thereof. Regulations for parts of wetlands overlapping with 4h-4j (supra) will, however, be as per the corresponding regulatory framework. Ramsar site areas, not covered under any of the overlapping laws and rules, will attract the provisions of the Wetlands Rules (Refer illustration 1 below).



Illustration 1: Using the Wetlands Rules to fill in the gaps in situations of multiple regulations in a Ramsar Site. In the situation above, wildlife sanctuary (indicated as a) and a reserved forest (indicated as b) partly overlap with the Ramsar Site boundary. Being a coastal wetland, a part (indicated as c) also falls under Coastal Regulation Zone. In such cases, it is recommended that the entire Ramsar Site, inclusive of overlapping areas, is delineated and notified under the Wetlands Rules. The overlapping areas shall continue to be regulated as per respective Acts and Rules, and the remaining area may be regulated as per the provisions contained in Wetlands Rules. Similar approach can be taken even for wetlands that have not been designated as Ramsar Site.

- 8. For wetlands falling within the criteria 3 (b) (supra), the exclusions mentioned at para 4 a) 4j) shall apply only in cases wherein the entire wetland falls under the said category. In cases wherein areas falling within para 4 a) 4 j) form a part of larger wetland or wetlands complex, and exclusion may result in impeded ecological contiguity and connectivity, such areas may be included within the boundary of wetland being notified. Regulations within the boundaries of areas mentioned at para 4 h) 4 j) will, however, be as per the corresponding regulatory frameworks (Refer Illustration 1 and 2).
- 9. Though Protected Areas and areas falling within the purview of Coastal Zone Regulation have been excluded from notification under the Wetlands Rules, management of such wetlands may benefit through the application of 'wise use' approach (within the framework of existing laws and rules) as outlined in Section VII of these guidelines.



Illustration 2: Considering river stretch and human-made wetlands for notification. In situations when the entire wetland, to be notified, is a river stretch [indicated as (a)], paddy fields [indicated as (b)], humanmade wetland waterbodies for irrigation [indicated as (c)], and human-made waterbodies created for aquaculture purposes [indicated as (d)], these may not be notified under the Wetlands Rules. However, in cases as in (e), wherein river channels, paddy fields, and human-made wetlands such as aquaculture areas form a part of a larger wetland or wetland complex, and excluding such area may fragment the wetland regime, the area to be notified may include river channels, paddy fields or any other human-made wetland.

10. Should the State Governments/UT Administrations be desirous, any wetland, even if included within the list of wetlands excluded from notification under Wetlands Rules, may be notified under the relevant state laws. In this regard, the approach/mechanism outlined in Wetlands Rules and these guidelines may be suitably adopted.

### III. Wetlands Authorities

- 11. As per Rule 5 of Wetlands Rules, 2017 the Wetlands Authorities within States and UTs are deemed as constituted with the following members:
  - a) Minister In-charge of the Department of Environment/Forests of the State Government or Minister In charge of the Department handling wetlands - Chairperson;(Administrator or Chief Secretary of the UT - Chairperson in the case of UT);
  - b) Chief Secretary of the State or Additional Chief Secretary equivalent Vice Chairperson;
  - c) Secretary in-charge of the Department of Environment Member ex-officio; (Vice-Chairperson in the case of UT)
  - d) Secretary in-charge of the Department of Forests Member ex-officio;
  - e) Secretary in-charge of the Department of Urban Development Member ex-officio;

- f) Secretary in-charge of the Department of Rural Development Member ex-officio;
- g) Secretary in-charge of the Department of Water Resources Member ex-officio;
- h) Secretary in-charge of the Department of Fisheries Member ex-officio;
- i) Secretary in-charge of the Department of Irrigation and Flood Control Member ex-officio;
- j) Secretary in-charge of the Department of Tourism Member ex-officio;
- k) Secretary in-charge of the Department of Revenue Member ex-officio;
- l) Director, State Remote Sensing Centre Member ex-officio;
- m) Chief Wildlife Warden Member ex-officio;
- n) Member Secretary, State/UT Biodiversity Board Member ex-officio;
- o) Member Secretary, State Pollution Control Board/UT Pollution Control Committee -Member ex-officio;
- p) Additional Principal Chief Conservator of Forests of the Regional Office of Ministry of Environment, Forest and Climate Change - Member ex-officio;
- q) One expert each in the fields of wetland ecology, hydrology, fisheries, landscape planning and socioeconomics to be nominated by the State Government / UT Administration
- r) Additional Secretary/Joint Secretary/Director in the Department of Environment/Forests or Department handling wetlands Member Secretary
- 12. The Department of Environment / Forests or Department handling wetlands shall designate one expert each in the following fields for a period not exceeding three years: [Ref. Rule 5 (2) (xvi) of Wetlands Rules]
  - a) Wetlands ecology
  - b) Hydrology
  - c) Fisheries
  - d) Landscape planning
  - e) Socioeconomics
- 13. The Wetlands Authority may co-opt other members, not exceeding three in number. It is recommended that at least one member may be drawn from civil society to enable stakeholder representation.
- 14. The Authority shall exercise following powers and perform the following functions:
  - a) Prepare a list of all wetlands of the State or UT within three months from the date of publication of these rules;
  - b) Prepare a list of wetlands to be notified, within six months from the date of publication of these Rules, taking into cognizance any existing list of wetlands prepared/notified under other relevant State Acts;
  - c) Recommend identified wetlands, based on their Brief Documents, for regulation under these rules;
  - d) Prepare a comprehensive digital inventory of all wetlands within one year from the date of publication of these rules and upload the same on a dedicated web portal, to be developed by the Central Government for the said purpose; the inventory ought to be updated every ten years;
  - e) Develop a comprehensive list of activities, to be regulated and permitted within the notified wetlands and their zone of influence;
  - f) Recommend additions, if any, to the list of prohibited activities for specific wetlands;
  - g) Define strategies for conservation and wise use of wetlands within their jurisdiction;
  - h) Review Integrated Management Plan for each of the notified wetlands (including transboundary wetlands in coordination with Central Government), and within these plans to

consider continuation and support to traditional uses of wetlands that are harmonized with ecological character;

- i) Recommend mechanisms for maintenance of ecological character through promotional activities for land within the boundary of notified wetlands or wetlands complex have private tenancy rights,;
- j) Identify mechanisms for convergence of implementation of the management plan with the existing State/UT level development plans and programmes;
- k) Ensure enforcement of these rules and other relevant Acts, rules and regulations and on a half-yearly basis (June and December of each calendar year) inform the concerned State Government or UT Administration or Central Government on the status of such notified wetlands through a reporting mechanism;
- Coordinate implementation of Integrated Management Plans based on wise use principle through various line departments and other concerned agencies;
- m) Function as a nodal authority for all wetland-specific authorities within the State or UT Administration;
- n) Issue necessary directions for the conservation and sustainable management of wetlands to the respective implementing agencies.
- o) Undertake measures for enhancing awareness within stakeholders and local communities on values and functions of wetlands; and
- p) Advise on any other matter suo-motu, or as referred by the State Government/UT Administration.
- [Ref. Rule 5 (4) of Wetlands Rules]
- 15. The State Government or UT Administration shall designate a department as nodal department for wetlands. Such department shall provide all necessary support and act as Secretariat to the Authority. The State Governments / UT Administrations may allocate sufficient budget and human resources to ensure smooth functioning of the Authority and conduct of its various activities. The Authority and the nodal department may identify a professional institute(s)/organization(s) that would assist them in their various functions such as preparing a list of wetlands, Brief Documents for notification etc.
- 16. The Authority shall meet at least thrice in a year. State Government / UT Administration may decide an appropriate quorum, not less than half of the members. Minutes of meetings of the Authority may be placed in the public domain within a period not exceeding two weeks from the day on which meeting has been convened. [Ref. Rule 5 (2) (8) of Wetlands Rules]
- 17. Each Wetlands Authority shall constitute:
  - a) Technical Committee to review Brief Documents, Management Plans and advise on any technical matter referred by the Wetlands Authority; and,
  - b) Grievance Committee, consisting of four members, to provide a mechanism for hearing and forwarding the grievances raised by the public to the Authority.

[Ref. Rule 5 (6)(b) of Wetlands Rules]

- 18. The composition of these committees may be decided by the concerned State / UT Wetlands Authority. Meetings of these committees shall be held **at least once every quarter**, and proceedings presented in the next meeting of the Authority.
- 19. The Wetlands Authority may empower the Grievance Committee to redress grievances at the local level and to recommend to the Authority for the finality of decisions. The State Government

/ UT Administration may consider appointing at least one member with a legal background in the Grievance Committee. [Ref. Rule *5(6)(b)* of Wetlands Rules]

- 20. State or UT level Wetlands Authorities constituted before notification of Wetlands Rules, shall be deemed dissolved for the purpose of these Rules.
- 21. State / UT Wetlands Authorities shall serve as nodal authority for authorities / agencies created for specific wetlands. Management plans and notifications pertaining to the specific wetland shall be subject to approval and endorsement of the State / UT Wetlands Authority. Administrative matters, however, may continue to be dealt by the nodal department specified within the constitution of the wetlands specific authority.

### IV. Preparing a list of wetlands

- 22. The State / UT Wetlands Authorities are expected to prepare a list of wetlands within the boundaries of their respective States / UTs. This list should be comprehensive, and not just focus on wetlands that qualify for notification under these Rules. Therefore, it is recommended that the list is developed based on wetlands definition of the Ramsar Convention (to which India is a Contracting Party).
  - 22.1 The Convention, ratified by Government of India, defines wetlands as 'areas of marsh, fen, peatland or water, whether natural or artificial, permanent or temporary, with water that is static or flowing, fresh, brackish or salt, including areas of marine water the depth of which, at low tides, does not exceed six meters'. In addition, to protect coherent sites, Article 2.1 of the Convention provides that 'wetlands may include riparian and coastal zones adjacent to the wetlands, and islands or bodies of marine water deeper than six meters at low tide lying within the wetlands.'
- 23. The National Wetlands Atlas prepared by Space Application Center under the National Wetlands Inventory and Assessment project, and available at <u>https://vedas.sac.gov.in/vedas/downloads/atlas/Wetlands/NWIA\_National\_atlas.pdf</u> has spatial data on wetlands for each State and UT.
  - 23.1 The GIS data has already been made available by the Wetlands Division of the MoEF&CC to the representatives of the State Governments / UT Administrations during the regional consultation workshops held during 2016-18.
  - 23.2 Wetlands Authority may seek the assistance of District Administration to validate the information provided in the Atlas. Existing land records may also be considered while developing the list of wetlands.
  - 23.3 The final list of wetlands/wetland complexes may be prepared under the following heading:
    - a) Wetland Name
    - b) Geographical coordinates (latitude and longitude of the centre of the wetland)
    - c) Wetland type (inland and coastal) and sub-type (natural or human-made)
    - d) District(s) within which the wetland is located
    - e) Approximate area of the wetland
    - f) Whether the wetland falls within the category of regulated wetlands as per Wetlands Rules.

A format for compiling the list of wetlands is at **Annex 1**. This list may also contain transboundary wetlands (at the end) with additional details such as the bordering State/UT under which wetland is falling along with corresponding area.

24. In addition to the National Wetlands Atlas, it may also be helpful to consider the list of wetlands studied and described by various agencies, including revenue records (particularly areas recorded as any of the wetlands types such as ponds, lake, *talab, sarovar* etc.). The States/UTs may seek the assistance of State Remote Sensing Agencies and local experts for preparing such wetland inventory expeditiously. State Governments/ UT Administrations are also encouraged to make use of satellite images available at National Remote Sensing Center's Geo-platform Bhuvan, accessible at <a href="http://bhuvan.nrsc.gov.in/data/download/index.php">http://bhuvan.nrsc.gov.in/data/download/index.php</a>.

### V. Delineating wetlands

- 25. After the wetlands have been identified for notifications under the Wetlands Rules, the next step involves delineation of each of these wetlands (or wetlands complexes) and their zone of influence.
- 26. For delineating wetlands, it is essential to be aware of the distinguishing characteristics of these ecosystems. Wetlands arise when inundation by water produces soil dominated by anaerobic processes, which in turn forces the biota, particularly rooted plants to adapt to flooding. Wetlands, thus, have the following general distinguishing characteristics:
  - a) Permanent or periodic inundation or saturated soils throughout the year or during parts of the year
  - b) Presence of macrophytes adapted to wet conditions (also known as hydrophytes)
  - c) Soil that are saturated or flooded long enough favouring development of anaerobic conditions
- 27. Water creates wetlands. The biological composition of wetlands, from fish to migrating waterbirds, depends on the ways water moves within a wetland. The amplitude and frequency of water level fluctuations are probably the most critical factors affecting the composition and functioning of wetlands. Hydrological regimes may, therefore, be used as the primary delineation characteristics for defining wetland boundary.
- 28. Wetlands boundary can be derived as the outer envelope of the maximum area under inundation, the area covered by hydrophytes, or saturation of soil near the surface during a normal monsoon year. The boundary should be such that during a normal monsoon year, the entire area is inundated for at least 15 days, or the soil is saturated roughly within one foot from the surface. It may be pertinent to exclude areas that are only intermittently inundated in the case of high floods (such as one in 100-year floods) or extreme events (such as storm surges of extreme intensity).
- 29. Where two or more wetlands exist with a high degree on hydrological connectivity (for example, wetlands connected during monsoon), or ecological connectivity (sharing waterbird habitats or located on migratory fish pathways), these can be delineated as a single complex. In such cases, non-wetland areas may be included within the boundary of the complex to ensure connectivity and continuity. The connotation of wetland throughout this document includes wetlands complex, as may be the case.

- 30. For each wetland and wetlands complex, a map should be prepared using a Geographical Information System (WGS84 datum and UTM (Universal Transverse Mercator) projection) and adopting professional cartographic standards. Essential features to be included in the map are as follows:
  - a) Wetland boundary
  - b) The boundary of settlements located within and around the wetland
  - c) Connecting drainages, inflows and outflows
  - d) Main roads and railway (if any)
  - e) Major landmarks
- 31. Recommended scale for producing the wetlands maps is as follows:

Wetland / Wetlands complex area	Recommended scale
Below 100 ha	1: 4000
Between 100 – 500 ha	1: 10,000
Between 500- 4000 ha	1: 25,000
4000 ha and above	1: 50,000

These scales have been recommended on the basis of spatial data available for preparing wetlands maps and details that may be extracted for management planning and monitoring decisions. Resources at 2 LISS IV data that may be used for preparing map of wetlands below 100 ha renders an approximate scale of 1:4000. Even larger wetlands can be mapped using finer resolution data. However, for expedience and cost effectiveness, a lower scale may be sufficient for meeting management needs.

### VI. Delineating zone of influence

- 32. For each wetland to be notified, a zone of influence is to be defined. The zone of influence of a wetland is an area, developmental activities wherein are likely to induce adverse changes in wetland ecosystem structure and (ecological) functioning.
- 33. The boundary of the zone of influence may be defined with due consideration to local hydrology and nature of land use. For wetlands with a well-defined surface drainage system, its directly and freely draining basin should be delineated as the zone of influence. This can be done using a suitable digital elevation model data and validated using toposheets. The basin should encompass all direct inflow as well as outflow areas. The river basin atlas of India (available at <a href="http://www.india-wris.nrsc.gov.in/wrpinfo/index.php?title=WRIS\_Publications">http://www.india-wris.nrsc.gov.in/wrpinfo/index.php?title=WRIS\_Publications</a>) may be used to support the delineation.
- 34. For wetlands with diffused drainage and where the slope is too gentle leading to large basin area, the zone of influence can be delineated on the basis of features that are likely to influence wetland functioning adversely. These could be based on the outer periphery of adjoining settlements, or peripheral agricultural fields that drain directly into the wetland.
- 35. A map should be prepared to indicate the following elements in a Geographical Information System (WGS84 datum and UTM projection) and adopting professional cartographic standards:
  - a) Zone of influence
  - b) Wetland boundary

- c) Connecting drainages, inflows and outflows
- d) Main roads and railway (if any)
- e) Major landmarks

36. The recommended scale at which the map of the zone of influence is to be produced is as follows:

Area of zone of influence	Recommended mapping scale
Below 100 ha	1: 4000
Between 100 and 500 ha	1: 10,000
More than 500 ha	1: 50,000

### VII. Wetlands wise use and ecological character

- 37. Management of notified wetlands is recommended to be based on 'wise use' approach. Human beings and their use of resources form an essential component of wetland ecosystem dynamics. The 'wise use' approach recognises that restricting wetland loss and degradation requires incorporation of linkages between people and wetlands. The wise use principle emphasises that human use of these ecosystems on a sustainable basis is compatible with conservation.
- 38. Ramsar Convention defines the 'wise use' of wetlands as "the maintenance of their ecological character, achieved through the implementation of ecosystem approaches, within the context of sustainable development". Ecosystem approach requires consideration of the complex relationship between various ecosystem elements and promotion of integrated management of land, water and living resources. Wise use, through an emphasis on sustainable development, calls for resource use patterns which can ensure that human dependence on wetlands can be maintained not only in the present but also in the future. Seen in totality, wise use is about maintaining and enhancing wetland values and functions to ensure the maintenance of the flow of benefits from wetlands (their ecosystem services) from an inter-generational equity point of view.
- 39. Ecological character is "the combination of ecosystem components, processes and services that typify the wetland at a given point in time". Ecosystem components are living (biotic) and non-living (abiotic) constituents of the wetland ecosystem. These include:
  - a. Geomorphic setting (landscape, catchment, river basin);
  - b. Climate (precipitation, wind, temperature, evaporation, humidity);
  - c. Physical setting (area, boundaries, topography, shape, bathymetry, habitat type and connectivity);
  - d. Water regime (inflow, outflow, balance, surface-groundwater interactions, inundation regime, tidal regime, quality);
  - e. Wetland Soil (texture, chemical and biological properties);
  - f. Biota (Plant and animal communities)
- 40. Ecosystem processes occur between organisms and within and between populations and communities, including interactions with the non-living environment that result in an existing ecosystem state and bring about changes in ecosystems over time. These include: Physical processes (water stratification, mixing, sedimentation, erosion); Energy nutrient dynamics (primary production, nutrient cycling, carbon cycling, decomposition, oxidation-reduction);

Processes that maintain animal and plant population (recruitment, migration); and Species interaction (Competition, predation, succession, herbivory).

- 41. Ecosystem services are benefits obtained by humans from ecosystems, categorized as: Provisioning (fisheries, use of aquatic vegetation for economic propose, wetland agriculture, biochemical products); Regulating (maintenance of hydrological regimes) and Cultural (recreation and tourism, spiritual, scientific and educational value). Supporting services are included within ecosystem processes.
- 42. A wetland use is not 'wise-use' if:
  - a. The intervention leads to adverse changes in ecosystem components and processes, such as:
    - i. Reduction in water flowing into the wetlands
    - ii. Reduction in the area under inundation, or changes in inundation regime
    - iii. Reduction and alteration of natural shoreline
    - iv. Fragmentation of wetlands into small patches of water
    - v. Reduction in water holding capacity
    - vi. Degradation of water quality
    - vii. Reduction in diversity of native species
    - viii. Introduction or emergence of invasive species
    - ix. Decline in wetlands resources, such as fish, aquatic plants, and water
  - b. The intervention enhances some ecosystem services (such as food production values) while diminishing other ecosystem services (such as the ability of wetlands to moderate wetlands regime).

43.	Some exam	ples of	wetlands	uses that	may not be	'wise-use'	are as follows:
	-				./		

Type of wetland	Intervention	Ecosystem services likely to be enhanced	Ecosystem services likely to be diminished
Lagoon	Prawn aquaculture by creating enclosures within the lagoon area	<ul> <li>Food provision</li> <li>Livelihoods for wetlands dependent communities</li> </ul>	<ul><li>Water regime moderation</li><li>Flood buffering</li></ul>
Lake	Impounding water by regulating outflows	Increased water availability for human use	• Ability to moderate floods
Marsh	Construction of road connecting settlements located on the periphery	Transport	<ul> <li>Hydrological regime moderation</li> <li>Flood buffering</li> <li>Aesthetics</li> </ul>
Urban lake	Concretization of shoreline for beatification	<ul><li>Aesthetic value</li><li>Tourism and recreational benefits</li></ul>	<ul> <li>Ability to accommodate monsoon flows</li> <li>Habitat values</li> </ul>

44. In several cases, the impact on ecosystem structure and functions, or tradeoffs in ecosystem services may not be immediately apparent. It is, therefore, recommended that the 'precautionary

approach' is adopted to ensure that wetlands conservation is prioritized in the case of information uncertainty.

### VIII. Prohibited activities in a notified wetland

- 45. The following activities are prohibited within notified wetlands:
  - a. Conversion for non-wetland uses including encroachment of any kind;
  - b. Setting up of any industry and expansion of existing industries;
  - c. Manufacture or handling or storage or disposal of construction and demolition waste covered under the Construction and Demolition Waste Management Rules, 2016; hazardous substances covered under the Manufacture, Storage and Import of Hazardous Chemical Rules, 1989 or the Rules for the Manufacture, Use, Import, Export and Storage of Hazardous Microorganisms/Genetically Engineered Organisms or cells, 1989 or the Hazardous Wastes (Management, Handling and Transboundary Movement) Rules, 2008; electronic waste covered under the E-Waste (Management) Rules, 2016;
  - d. Solid waste dumping;
  - e. Discharge of untreated wastes and effluents from industries, cities, towns, villages and other human settlements;
  - f. Any construction of a permanent nature except for boat jetties within fifty metres from the mean high flood level observed in the past ten years calculated from the date of commencement of these rules; and,
  - g. Poaching. [Ref. Rule 4 (2) of Wetlands Rules]
- 46. State/UT Wetlands Authority, based on consideration of site-specific conditions, may consider expanding the list of prohibited activities for a notified wetland (or wetlands complex). This should be specified as such within the notification for specific wetland (or wetlands complex).
- 47. Permission for carrying out any activity included within the list of prohibited activities [as per Rule 4(2) of Wetlands Rules], within a notified wetland can only be given by the MoEF&CC. A specific request needs to be made by the State Government based on the recommendation of Wetlands Authority specifying:
  - a) Activity for which permission is sought;
  - b) Justification thereof;
  - c) The premise on which the activity is not considered detrimental to the wetland's ecological character; &
  - d) Supporting evidence-base (such as an expert report, EIA, mitigating measures proposed to be undertaken etc.)

### IX. Developing a list of activities, to be regulated in a notified wetland:

- 48. Activities within a notified wetland and its zone of influence, which when contained within a specific threshold or area, are not likely to induce an adverse change in wetlands ecological character may be placed under the 'regulated' category. Such activities should be notified within the notification for a specific wetland (wetlands complex).
- 49. Following activities, when regulated, are not likely to induce an adverse change in wetlands:
  - a) Subsistence level biomass harvesting (including traditional practices);

- b) Sustainable culture fisheries practices (in private lands);
- c) Plying of non-motorized boats;
- d) Desilting, in case where wetlands inflow regimes and water-holding capacity are impacted by siltation (note that 'deepening' activities are not the same as 'desilting'); &
- e) Construction of temporary nature
- 50. Each activity, however, would need to be considered on a case to case basis keeping in mind the ecological character of wetland or wetlands complex. A generic listing of a set of activities for all wetlands of the State / UT may not be feasible or desirable. For example, releasing treated sewage may not be advisable for high altitude wetlands that have slow decomposition rates.
- 51. For each regulated activity, it may be desirable to set a threshold limit beyond which the activity may be prohibited. The thresholds can be in the form of a spatial limit (such as areas wherein capture fishing may be carried), temporal limits (such as observing closed season), ecological condition (such as maintenance of a water quality parameter within a prescribed range), number of people (such as number of tourists permitted to visit the wetland on a given day), land use (such as prohibiting use of intermittently inundated area for permanent agriculture, or construction of enclosure), or any relevant dimension. Some examples of thresholds are:

Activity (Indicative List)	Aspect on which threshold can be specified
a) Subsistence level biomass harvesting (including traditional practices)	<ul> <li>Number of people that can be permitted to harvest biomass within the wetlands</li> <li>Type of harvesting gears (mesh size) and crafts</li> <li>Area wherein harvesting is permitted</li> </ul>
b) Releasing of treated sewage	<ul> <li>Water quality parameters (such as):</li> <li>Dissolved Oxygen,</li> <li>Biological Oxygen Demand</li> <li>Chemical Oxygen Demand</li> <li>Concentration of heavy metals</li> <li>Coliforms</li> </ul>
c) Sustainable culture-based fisheries practices	<ul> <li>Area wherein culture-based fisheries is permitted</li> <li>Stocking density</li> <li>Water quality</li> </ul>
d) Plying of non-motorized boats	<ul><li>Area wherein plying is permitted</li><li>Number of boats</li></ul>
e) Desilting, in cases where wetlands inflow regimes and water holding capacity are impacted by siltation	• Area wherein desilting can be carried out
f) Noise Pollution	• Limiting below level suited for waterbird habitat
g) Washing and bathing activities	• Use of detergent
h) Construction of temporary nature	• Area wherein temporary constructions can be carried out

	•	The period for which such structure can be maintained inside the notified wetlands
i) Change in landuse pattern within the zone of influence	•	Land use does not alter the hydrological regime or interrupt species interactions (such as bird migration pathways)

52. The Wetlands Authority shall be responsible for enforcing the regulations, through enforcement machinery of the concerned State Government / UT Administration.

### X. Developing a list of activities permitted in a notified wetland

- 53. Activities aligned with the 'wise use' of wetland may be permitted within the wetland (wetlands complex) or its zone of influence. The following activities are likely to be aligned with the 'wise use' approach:
  - a) Ecological rehabilitation and rewilding of nature ;
  - b) Wetlands inventory, assessment and monitoring;
  - c) Research;
  - d) Communication, environmental education and participation activities;
  - e) Management planning;
  - f) Habitat management and conservation of wetland-dependent species;
  - g) Community-based ecotourism (with minimum construction activities);
  - h) Harvesting of wetlands products within regenerative capacity; and,
  - i) Integrating wetlands as nature-based solutions for climate change mitigation and adaptation.
- 54. Permitted activities may need to be identified considering the ecological character of each wetland to be notified. It is likely that an activity may be benign for one wetland, yet would need regulation for others. For example, ecotourism may not be desirable for all wetlands.

### XI. Registration of wetlands

55. It is advised that the State/UT governments may ascertain whether the respective wetland has been registered appropriately in the land revenue records. If the wetland has not been registered as yet, necessary steps may be taken early. This would help in ensuring that the usage of wetland is not altered in future through encroachment, illegal claim of ownership etc.

### XII. Account of pre-existing rights and privileges in a notified wetland

56. Each wetland is likely to be associated with a range of pre-existing rights and privileges, and it must be ensured that such rights and privileges are aligned with the 'wise use' approach. 'Privilege' is defined here as a special entitlement granted to restricted group or persons, on a conditional basis and can be revoked. 'Rights', on the other hand, may be irrevocable and inherently held by a human being. Thus, a fish lease granted in certain wetlands by the Department of Fisheries can be considered as a privilege. Privilege can also be customary and traditional (for example, the use of traditional fishing techniques, buffalo wallowing, elephant bathing, the source of drinking water for bovines, etc.). Parking a houseboat against a lease right to clean environment are examples of rights.

57. For assessing the consequence of a pre-existing right or privilege on a wetland, it may be important to consider their implication on wetland ecological character. The privilege of fishing granted along a migratory route can lead to an adverse change in fish stocks. Similarly, the disposal of untreated sewage by houseboat in a wetland can lead to pollution. Thus, such privileges are not aligned with 'wise use'. On the other hand, in many cases, the subsistence level harvest of macrophytes may help in keeping species invasion in check and therefore aligned with ecosystem health. Such considerations may need to be made while deciding whether a wetland use is to be regulated or permitted.

### XIII. Notifying wetlands

- 58. For each wetland proposed to be notified, a 'Brief Document' containing the following information needs to be prepared:
  - a) Demarcation of wetland boundary, supported by accurate digital maps with coordinates and validated by ground truthing;
  - Demarcation of its zone of influence alongwith land use and land cover thereof indicated in a digital map;
  - c) Ecological character description;
  - d) Account of pre-existing rights and privileges;
  - e) List of site-specific activities, to be permitted within the wetland and its zone of influence;
  - f) List of site-specific activities, to be regulated within the wetland and its zone of influence; and,
  - g) Modalities for enforcement of regulation.
  - A format for preparing the Brief Document is at Annex 2.
- 59. The nodal department, designated by the State Government/UT Administration for wetlands, shall be responsible for preparing the Brief Documents.
- 60. In the case of transboundary wetlands, the respective State Governments/UT Administration may initiate the process of preparation of a common Brief Document and submit the same to MoEF&CC. If required, MoEF&CC shall coordinate with the concerned State Governments/UT Administrations for preparation of the Brief Document and addressing relevant issues. The Ministry will further process Brief Document as per process laid under Rule 7(4) of Wetlands Rules, 2017.
- 61. All Brief Documents shall be placed for approval of the Wetlands Authority. The Authority may endorse the Brief Document for notification to the concerned State Government / UT Administration.
- 62. The State Government / UT Administration shall issue a draft notification indicating the wetland (wetlands complex) to be covered under the Wetlands Rules. The notification should contain:
  - a) Description of the wetland (wetlands complex) boundary along with its map
  - b) Description of the zone of influence along with a map
  - c) List of activities prohibited within the wetland (wetlands complex) and its zone of influence
  - d) List of activities regulated within the wetland (wetlands complex) and its zone of influence
  - e) List of activities permitted within the wetland (wetlands complex) and its zone of influence
  - f) Name and contact details of the nodal person, who is to be contacted for seeking permission to undertake regulated activities.

A format for notification is at Annex 3.

- 63. Each draft notification shall be placed for public consultation for sixty days.
- 64. The State Government after considering objections from the concerned and affected persons shall publish the final notification within a period not exceeding 240 days from the date of **draft** notification.
- 65. MoEF&CC shall issue the draft and final notification for transboundary wetlands.
- 66. All Ramsar Sites, deemed covered under these Rules, shall also be notified as per the process laid out in paragraphs 57-64. This is proposed to ensure that the site boundaries are properly delineated and the knowledge about the same is available in public domain. It is adused that the information in the 'Brief Document' may be consistent with Ramsar Site Information Sheet (RSIS), submitted to the Ramsar Convention during site designation or RSIS updated thereafter.

#### XIV. Integrated Management Plan

- 67. Wetlands are one of the most embedded and interlinked ecosystems with human livelihoods and well-being. A balanced management approach, addressing biodiversity conservation values while providing for sustainable utilisation in a way compatible with the maintenance of natural properties of the ecosystem, needs to be adopted for these ecosystems. It is, therefore, recommended that management of each notified wetland (is guided by an "Integrated Management Plan". The plan refers to a document which describes strategies and actions for achieving 'wise use' of the wetland and includes objectives of site management; management actions required to achieve the objectives; factors that affect, or may affect, various site features; monitoring requirements for detecting changes in ecological character and for measuring the effectiveness of management; and resources for management implementation. Besides identifying resources, a management plan serves several important functions including generating baseline information, communication with stakeholders and ensuring compliance with regulatory frameworks and policy commitments.
- 68. While it is recognized that each wetland has its own distinctive ecological and hydrological features and thereby distinctive management needs, the following broad planning principles need to be kept in mind while formulating integrated management plans:
  - Integrated planning: Aquatic and terrestrial ecosystems are intimately linked by the process of the water flowing through them. Every land use decision has a consequence on water availability. Delineating a basin or a coastal zone enables demarcation of a distinct hydrological unit which is the natural integration of all hydrological processes within its boundary and therefore an ideal and rational unit for soil, water and bio-resources conservation and management. Thus, management planning for wetlands should not be restricted to a defined administrative boundary, but rather take into account wider planning and management context of the basin or coastal zone within which the site is located.

The process of development and implementation of management plans for wetlands often needs to be accompanied by governance improvements at basin and coastal zone level. Such an approach underpins Integrated Lake Basin Management framework that calls for achieving 'sustainable management of wetlands through gradual, continuous and holistic improvement of basin governance, including sustained efforts for integration of institutional responsibilities, policy directions, stakeholder participation, scientific and traditional knowledge, technological possibilities, and funding prospects and constraints.

Achieving close relationship between planning and governance is critical, considering multiple stakeholder and sectoral interests which underlie and, to a large extent, structure wetland biodiversity and ecosystem service values, and the need to secure people's involvement and participation in basin-scale management for considerably long periods of time.

Reflection upon the following six pillars of basin-scale governance may thus be useful:

- Institutions: Development of effective organisations and governance frameworks
- Policies: Setting broad directions and specific rules
- Participation: Expanding the circle of involvement
- Technology: Possibilities and limitations
- Information: Pursuing sources of knowledge and wisdom, and
- Finance: Seeking sustainable sources at the appropriate level
- Use of diagnostic approaches for defining management approach and actions: Given the
  uniqueness associated with each wetland, it is important that 'one size fit all' approach is
  replaced with a diagnostic approach, wherein the ecological, hydrological, socioeconomic
  and institutional features are comprehensively assessed and trends therein determined to
  be able to spell out management objectives and actions clearly.
- Adaptable management: Wetlands are influenced by a range of drivers and pressures that act at multiple spatial, temporal and political scales. Their management plan, therefore, needs to be accommodative of uncertainties and challenges. This can be achieved by using an adaptable management approach that allows for suitable modification of management based on continuous site monitoring and assessment of new information.
- **Stakeholder participation:** The condition of any wetland is an outcome of actions by a range of stakeholders, which are linked to the ecosystem in a number of ways. Management planning, therefore, needs to recognise these linkages, and build a mechanism for participation of stakeholders in design, review and implementation processes.
- **Governance:** Being located at the interface of land and water, wetlands are influenced by a range of developmental activities that take place within their direct and indirect basins and coastal zones. Institutional arrangements for managing wetlands need to be such that they are capable of integrating activities across multiple sectors (such as agriculture, water resources, forests, rural development, urban development, forests and wildlife and others), and balancing the needs of a group of diverse stakeholders while ensuring that ecological integrity of these fragile ecosystems is not adversely affected.

In the above context, association of entities or individuals as 'Wetland Mitras' can encourage stakeholder participation and overall governance.

69. An integrated wetlands management plan can be developed in the following steps, thus enabling a systematic diagnosis of wetlands features and their governing factors to arrive at management objectives and activities.

Step 1	Preamble	Concise policy statement describing the rationale for the	
		application of human, technical and financial resources for the	
		wetland management	
Step 2	Description of wetland features	Collation and synthesis of data to describe: wetland location and extent, catchment, hydrological regimes, biodiversity, ecosystem services, socioeconomic and livelihoods	
Step 3	Evaluation of	Based on the description of features, identification of priority	
1	wetland features	wetland features that need to be maintained, and key threats that	
		adversely affect these features	
Step 4	Institutional arrangements	<ul> <li>Provide an overview of the current institutional arrangements in the context of wetlands management;</li> <li>Discuss why the current institutional arrangements are institutional arrangements are institutional arrangements.</li> </ul>	
		<ul> <li>Propose institutional arrangement for wetland management, with specific focus on:</li> <li>a) Nodal Agency</li> </ul>	
		b) Role of various departments and agencies and coordination mechanism, and	
		c) Role of civil society and communities.	
		• Develop an organogram for management plan implementation.	
		• Regulatory regime specifying activities prohibited within wetlands, activities to be regulated within wetlands and zone of influence and regulation thresholds and activities permitted	
Step 5	Setting Management Objectives	<ul> <li>Provide a statement of the overall goal that the management plan seeks to achieve;</li> <li>Summarize the ecological and economic benefits that are expected from management plan implementation;</li> <li>Enlist specific objectives;</li> <li>Describe strategy(ies) for achieving each of the management objectives;</li> </ul>	
		<ul> <li>Provide a strategy for implementing regulatory regime – including list of activities liable to be prohibited, regulated and permitted within the wetland (wetlands complex)</li> </ul>	
Step 6	Monitoring and Evaluation Plan	<ul> <li>Present an overview of monitoring the wetland, and management plan implementation;</li> <li>Describe monitoring parameters, the frequency of monitoring and the agency that will be responsible for monitoring;</li> <li>Describe how coordination between different monitoring agencies will be achieved;</li> <li>Discuss the infrastructure and human resource requirement for implementing the management plan. (As far as possible, include local universities, research organizations and NGOs in wetlands monitoring);</li> <li>Discuss the frequency in which reporting shall be done and the responsible agency; Discuss how the monitoring outcomes will be used to adapt management</li> </ul>	
Step 7	Action Plan	Listing of management components and specific activities to achieve management objectives. For each activity,	

		implementation location, prioritisation, implementing agency
		and timeline should be specified.
Step 8	Budget	Assessment of financial resources required for implementing the
		management plan and sources of funds.

A description of each step and format for the compilation of integrated management plan is at **Annex 4.** 

- 70. The management plans should be presented to the Wetlands Authority. The implementation shall begin only after receiving their endorsement. Management plans for Ramsar Sites and transboundary wetlands shall also be reviewed and endorsed by the MoEF&CC.
- 71. The diagnostic management planning process, as described above, may also be used to guide management of wetlands excluded from notification under Wetlands Rules.

### XV. Violations and penal provisions

- 72. The Wetlands Authorities are entrusted with the responsibility of ensuring enforcement of Wetlands Rules and other relevant Acts, Rules and Regulations. Provisions of the relevant Central and State Government Acts are applicable.
- 73. All prohibited and regulated activities beyond their thresholds, if taken up within the wetlands and its zone of influence, shall be deemed violations under the Wetlands Rules.
- 74. The violations of the Wetlands Rules shall attract the penal provisions as per the Environment (Protection) Act, 1986.
- 75. Complaints may need to be filed in the case of violations. In exercise of powers conferred under clause (a) of section 19, the Central-Government has authorised the officers and authorities listed, in the Table (p. 238) vide S.O. 394 (E) published in the Gazette No. 185 dated 16-4-87, S.O. 237(E) published in Gazette No. 171 dated 29-3-89 and S.O. 656(E) published in the Gazette No. 519 dated 21-8-89, and amendments thereafter, if any.
- 76. The Authority should evolve a mechanism for continuous watch and ward of wetlands within their jurisdiction. At the local level, the concerned Gram Panchayat and Urban Local Body may be entrusted with watch and ward in association with any body constituted by the State Wetlands Authority, such as a Wetlands Management Unit for a specific Wetland. At District levels, the responsibility may be entrusted to the DDO/CDO (District/Chief Development Officer)/CEO (Chief Executive Officer)/ Chief Programme Officer of the Wetland level body, such as a Wetlands Management Unit.
- 77. The State Governments should proactively ensure incorporation of wetlands within land records.
- 78. The Wetlands Authority shall report the status of notified wetlands on half yearly basis to the State Government/UT Administration and Central Government (recommended proforma at Annex 5).

### XVI. Portal for information sharing

79. The MoEF&CC has created a web-portal for sharing information regarding implementation of Wetlands Rules. The portal may be accessed at MoEFCC website. The Central Government, State Government and UT Administration are required to upload all relevant information and documents pertaining to wetlands in their jurisdiction. State Governments / UT Administrations are encouraged to develop their own portals and hyperlink the same to the national portal. The State Governments and UT Administrations are also encouraged to upload other project documents and publications to enable sharing and exchanging good practices related to wetlands management in general, and implementation of regulatory framework in particular.

### Annexes

# Annex 1: Format for compiling list of wetlands

S.	Wetland	Geographical	District (s)	Village	Wetlands	Wetlands	Area	Khasra	Whether falls
No.	Name	coordinates	in which		type	sub-type	(ha)	or	within category
			the wetland					Survey	of regulated
			is located					numbers	wetlands as per
									Wetlands
									Rules
		(latitude and			(inland or	(natural or			
		longitude of			coastal)	human-			
		the centre of				made)			
		the wetlands)							
Tota	l no. of wetl	ands:							
Tota	l no. of wet	ands to be regu	lated/notified ı	ınder We	etlands Rules:				

# Annex 2: Format for preparing Brief Document

State / Union Territory:				
Name	e and address of person(s) compiling this information			
Sectio	on 1: Identification, Location and Jurisdiction			
1.1	Name of the Wetland (Alternative names, including in local language should be given in parenthesis after official name)			
1.2	Name of the Village(s) , Tehsil(s), Municipal area (s)			
1.3	Name of the District(s) in which wetland complex is located			
1.4	Geographical coordinates (Latitude and Longitude, to degree, minutes and second)			
	Latitude: From to			
	Longitude: From to to			
1.5	Name of the Department / Agency which has jurisdiction over the wetland / wetlands complex			

# Section 2: Site Characteristics

- 2.1 Area of wetland / wetlands category (ha)
- 2.2 Wetland type (Please tick appropriate categories and sub-categories)

Category	Subcategory		
Natural (Inland)	Permanent lakes		
	Seasonal/ intermittent lakes		
	Permanent streams/ creeks		
	Seasonal/ intermittent streams/ creeks		
	River floodplain		
	Permanent freshwater marshes		
	Seasonal/ intermittent freshwater marshes		
	Shrub-dominated wetlands		
	Tree-dominated wetlands		
	Geothermal wetlands		
	Karst and other subterranean hydrological systems		

□ Natural (Coastal)		
	Estuary	
	<ul> <li>Intertidal mud, sand or sa</li> <li>Mangroves</li> </ul>	lt flats
	Coral reefs	
Human-made	Aquaculture pond	
	□ Tank □ Saltpan	
	Dam / Reservoir	
3 Depth (m) Ave	rage	Maximum
Elevation (m above me	an sea level)	m
Water regimes		
Main source of water (	ick all applicable)	
🗖 Rainfall 🗖 Grour	dwater 🗖 Catchment runoff 🛛	Direct / indirect inflow from river
Others, please speci	fy	
Water permanence		
□ Mostly permanent	□ Mostly intermittent	
Destination of water fro	om wetland	
Feeds groundwater	□ To downstream catchment	To river To sea
Water pH		
<b>Acid</b> (< 5.5)	<b>C</b> ircumneutral (5.5 – 7.4)	□ Alkaline (> 7.4)
Not known		
Water salinity		
□ Fresh (< 0.5 g/l)	□ Brackish (0.5 - 30 g/l))	□ Euhaline (30- 40 g/l)
□ Hypersaline (>40g/l)	□ Not known	
Nutrient in water		
Eutrophic	Mesotrophic	□ Oligotrophic
Not known		
6 Climatic setting		

a)	Annual Rainfall /Snowfall(mm)		
b)	Temperature (°C)	Minimum	Maximum
c)	Humidity (%)	Minimum	Maximum
2.7	Area of zone of influence (in ha) the guidelines on wetlands]		[Ref. paras 32-34 of
2.8	Major land use within zone of inf	luence (provide as appro	ximate % of catchment area)
	Forests	%	
	Plantation	%	
	Agriculture	%	
	Settlements (Rural)	%	
	Settlements (Urban)	%	
	Industrial	%	
2.9	Map of wetland complex and zon	e of influence	
	(To be enclosed as Annex I and I	II to this proposal)	
Secti	on 3: Biodiversity		
3.1	Notable plant species present in w	retland	
3.2	Notable animal species present in	wetland	
3.3	Species of conservation significan	ce (rare, endangered, thre	eatened, endemic species)
3.4	Major plant invasive alien species		
3.5	Major animal invasive alien specie	es	

## Section 4: Ecosystem services

Importance	Relevan	t for the site	If Yes, Details (upto 50 words for
	(please t	tick yes or	each category)
Source of driphing up to for people living	no)		
and around			
Source of water for agriculture	□Yes	□No	
Fisheries	□Yes	□No	
Cultivation of aquatic food plants	□Yes	□No	
For buffalo wallowing and use of	□Yes	□No	
domesticated animals			
Medicinal plants	□Yes	□No	
Is a recreational site	□Yes	□No	
Buffering communities from extreme events as floods and storms	□Yes	□No	
Groundwater recharge	□Yes	□No	
Water purification	□Yes	□No	
Acts as a sink for sediments	□Yes	□No	
Has significant cultural and religious values	□Yes	□No	
Is a site for recreation and tourism	□Yes	□No	
Supports noteworthy plants species	□Yes	□No	
Supports noteworthy animal species	□Yes	□No	
Site of high congregation of migratory water birds	□Yes	□No	
Supports life cycle of fish or amphibians	□Yes	□No	
Mining	□Yes	□No	
Any other, please list			

# Section 5: Pre-Existing Rights and Privileges

Nature of right and privilege	Relevant	for the	Does this negatively	Brief description (upto 50
	site (plea	se tick	impact the wetland's	words for each category)
	yes or no	)	ecological health?	
Community Fishing (without any	□Yes	□No	□Yes □No	
lease or permission from				
government department)		<b>—</b> • •	□Not assessed	
Fishing under lease from	□Yes	□No	$\square$ Yes $\square$ No	
government department				
Harvest of plants (without any	TYes			
lease or permission from	<b>–</b> 105			
government department)			□Not assessed	
Harvest of plants under lease	□Yes	□No	□Yes □No	
from government department				
			□Not assessed	
Agriculture or horticulture within	□Yes	□No	<b>D</b> Yes <b>D</b> No	
wetland				
			UNot assessed	
Grazing	LYes		LIYes LINO	
Religious practices				
Religious practices				
			□Not assessed	
Withdrawal of water for	□Yes	□No	□Yes □No	
domestic use				
			□Not assessed	
Withdrawal of water for	□Yes	□No	□Yes □No	
agriculture or fisheries				
			□Not assessed	
Bathing or wallowing of domestic	□Yes	□No	<b>D</b> Yes <b>D</b> No	
animals				
			□Not assessed	
Plying of boats				
			□Not assessed	
Any other, please list here	□Yes	□No	□Yes □No	
_				
			□Not assessed	

# Section 6: Present and Potential Threats

Threat	Degree	Present or Potential	Additional
			information, if any
Changes in water inflow	□High□Medium □Low	□Present	
and outflow		Potential	
Pollution	□High □Medium □Low	□Present	
		□Potential	
Unsustainable harvest of	□High □Medium □Low	<b>D</b> Present	
biological resources		□Potential	
Mining	□High □Medium □Low	□Present	
		□Potential	
Siltation	□High □Medium □Low	<b>D</b> Present	
		□Potential	
Encroachment	□High □Medium □Low	□Present	
		□Potential	
Spread of invasive	□High □Medium □Low	□Present	
species		□Potential	
Any other, please list	□High □Medium □Low	<b>D</b> Present	
		□Potential	

# Section 7: Activities Proposed to be Prohibited (other than those listed in Rule 4(2) of Wetland Rules and Regulated

Activity	Whether prohibited or regulated	Regulation within wetlands or zone of influence	If regulated, indicate the level of regulation (in terms of people, restricted area or any other)	Name of department / agency responsible for regulation / prohibition	Additional information, if any
Withdrawal of water /		U Wetland /			
or any other		boundary			
hydrological		$\square$ Zone of influence			
intervention					
Harvesting of resources		D Wetland /			
(living / non-living)		Wetlands complex			
		boundary			
		□ Zone of influence			
Grazing		D Wetland /			
		Wetlands complex			
		boundary			
		□ Zone of influence			
Discharge of treated		D Wetland /			
sewage/ effluent /		Wetlands complex			
wastewater		boundary			
		<b>Z</b> one of influence			
	1				

Construction of boat	Wetland	/	
jetties, and facilities for	Wetlands c	omplex	
temporary use , as	boundary		
pontoon bridges	<b>Z</b> one of	influence	
Aquaculture, agriculture	Wetland	/	
and horticulture	Wetlands c	omplex	
activities within the	boundary		
wetland boundaries.	<b>Z</b> one of	influence	
Any other, please list	Wetland	/	
	Wetlands c	omplex	
	boundary		
	<b>Z</b> one of	influence	

# Section 8: Activities Proposed to be permitted

Activity	Place a tick	Within wetlands or zone of	Additional information, if any
	mark if	influence	
	relevant		
		Wetland / Wetlands complex	
		boundary	
		<b>Z</b> one of influence	
		Wetland / Wetlands complex	
		boundary	
		<b>Z</b> one of influence	
		Wetland / Wetlands complex	
		boundary	
		<b>Z</b> one of influence	
		Wetland / Wetlands complex	
		boundary	
		<b>Z</b> one of influence	
	D	Wetland / Wetlands complex	
		boundary	
		<b>Z</b> one of influence	
		Wetland / Wetlands complex	
		boundary	
		<b>Z</b> one of influence	
		Wetland / Wetlands complex	
		boundary	
		<b>Zone of influence</b>	

# Section 9: Listing of Available Scientific Resources Used

### CHECKLIST

- **D** Responsible agency has been clearly identified and details of contact person included
- Wetland/ wetlands complex boundary has been delineated using GIS and firmed up by adequate ground truthing
- Wetland/ wetlands complex map has been provided at required scale
- **D** Zone of influence has been delineated and included in wetland map or a separate map
- Wetland zone of influence is sufficient to manage all activities
- Site's importance have been listed, and for major categories, justification is provided
- Site's biodiversity values are listed, and for major categories, justification is provided
- **D** List of pre-existing rights and privileges is provided
- Consistency or inconsistency of pre-existing rights and privileges is indicated to be best of available knowledge
- Threats to site are listed, and for major categories details are provided
- Activities prohibited, other than those listed in Rule 4(2) have been mentioned
- **D** List of activities to be regulated within wetlands and zone of influence is provided
- List of activities to be permitted is provided

Annex 3: Format for draft notification of wetlands under Wetlands (Conservation and Management) Rules, 2017

#### Government of [State / Union Territory / India]

### [Date]

S.O.\_\_\_\_\_ The draft of the notification, which the [name of the issuing entity] proposes to issue in exercise of the powers conferred under rule 7 of the Wetlands (Conservation and Management) Rules 2017 read with Environment (Protection) Act, 1986 (29 of 1986), is hereby published for the information of the persons likely to be concerned or affected thereby; and notice is hereby given that the said draft notification shall be taken into consideration on or after the expiry of a period of sixty days from the date on which copies of the Gazette of ...... containing this notification are made available to the public;

Any person interested in making any objection or suggestion on the proposals contained in the draft notification may forward the same in writing, for consideration of the [State Government / UT Administration / MoEFCC, GoI], within the period so specified to the [insert designation and address], or at email address,.....

### **Draft Notification**

- 1. WHEREAS, the ...... wetland / wetland complex, situated in ..... village(s), tehsil(s), district(s) of state of ...... , is considered to be critically significant for its ecosystem services and biodiversity values for the local communities and society at large;
- 2. AND WHEREAS, it is considered that for sustaining these values, the ecological character of wetland ecosystem needs to be maintained by regulating developmental activities within the wetland as well as within its zone of influence;
- 3. NOW THEREFORE, the [State Government, UT Administration / Government of India] declares that the said wetlands shall be covered under the provisions of Wetlands (Conservation and Management) Rules, 2017.

- 4. The extent of the wetland /wetland complex and its zone of influence is described in **Schedule I** of this notification;
- 5. Activities prohibited within the wetland and its zone of influence are listed in **Schedule II** of this notification. Such prohibitions shall not apply for areas designated under other Acts and Rules, and listed at para 1.2 (a), (b) and (c) of Schedule I. Relevant provisions of respective Acts and Rules shall apply in such areas.
- 6. Activities regulated within the wetland and its zone of influence, i.e. permitted only with permission of [State Government, UT Administration / Government of India] are listed in Schedule III of this notification. Request for permissions can be made to the [Designation, contact address and email]. Such regulations shall not apply for areas designated under other Acts and Rules, and listed at para 1.2 a), b) and c) of Schedule I. Relevant provisions of respective Acts and Rules shall apply in such areas.
- 7. Activities permitted within the wetland and its zone of influence are listed in **Schedule IV** of this notification. Such permissions however shall not apply for areas designated under other Acts and Rules, and listed at para 1.2 (a), (b) and (c) of Schedule 1. Relevant provisions of respective Acts and Rules shall apply in such areas.
- 8. The [State / UT Wetlands Authority] and the Ministry of Environment, Forest and Climate Change shall monitor the enforcement of the provisions of this notification.

By order

•••••

### Schedule 1: Location and Extent of Wetland / Wetlands Complex and its Zone of Influence

### 1.1 Wetland / wetlands complex

The wetland / wetlands complex, as delineated, extends within an area of .....ha within the geographical coordinates as under:

Extremity	North	South	West	East
Latitude				
Longitude				

The map of wetland / wetlands complex boundary is at Map 1(a).

1.2 Boundary of area already designated under provisions of other Acts and Rules

The wetland / wetland complex boundary includes an area of ...... ha designated under other Acts and Rules, with the geographical coordinates as under:

1.2 (a) Area designated under Indian Forest Act, 1927; Forest (Conservation) Act, 1980; State Forest Acts and amendments thereof

Extremity	North	South	West	East
Latitude				
Longitude				

1.2 (b) Area designated under Wildlife (Protection) Act, 1972 and amendments thereof

Extremity	North	South	West	East
Latitude				
Longitude				

1.2 (c) Area designated under the Coastal Regulation Zone Notification, 2011 and amendments thereof.

Extremity	North	South	West	East
Latitude				
Longitude				

The above areas should be clearly demarcated on the map of wetland / wetlands complex boundary i.e. **Map 1(a).** 

### 1.3 Zone of influence

The geographical coordinates of the zone of influence span an area of ...... ha within the geographical coordinates as under:

Extremity	North	South	West	East
Latitude				
Longitude				

The map of zone of influence of the wetland is at Map 1(b).

1.4 List of revenue villages / municipal areas falling fully or partly within the wetland is as under:

[Insert list]

1.5 List of revenue villages / municipal areas falling fully or partly within the zone of influence is as under: [Insert list]

### Schedule II: List of activities prohibited within wetland/ wetlands complex boundary

- a) Conversion for non-wetland uses including encroachment of any kind;
- b) Setting up of any industry and expansion of existing industries;
- c) Manufacture or/and handling or/and storage or/and disposal of construction and demolition waste covered under the Construction and Demolition Waste Management Rules, 2016; hazardous substances covered under the Manufacture, Storage and Import of Hazardous Chemical Rules, 1989 or the Rules for Manufacture, Use, Import, Export and Storage of Hazardous Micro-organisms Genetically engineered organisms or cells, 1989 or the Hazardous Wastes (Management, Handling and Transboundary Movement) Rules, 2008; electronic waste covered under the E-Waste (Management) Rules, 2016;
- d) Solid waste dumping;
- e) Discharge of untreated wastes and effluents from industries, cities, towns, villages and other human settlements;
- f) Any construction of a permanent nature except for boat jetties within fifty metres from the mean high flood level observed in the past ten years calculated from the date of commencement of these rules; and,
- g) Poaching.

[Other activities, likely to have an adverse impact on the ecosystem to be inserted from the Brief Document]

Schedule III: List of activities regulated within the boundary of wetlands / wetlands complex and its zone of influence and for which prior approval of [State Government/ UT Administration/MoEF&CC] is required to be obtained

Activity	Restrictions		
	Within the boundary of	Within the zone of influence	
	wetland / wetlands complex		
[Insert from brief document]	[Insert from Brief Document]	[Insert from Brief Document]	

Schedule IV: List of activities permitted within the boundary of wetlands / wetlands complex and its zone of influence

Activity	Levels and types not requiring permission		
	Within the boundary of	Within the zone of influence	
	wetland / wetlands complex		
[Insert from brief document]	[Insert from Brief Document]	[Insert from Brief Document]	
#### Annex 4: Steps and format for developing Integrated Management Plan

- 1. Wetlands provide wide-ranging ecosystem services that support human well-being in a number of ways. Numerous plant and animal species depend on wetlands during different parts of their lifecycle. In order to ensure that wetlands continue to provide their ecosystem services and support biodiversity, it is essential that a well-defined strategy and actions are identified for their conservation and wise use. An Integrated Management Plan reflects a common understanding between various stakeholders on the management purpose, significant threats and constraints limiting conservation and wise use, opportunities and specific actions for addressing these threats, and mainstreaming wetlands within the wider developmental planning.
- 2. The Integrated Management Plan is formulated to serve the following purposes:
  - Identify the objectives of wetland management;
  - Identify the factors that affect or may affect the wetland;
  - Resolve conflicts between various stakeholders having an interest in the wetland;
  - Define monitoring requirements and research needs;
  - Help obtain financial resources for managing the wetland;
  - Enable communication between different wetland managers, organizations and stakeholders;
  - Ensure compliance with extant laws and regulation; and,
  - Demonstrate that management is effective and efficient
- 3. Systematic diagnosis of various wetlands features and factors influencing these features is essential to arrive at management objectives and actions. The following eight steps are recommended for developing an Integrated Management Plan:

#### Step 1: Preamble

- 4. The process for management planning must begin with an exercise of setting up an overarching preamble describing the rationale for application of human, technical and financial resources for the wetland. This is a concise policy statement that expresses the commitment of the State Government/ UT Administration for integrated management. The preamble can be developed on the basis of:
  - Importance of the wetland for the state / UT
  - Ways in which the wetlands conservation and wise use will contribute to conservation and developmental goals
  - Alignment with sectoral policies, directives and planning frameworks

### Step 2: Description of wetland features

5. This step entails collation and synthesis of existing information on various site features so as to provide a basis for the identification of management objectives. A generic listing of management information needs and data requirements are presented in Table 1.

Wetland	Management information needs	Data requirement
feature		
Watland trpa	Leastion	Caagemphical acordinates
wenand type		- Geographical coordinates
and extent	• Wetland type	• Land use and land cover data for the
	<ul> <li>Wetland area</li> </ul>	wetland (at least for two seasons, pre and
	• Significant inter-annual changes in the	post-monsoon)
	wetland	• Historical map of the wetland ( can be
	• Major changes in the wetland extent in	developed from the Survey of India
	the last 20 - 30 years (if available)	toposheets) (if available)
Catchment/	• Direct and indirect catchment of the	<ul> <li>Geology and geomorphology</li> </ul>
Drainago	wetland	<ul> <li>Topography</li> </ul>
Basin	Geological and geomorphological	<ul> <li>Drainage pattern</li> </ul>
Dasin	characteristics that have led to the	<ul> <li>Soil types</li> </ul>
	formation of the wetland	<ul> <li>Climate setting</li> </ul>
	• Present land use and land cover of the	<ul> <li>Land use and land cover change</li> </ul>
	catchment and their implication for	
	wetland	
	<ul> <li>Major developmental activities in the</li> </ul>	
	catchment and their impacts on the	
	wetland	
Hydrological	<ul> <li>Maior sources of water inflow and</li> </ul>	<ul> <li>Water inflow, outflow and balance</li> </ul>
regimes	outflow from the wetland	<ul> <li>Inundation pattern</li> </ul>
regimes	<ul> <li>Major sources of sediments into the</li> </ul>	Sedimentation
	wetland	<ul> <li>Groundwater</li> </ul>
	<ul> <li>Inundation regime</li> </ul>	<ul> <li>Water quality</li> </ul>
	<ul> <li>Trends in water holding capacity and</li> </ul>	<ul> <li>Water use within the basin</li> </ul>
	factors for the decline	water use within the basin
	<ul> <li>Water quality and pollution status</li> </ul>	
	• Water use pattern within the wetland	
	catchment and implication for wetland	
Biodiversity	Species richness	<ul> <li>Species richness and diversity</li> </ul>
5	• Role of the wetland in the life-cycle of	<ul> <li>Biological significance of habitats</li> </ul>
	migratory species	<ul> <li>Risk of species invasion</li> </ul>
	<ul> <li>Invasive species and major contributing</li> </ul>	¥
	factors	
	<ul> <li>Major changes in species richness and</li> </ul>	
	habitat and factors thereof	
	המסוגת מוע ומכנסו א נוכדכסו	

Table 1: Information Required for Description of Wetlands Features

Ecosystem	• Key ecological and hydrological • Provisioning services(direct wetland
Services	characteristics required for the sustained products, eg: food, fibre, water)
	provision of ecosystem services  • Regulating services (the ability of an
	<ul> <li>Ecosystem services trade-offs</li> <li>Ecosystem services trade-offs</li> <li>ecosystem to regulate hydrological regimes, influence micro-climate, reduce disaster risk, groundwater recharge)</li> <li>Cultural services (recreational values, cultural and religious norms and beliefs related to wetlands)</li> <li>Supporting services (Primary production and other ecosystem functions which enable wetlands to deliver all above ecosystem services)</li> </ul>
Socioeconomi	<ul> <li>Extent of dependence on wetlands for</li> <li>Demographic features of communities</li> </ul>
cs and	livelihoods living in and around
livelihoods	• Status of community infrastructure (such • The contribution of wetland to income
	as water and sanitation) and implication and employment
	for wetlands • Community resource use and
	Livelihood vulnerability and relationship management practices
	with changes in wetland resources
	Resource use conflicts
	<ul> <li>Major shifts in livelihoods and implications for wetlands</li> </ul>

6. Attention should be paid to the robustness of data and associated uncertainties thereof. It is recommended that the data on-site features and linked metadata are, to the extent possible, maintained in a spatial format to enable updation at a later stage as more information becomes available through monitoring programmes. The step should also include identification of data gaps.

#### Step 3: Evaluation of wetland features

- 7. This step entails an evaluation of information on status and trends on wetlands features (conducted in the previous step) to identify:
  - a) Key wetland features that should be a priority for management planning
  - b) Natural variability within these features, including describing thresholds, if any
  - c) Threats that limit (or potentially limit) maintenance of wetlands features in the desirable state
- 8. Evaluation of wetland features can be done on the basis of criteria such as:
  - Naturalness
  - Rarity
  - Criticality for ecosystem functioning
  - Socioeconomic importance
  - Requirement under the extant regulatory regime
- 9. The evaluation process will lead to narrowing down of the list of wetland features, for which threats may be identified. The management plan is a response to these threats. Through this process, it is

ensured that the plan does not merely focus on symptoms (for example, poor water quality) but on the root causes (in this case, ineffective sewage management in wetland catchments).

#### Step 4: Defining an institutional arrangement for wetland management

- 10. The purpose of this step is to evaluate whether existing institutional arrangements are sufficient and effective in addressing the threats to wetlands. Based on the gaps identified, an institutional arrangement for implementation of the management plan is developed.
- 11. This step includes:
  - a) Enlisting of government departments having programmes which impact (or have the potential to impact) wetlands features or threats on these features;
  - b) An analysis of laws and regulation related to wetland, access and use of wetland resources, biodiversity or any dimension;
  - c) Ownership, rights and privileges pertaining to wetlands;
  - d) Analysis of the role of CSOs and communities in wetlands management, with particular reference to their views, rights and capacities; and,
  - e) Gaps and challenges.
- 12. Based on the analysis, an institutional arrangement for wetlands management should be developed, clearly stating:
  - a) The nodal agency responsible for managing wetlands
  - b) Role of different government departments and mechanisms for inter-departmental coordination
  - c) Role of CSOs and communities
- 13. In line with the requirements of Wetlands (Conservation and Management) Rules, 2017, the following should be specified:
  - a) Activities prohibited within the boundary of wetlands;
  - b) Activities to be regulated within wetlands and zone of influence and regulation thresholds; and,
  - c) Activities permitted.

#### Step 5: Setting management objectives

- 14. This step involves the identification of site management objectives that need to be met so as to ensure that site features are maintained or improved. The management objectives may address the threats identified in the previous step, and issues relating to maintenance of wetland in a desired healthy state.
- 15. While defining objectives, the following may be considered:
  - a) **Measurability** The objectives must be measurable so as to enable reporting on progress towards meeting them (for example, reducing silt load from the wetland catchment by xx %)
  - b) Achievability The objectives must be achievable at least in the medium or long term. An objective that cannot be achieved can lead to an overall loss of sense of direction and misallocation of resources (for example, completely preventing nutrient enrichment in a wetland located in the intensive agricultural landscape is an unachievable objective, a much better proposition would be to reduce the current rate by xx%).

c) **Indicative of purpose and not the process** – The objectives should not be prescriptively stating the way the objective should be achieved. It should ideally reflect the purpose of management (for example – afforestation in xxx ha is not an objective but a way to reduce siltation. Focusing just on afforestation then limits the use of other options for reducing siltation in a wetland).

### Step 6: Developing a monitoring and evaluation plan

16. This section aims at outlining a monitoring and evaluation plan to enable assessment of overall management effectiveness and identify needs for mid-term correction.

### Performance indicators

17. For each of management objectives, a set of performance indicators should be identified.

Wetland feature	Management objective	Performance Indicator	Means of measurement
Area	Maintain wetland area	Wetland area which has not been altered for non- wetland usages	Area estimated from analysis of remote sensing images and ground truthing
Catchments	Reduction in silt load from catchment	Silt load	Monitoring pilot watersheds
Hydrological regimes	Reduce pollution	Biological Oxygen Demand, Chemical Oxygen Demand or any other water quality parameter assessed against a threshold	Water quality monitoring
	Enhance hydrological connectivity within wetlands complex	Area of wetland complex inundated during high floods period	Analysis of remote sensing data, and hydrological surveys
Biodiversity	Maintain and enhance habitat of waterbirds	Area of wetland used by waterbirds	Physical survey
	Reduce area under invasive macrophyte	Area under invasive macrophyte	Analysis of remote sensing images and ground truthing
	Maintain fish species richness	Fish species richness	Sampling

Socioeconomics	Reduce use of harmful fishing practices	Number of destructive fishing gear used in the wetland	Survey
	Reduce direct dependence of communities on capture fisheries	Reduction in % of income derived from wetland	Socioeconomic surveys

18. For each performance indicator, a baseline value at the beginning of management plan implementation may be specified. These values should be tracked over the course of management plan implementation to assess whether management objectives are being met.

### Monitoring mechanism

- 19. Besides setting up performance indicators for the management plan, it is also essential to set up a monitoring system for the wetland to be able to assess changes in ecosystem condition over a period of time.
- 20. A generic listing of monitoring parameter, method and frequency is presented in the Table 3 below. Parameters marked with a single asterisk (\*) sign are relevant for all wetlands and must from a part of the monitoring system. In addition to these, parameters marked with a double asterisk (\*\*) are relevant for wetlands located in urban and peri-urban areas. Other parameters may be included based on the assessment of relevance and wetland contexts.
- 21. Photographic documentation (before, during and after management intervention) may also be maintained as part of monitoring process. Aquatic drones/ buoy- based sensor induced transmission for online data updating may be used for large wetlands, which will further help in enriching the management practices.

Wetland feature	Monitoring parameter	Monitoring method	Recommended Frequency
Wetland extent	• Wetland area*	Remote sensing and ground truthing	Once in a year
	• Land use and land cover within the wetland area	Remote sensing and ground truthing	Once in a year
	Connectivity with other adjoining wetlands, river / streams, coastal zone	Remote sensing and ground truthing	Once in a year

Table 3: Parameters for wetlands monitoring

Wetland Catchment	Climate	Data from the nearest weather station	Monthly
	Land use and Land Cover*	Remote sensing and ground truthing	Once in 3 years
	• Total sediment yield	Stream gauging station	Monthly
	Total nutrient yield	Stream gauging station	Monthly
Hydrological regimes	• Water inflow and outflow*	Stream gauging station	Monthly
	Waterholding     capacity	Bathymetric survey	Once in 5 years
	Peak inundation	Remote sensing and ground truthing	Once in 2 years
	Dissolved Oxygen, Biological Oxygen Demand *	Data from water quality sampling stations	Atleast monthly
	Chemical Oxygen     Demand **	Data from water quality sampling stations	Atleast monthly
	• Number of point sources discharging untreated sewage into the wetland **	Surveys	Once a year
Biodiversity and Habitat	• Population of major wetland dependent species groups (such as waterbirds, mammals etc.)*	Mid-winter counts	Once a year
	• Habitat use by key species	Physical surveys	Once a year
	• Number of migratory species using the wetland as a habitat	Physical surveys	Once a year
	Area under invasive macrophyte**	Physical surveys	Once a year
Ecosystem Services	Annual Fish yield	Sampling	Monthly samples collated into an annual estimate

	Number of tourists	Surveys	Monthly samples collated into an annual estimate
	• Volume of surface water abstracted from wetland	Hydrographic surveys	Monthly samples collated into an annual estimate
	• Volume of groundwater recharged	Hydrographic surveys	Once a year
	• Proportion of floodwaters stored in the wetland	Hydrographic surveys	Once a year
	• Use of wetland for research and education	Surveys	Annual estimate
Livelihoods	Population living around the wetland*	Surveys	Once every three years
	Population     depending on     wetlands for     livelihoods	Surveys	Once every three years
	Number of households around the wetland using safe sanitation practices	Surveys	Once every three years
	Participation of communities in wetlands management	Surveys	Once every three years

Note: (i) The frequency, as above, is advisable for wetlands above 100 **ha** and is indicative in nature. The Wetland Authority may suitably modify based on logistics involved.

(ii) For wetlands less than say 100 ha, the frequency may be appropriately **divided**.

#### Step 7 - Developing an action plan

- 22. The last stage of the management planning process includes defining the action plan, or specific interventions that address the identified management objectives. A generic listing of activities is presented in Table 4. The projects need to be defined very clearly to ensure good implementation. While identifying activities for management of wetlands, the following must be kept in mind:
  - a) Ecosystem-based interventions should be promoted as far as possible
  - b) Engineering interventions in wetlands should be taken up in a limited manner, with impact assessments conducted for all major works
  - c) Operations and maintenance of all structural works should be included in project design

# d) Participation of local communities should be included to the extent possible

Management	Activities	Key considerations
Plan component		
Boundary delineation and demarcation	Boundary mapping and delineation	Site boundaries should be established with reference to inundation regimes, soil conditions and vegetation types. Landscape connectivity should also be taken into account when wetlands exist in patches. All activities should be completed within the first year.
	Removal of encroachments	Boundaries should be notified and legally protected wherever possible. All activities should be completed within the first year.
	Shoreline management	Mostly required for wetlands in urban and peri-urban setting. For stabilizing bunds of wetlands, naturalization of slopes using vegetative measures should be preferred. Development of promenade for urban lakes can be included based on an evaluation of natural drainage and shoreline ecosystem niches.
Catchment conservation	Afforestation and aided regeneration Small scale engineering measures (gully plugging, check	Catchment conservation plans should be developed at watershed scales and based on Joint Forest Management approaches. Native species should be used for forestry operations. Pilot watershed should be periodically monitored to assess changes in soil moisture regimes. Livelihood interventions for catchment communities aimed at reducing dependence on wood as an energy source should be included as appropriate. Community participation in design, implementation and post- project maintenance of structures should be ensured.
	dams, gabion structures etc.)	
Water management	Selective dredging and desilting to improve hydrological connectivity	Dredging to be used only selectively, and be based on assessments of bathymetric profile and species interactions. For inflowing channels, dredging ca be used to improve water inflow.
	Interception, diversion and	Mostly recommended for wetlands in the urban and peri-urban setting.

Table 4: Generic listing of activities for management of wetlands

Management	Activities	Key considerations
Plan component		
	treatment of point sources of pollution	<ul> <li>Provision of comprehensive sanitation and safe drinking water coverage to communities living around the wetlands may be ensured.</li> <li>Engineering (STPs) as well as biological options (constructed wetlands) should be evaluated for application. Planning for Operation and Maintenance expenses should be included for all engineering structures.</li> </ul>
	Construction and operation of hydraulic structures for maintenance of water regimes and flood control	For each significant structure, environmental impact assessments should be carried out prior to construction.
	Balancing water allocation for human and ecological purposes	Environmental flows for wetlands, hydrological regimes of which are affected by hydraulic structures, should be assessed and implemented in consultation in water managers
Biodiversity conservation	Habitat evaluation and improvement	Until specifically desired, plantation of terrestrial plant species in wetlands should be avoided.
	Improvement and maintenance of migratory routes	Community groups should be involved in habitat monitoring and maintenance of migratory routes
	Maintenance of breeding and spawning grounds for key species	Community groups should be involved in the maintenance of breeding and spawning grounds
	Management of invasive species	A mix of mechanical and biological methods for controlling species invasion should be used.
		For plant invasives, economic utilization along with physical removal should be included.
Sustainable resource development and livelihood improvement	Microenterprise development for reducing dependence on wetland resources for livelihoods	Identification of micro-enterprise development options should be based on an assessment of community livelihoods, capacities, resources and market linkages.
	Sustainable fisheries development	Only capture based fisheries techniques should be promoted in natural wetlands

Management	Activities	Key considerations
Plan component		
		Options for improving culture fisheries in areas around wetlands
		may be included to reduce dependence on capture fisheries
	Sustainable	Organic farming practices in immediate catchments should be
	agriculture	included to minimize nutrient enrichment in wetland.
	development	
Institutional	Setting regulatory	Site regulation should be harmonized with national and State level
development	regimes	regulations.
		Local customary self-regulation which supports maintenance of
		conservation values should be promoted
		conservation values should be promoted
	Development of	Comprehensive monitoring and evaluation mechanism for
	monitoring and	hydrological, ecological, socio-economic and institutional features
	evaluation system	should be made a part of the management system
		Involvement of stakeholders in monitoring should be
		encouraged.
	Communication and	Increasing awareness on values and functions of wetland should
	Outreach	be made an integral part of the management plan.
		The use of television, print, electronic and social media for
		awareness generation and outreach may be included as
		appropriate. Developing and disseminating dos and donts in
		wetlands for general public may also be considered.
	Research	For each site, key research areas to support management needs
		should be identified and included in the management plan
	1	

### Step 8: Developing budget and financing plan

23. A complete costing of the Integrated Management Plan item wise may be done for the entire tenure of the plan using the existing norms of the State and central government, as may be the case. Year wise requirement of funds for various items of work/ activities, band PERT charts for the works/activities should be prepared. Summary of Cost Estimates and year-wise breakup of the requirement of funds may be presented in the formats given below:

### Table 5: Summary of budget

S. No.	Management Plan component	Budget

:	
:	
:	

### Table 6: Year wise breakup of requirement of funds

S. No.	Activity	Funds	Funds	Funds	Funds	Funds	Total
		Required	Required	Required	Required	Required	
		in Yr I	in Yr II	in Yr III	in Yr IV	in Yr V	

### Table 7: year wise breakup of requirement of funds

S.	Total	Funds from	Funds from	Funds from	Funds from	Funds	Funds
No	Budge	Central	State	other	private	available	require
•	t	Governmen	Governmen	donors(Projec	sector(Nam	from	d to be
		t Scheme	t (Scheme	t and donor	e of the	convergenc	raised
		(Scheme	Name)	name)	agency)	e sources	
		Name)					
	(a)	(b)	©	(d)	(e)	(f)=(b)+(c)	(g) = (a)-
						+(d) + (e)	(f)

#### Format for compiling Integrated Management Plan

24. The management plan should have a cover sheet with the following information:

- Wetland Name
- Wetland Area (in ha)
- Location: (District(s), State / UT)
- Area of the direct catchment (in ha)
- Name of the nodal agency for management plan implementation
- Management plan period
- Date on which approval of State / UT Wetland Authority was obtained
- Total budget
- Total funds available from convergence sources

Chapter heading	Sub-headings	Explanation	Reference to Management Planning Steps
1. Introduction	1.1 Rationale for management planning	Describe the importance of wetland, ways in which wetlands conservation and wise use will contribute to state conservation and development goals and alignment with state and central government policies, directives and planning frameworks	Step 1
	1.2 Terms of reference	Enlist the overall terms of reference for the management plan	Step 1
	1.3 Approach and Method	Provide an overview of approach (ways in which the recommended steps have been used) Describe the data sources and research carried out for management planning if any	Step 1
2. Description of wetlands features	<ul> <li>Description of wetland features</li> <li>Location and extent</li> <li>Wetland catchments</li> <li>Hydrological regimes</li> <li>Biodiversity</li> <li>Ecosystem Services</li> <li>Socioeconomics and livelihoods</li> </ul>	Describe wetland features. As far as possible, present the data in maps.	Step 2
3. Evaluation of wetlands features	<ul> <li>Evaluation</li> <li>Priority wetland features that need to be maintained and thresholds thereof</li> <li>Threats</li> </ul>	From the wetlands features described in the previous section, enlist the priority wetlands features. Describe the threats that adversely affect the priority wetland features.	Step 3

### 25. The management plan may be compiled in the following eight chapters:

Chapter heading	Sub-headings	Explanation	Reference to Management Planning Steps
4. Institutional arrangements	<ul> <li>4.1 Review of existing arrangements</li> <li>Key organizations and programmes</li> <li>Rules and regulations</li> <li>Role of civil society and community based organizations</li> </ul>	Provide an overview of the current institutional arrangements in the context of wetlands management	Step 4
	4.2 Gaps	Discuss why the current institutional arrangements are insufficient in ensuring wetlands conservation and wise use.	Step 4
	4.3 Proposed arrangements for wetland management	Propose institutional arrangement for wetland management, which specific focus on a) nodal agency, b) role of various departments and agencies and coordination mechanism, and c) the role of civil society and communities. Develop an organogram for management plan implementation.	Step 4
5. Setting Management Objectives	5.1 Goal and purpose	Provide a statement of the overall goal that the management plan seeks to achieve	Step 5
	5.2 Benefits (ecological as well as societal)	Summarize the ecological and economic benefits that are expected from management plan implementation	
	5.3 Management objectives	Enlist the specific objectives	Step 5
	5.4 Strategies	Describe strategy(ies) for achieving each of the management objectives	Step 5
6. Monitoring and evaluation plan	6.1 Monitoring strategy	Present an overview of monitoring the wetland, and management plan implementation	Step 6
	6.2 Monitoring parameters, frequency and responsibility	Describe the monitoring parameters, the frequency of monitoring and the agency that will be responsible for monitoring	Step 6

Chapter heading	Sub-headings	Explanation	Reference to Management Planning Steps
	6.3 Institutional design	Describe how coordination between different monitoring agencies will be achieved.	Step 6
	6.4 Infrastructure and human resources design	nd Discuss the infrastructure and esign human resource requirement for implementing the management plan as far as possible, including local universities, research organizations and NGOs in wetlands monitoring	
	6.5 Reporting	Discuss the frequency in which reporting shall be done and the responsible agency.	Step 6
	6.6 Review and adaptation	Discuss how the monitoring outcomes will be used to adapt management	Step 6
7. Developing an       7.1 Component wise         Action Plan       activities linked with         management objectives		<ul> <li>Generic listing of activities</li> <li>indicating:</li> <li>What will be done?</li> <li>Where will the activity be done?</li> <li>What is the priority for the activity?</li> </ul>	Step 7.1
	7.2 Components for consideration for support under National Plan for Conservation of Aquatic Ecosystems (NPCA)	<ul> <li>For all activities eligible for support under NPCA indicate:</li> <li>Why is the activity important?</li> <li>How will the activity be</li> <li>implemented? (include intermediate steps, technical specifications and relevant drawings, as may be the case)</li> <li>Where will the activity be implemented?</li> <li>Who will implement the activity?</li> <li>What are the quantitative targets to be met?</li> </ul>	Step 7.2

Chapter heading	Sub-headings	Explanation	Reference to Management Planning Steps
8. Budget and activity phasing	8.1 Activity linked budget	Present a summary budget in line with Table 5 Provide details of funding available from convergence sources in line with Table 6 Provide detailed budget for NPCA in line with Table 7	Step 8
	8 2 Time planning	Present a monthly Gantt Chart for management plan implementation	Step 8

### Checklist for submission of Integrated Management Plan

- Approved by the State Govt./ UT Administration/ State Wetlands Authority/ UT Wetlands Authority (minutes of meeting to be enclosed)
- Forwarding letter states -commitment of the State Government/ UT for providing their share of budget (supporting document indicating concurrence to be enclosed)
- Integrated Management Plan has a cover sheet providing details on Wetland, catchment area, implementing agency, total budget and fund requested from NPCA
- Brief Document is enclosed with the management plan (as per Annex V)
- Wetlands map is provided in a standard GIS format
- Map of zone of influence in provided in a standard GIS format.
- Management plan is aligned with recommended format of eight chapters
- All activities proposed to be funded by the NPCA fall within the list of core and non-core activities
- Necessary drawings and technical specification for major activities is provided.
- Core activities have been allocated not less than 75% of the budget
- Non- core activities have been allocated not more than 25% of the budget
- Budget has been prepared with reference to an approved Schedule of Rates

# Annex 5: Format for reporting status of notified wetlands

1. Wetlands / Wetlands Complex Name:			Report Date:			
		R	Reporting Office	er:		
2. Wetlands status		<u> </u>				
2.1 Area: current-	; in not	ification				
2.2 Water inflow and o	utflow (attach data in	an <b>ann</b> e	ex)			
2.3 Water quality (attac	h data in an <b>annex</b> )					
2.4 Status of major threats						
(such as encroachment, sewage discharge, solid habitat modification / d wetland ecological char	, linear infrastructure and liquid waste dur estruction/alteration acter)	develop nping, d or any c	oment, destruct umping of haz other that has o	tive fishing ardous was r may indu	; practice ste, invas uce an ac	s, untreated ive species, lverse change in
3. Status of enforcement	nt of the regulatory re	egime				
Activity regulated	Whether regulation complied with?	Violati	on if any?	Where h violation reported	nas the been ?	Action taken
4. Implementation of th	ne management plan					
Management Plan Component and Activity Planned for the period	Progress of implementation du the period	ıring	Nodal agency	7	Remarl and cha	ks (successes allenges)

### Annexure III: Wetlands (Conservation and Management) Rules, 2017

#### MINISTRY OF ENVIRONMENT, FOREST AND CLIMATE CHANGE NOTIFICATION

#### New Delhi, the 26th September, 2017

G.S.R. 1203(E).—Whereas the wetlands, vital parts of the hydrological cycle, are highly productive ecosystems which support rich biodiversity and provide a wide range of ecosystem services such as water storage, water purification, flood mitigation, erosion control, aquifer recharge, microclimate regulation, aesthetic enhancement of landscapes while simultaneously supporting many significant recreational, social and cultural activities, being part of our rich cultural heritage;

And whereas many wetlands are threatened by reclamation and degradation through drainage and landfill, pollution (discharge of domestic and industrial effluents, disposal of solid wastes), hydrological alteration (water withdrawal and changes in inflow and outflow), over-exploitation of their natural resources resulting in loss of biodiversity and disruption in ecosystem services provided by wetlands;

### THE GAZETTE OF INDIA: EXTRAORDINARY [PART II—SEC. 3(i)]

And whereas clause (g) of article 51A of the Constitution stipulates that it shall be the duty of every citizen of India to protect and improve the natural environment including forests, lakes, rivers and wildlife and to have compassion for living creatures;

And whereas the Environment (Protection) Act, 1986 is a comprehensive legislation to provide protection and improvement of the environment, including inter-alia, wetlands, and for matters connected therewith;

And whereas the National Environment Policy, 2006 recognises the ecosystem services provided by wetlands and emphasizes the need to set up a regulatory mechanism for all wetlands so as to maintain their ecological character, and ultimately support their integrated management;

And whereas India is a signatory to the Ramsar Convention on Wetlands and is committed to conservation and wise use of all wetlands within its territory;

And whereas the Central Government has published the Wetlands (Conservation and Management) Rules, 2010, vide number G.S.R. 951(E), dated the 4th December, 2010;

And whereas conservation and wise use of wetlands can provide substantial direct and indirect economic benefits to state and national economy, and thereby the Central Government stands committed to mainstreaming full range of wetland biodiversity and ecosystem services in development planning and decision making for various sectors;

And whereas the State Governments and Union Territory Administrations need to take into account wetland ecosystem services and biodiversity values likewise within their developmental programming and economic well-being, also taking into cognizance that land and water, two major ecological constituents of wetland ecosystems, are enlisted as State subjects as per the Constitution;

And whereas the Central Government considered it necessary to supersede the Wetlands (Conservation and Management) Rules, 2010 for effective conservation and management of wetlands in the country;

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And whereas the Central Government had, in exercise of the powers conferred by section 25, read with subsection (1) and clause (v) of sub-section (2) and sub-section (3) of section 3 of the Environment (Protection) Act, 1986, published the draft Wetlands (Conservation and Management) Rules, 2016, vide number G.S.R. 385 (E) dated 31st March, 2016 for information of the public likely to be affected thereby; and notice was given that the said draft rules would be taken into consideration by the Central Government after expiry of a period of sixty days from the date on which copies of the Gazette notification is made available to the public;

And whereas the Central Government has received the suggestions and objections from the State Governments, Union Territories and its organisations, individuals and civil society organisations on the draft Wetlands (Conservation and Management) Rules, 2016;

And whereas the suggestions and objections received in response to the above mentioned draft rules have been duly considered by the Central Government in consultation with State Governments and Union Territory Administrations.

Now, therefore, in exercise of the powers conferred by section 25, read with sub-section (1) and clause (v) of sub-section (2) and sub-section (3) of section 3 and section 23 of the Environment (Protection) Act, 1986 and in supersession of the Wetlands (Conservation and Management) Rules, 2010, except as respects things done or omitted to be done before such supersession, the Central Government hereby makes the following rules for conservation and management of wetlands, namely:—

### 1. Short title and commencement.—

- (1) These rules may be called the Wetlands (Conservation and Management) Rules, 2017.
- (2) These shall come into force from the date of their publication in the Official Gazette.

### 2. Definitions.—

- (1) In these rules, unless the context otherwise requires,-
  - (a) "Act" means the Environment (Protection) Act, 1986;
  - (b) "Authority" means the State Wetlands Authority or Union Territory Wetlands Authority, as the case may be;
  - (c) "Committee" means the National Wetlands Committee referred to in rule 6;
  - (d) "ecological character" means the sum of ecosystem components, processes and services that characterise the wetlands;
  - (e) "integrated management plan" means a document which describes strategies and actions for achieving wise use of the wetland and the plan shall include objectives of site management; management actions required to achieve the objectives; factors that affect, or may affect, the various site features; monitoring requirements for detecting changes in ecological character and for measuring the effectiveness of management; and resources for management implementation;
  - (f) "Ramsar Convention" means the Convention on Wetlands signed at Ramsar, Iran in 1971;
  - (g) "wetland" means an area of marsh, fen, peatland or water; whether natural or artificial, permanent or temporary, with water that is static or flowing, fresh, brackish or salt, including areas of marine water the depth of which at low tide does not exceed six meters, but does not include river channels, paddy fields, human-made water bodies/tanks specifically constructed for drinking

water purposes and structures specifically constructed for aquaculture, salt production, recreation and irrigation purposes;

- (h) "wetlands complexes" means two or more ecologically and hydrologically contiguous wetlands and may include their connecting channels/ducts;
- (i) "wise use of wetlands" means maintenance of their ecological character, achieved through implementation of ecosystem approach within the context of sustainable development;
- (j) "zone of influence" means that part of the catchment area of the wetland or wetland complex, developmental activities in which induce adverse changes in ecosystem structure, and ecosystem services.
- (2) The words and expressions used in these rules and not defined, but defined in the Act, shall have the meanings assigned to them in the Act.
- **3.** Applicability of rules.— These rules shall apply to the following wetlands or wetlands complexes, namely:—
  - (a) wetlands categorised as 'wetlands of international importance' under the Ramsar Convention;
  - (b) wetlands as notified by the Central Government, State Government and Union Territory Administration:

Provided that these rules shall not apply to the wetlands falling in areas covered under the Indian Forest Act, 1927, the Wild Life (Protection) Act, 1972, the Forest (Conservation) Act, 1980, the State Forest Acts, and the Coastal Regulation Zone Notification, 2011 as amended from time to time.

### 4. Restrictions of activities in wetlands.-

- (1) The wetlands shall be conserved and managed in accordance with the principle of 'wise use' as determined by the Wetlands Authority.
- (2) The following activities shall be prohibited within the wetlands, namely,-
  - (i) conversion for non-wetland uses including encroachment of any kind;
  - (ii) setting up of any industry and expansion of existing industries;
  - (iii) manufacture or handling or storage or disposal of construction and demolition waste covered under the Construction and Demolition Waste Management Rules, 2016; hazardous substances covered under the Manufacture, Storage and Import of Hazardous Chemical Rules, 1989 or the Rules for Manufacture, Use, Import, Export and Storage of Hazardous Micro-organisms Genetically engineered organisms or cells, 1989 or the Hazardous Wastes (Management, Handling and Transboundary Movement) Rules, 2008; electronic waste covered under the E-Waste (Management) Rules, 2016;
  - (iv) solid waste dumping;
  - (v) discharge of untreated wastes and effluents from industries, cities, towns, villages and other human settlements;
  - (vi) any construction of a permanent nature except for boat jetties within fifty metres from the mean high flood level observed in the past ten years calculated from the date of commencement of these rules; and,
  - (vii) poaching.

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### THE GAZETTE OF INDIA: EXTRAORDINARY [PART II—SEC. 3(i)]

Provided that the Central Government may consider proposals from the State Government or UnionTerritory Administration for omitting any of the activities on the recommendation of the Authority.

### 5. Wetlands Authorities.—

- The Central Government hereby constitutes the State Wetlands Authority in each State with the following members, namely:—
  - Minister In-charge of the Department of Environment/Forests of the State Government or Minister Incharge of the Department handling wetlands - Chairperson;
  - (ii) Chief Secretary of the State or Additional Chief Secretary equivalent Vice Chairperson;
  - (iii) Secretary in-charge of the Department of Environment Member ex-officio;
  - (iv) Secretary in-charge of the Department of Forests Member ex-officio;
  - (v) Secretary in-charge of the Department of Urban Development Member ex-officio;
  - (vi) Secretary in-charge of the Department of Rural Development Member ex-officio;
  - (vii) Secretary in-charge of the Department of Water Resources Member ex-officio;
  - (viii) Secretary in-charge of the Department of Fisheries Member ex-officio;
  - (ix) Secretary in-charge of the Department of Irrigation and Flood Control Member ex-officio;
  - (x) Secretary in-charge of the Department of Tourism Member ex-officio;
  - (xi) Secretary in-charge of the Department of Revenue Member ex-officio;
  - (xii) Director, State Remote Sensing Centre Member ex-officio;
  - (xiii) Chief Wildlife Warden Member ex-officio;
  - (xiv) Member Secretary, State Biodiversity Board Member ex-officio;
  - (xv) Member Secretary, State Pollution Control Board Member ex-officio;
  - (xvi) Additional Principal Chief Conservator of Forests of the Regional Office of Ministry of Environment, Forest and Climate Change Member ex-officio;
  - (xvii) One expert each in the fields of wetland ecology, hydrology, fisheries, landscape planning and socioeconomics to be nominated by the State Government; and
  - (xviii) Additional Secretary/Joint Secretary/Director in the Department of Environment/Forests or Department handling wetlands Member Secretary.
- (2) The Central Government hereby constitutes the Union Territory Wetlands Authority for each Union Territory with the following members, namely:—
  - (i) Administrator or Chief Secretary of the Union Territory Chairperson;
  - (ii) Secretary in-charge of the Department of Environment Vice Chairperson;
  - (iii) Secretary in-charge of the Department of Forests Member ex-officio;
  - (iv) Secretary in-charge of the Department of Urban Development Member ex-officio;
  - (v) Secretary in-charge of the Department of Rural Development Member ex-officio;
  - (vi) Secretary in-charge of the Department of Water Resources Member ex-officio;
  - (vii) Secretary in-charge of the Department of Fisheries Member ex-officio;
  - (viii) Secretary in-charge of the Department of Irrigation and Flood Control Member ex-officio;

- (ix) Secretary in-charge of the Department of Tourism Member ex-officio;
- (x) Secretary in-charge of the Departments of Revenue Member ex-officio;
- (xi) Director, Remote Sensing Centre Member ex-officio;
- (xii) Member Secretary, Union Territory Pollution Control Committee Member ex-officio;
- (xiii) Member Secretary, Biodiversity Board of the UT Member ex-officio;
- (xiv) Chief Wildlife Warden Member ex-officio;
- (xv) Additional Principal Chief Conservator of Forests of the Regional Office of Ministry of Environment, Forest and Climate Change- Member ex-officio;
- (xvi) One expert each in the fields of wetland ecology, hydrology, fisheries, landscape planning and socioeconomics to be nominated by the Union Territory Administration; and
- (xvii) Additional Secretary/Joint Secretary/Director in the Department of Environment/Forests or Department handling wetlands Member Secretary.
- (3) The State Wetlands Authority or Union Territory Wetlands Authority may co-opt other members, not exceeding three in number, if required.
- (4) The State Wetlands Authority or Union Territory Wetlands Authority shall exercise the following powers and perform the following functions, namely:-
  - (a) prepare a list of all wetlands of the State or Union Territory within three months from the date of publication of these rules;
  - (b) prepare a list of wetlands to be notified, within six months from the date of publication of these rules; taking into cognizance any existing list of wetlands prepared/notified under other relevant State Acts;
  - (c) recommend identified wetlands, based on their brief documents, for regulation under these rules;
  - (d) prepare a comprehensive digital inventory of all wetlands within a period of one year from the date of publication of these rules and upload the same on a dedicated web portal to be developed by the Central Government for the said purpose; the inventory to be updated every ten years;
  - (e) develop a comprehensive list of activities to be regulated and permitted within the notified wetlands and their zone of influence;
  - (f) recommend additions, if any, to the list of prohibited activities for specific wetlands;
  - (g) define strategies for conservation and wise use of wetlands within their jurisdiction; wise use being a principle for managing these ecosystems which incorporates sustainable uses (such as capture fisheries at subsistence level or harvest of aquatic plants) as being compatible with conservation, if ecosystem functions (such as water storage, groundwater recharge, flood buffering) and values (such as recreation and cultural) are maintained or enhanced;
  - (h) review integrated management plan for each of the notified wetlands (including trans-boundary wetlands in coordination with Central Government), and within these plans consider continuation and support to traditional uses of wetlands which are harmonized with ecological character;
  - (i) in cases wherein lands within boundary of notified wetlands or wetlands complex have private tenancy rights, recommend mechanisms for maintenance of ecological character through promotional activities;
  - (j) identify mechanisms for convergence of implementation of the management plan with the existing State/Union Territory level development plans and programmes;
  - (k) ensure enforcement of these rules and other relevant Acts, rules and regulations and on half-yearly basis (June and December of each calendar year) inform the concerned State Government or

Union Territory Administration or Central Government on the status of such notified wetlands through a reporting mechanism;

- (l) coordinate implementation of integrated management plans based on wise use principle through various line departments and other concerned agencies;
- (m) function as nodal authority for all wetland specific authorities within the State or Union Territory Administration;
- (n) issue necessary directions for conservation and sustainable management of wetlands to the respective implementing agencies;

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- (o) undertake measures for enhancing awareness within stakeholders and local communities on values and functions of wetlands; and
- (p) Advise on any other matter suo-motu, or as referred by the State Government/Union Territory Administration.
- (5) The concerned Department of the State Government or Union Territory shall provide all necessary support and act as nodal Department and Secretariat to the Authority.
- (6) The Authority shall, within ninety days of publication of these rules, shall constitute,-
  - (a) a technical committee to review brief documents, management plans and advise on any technical matter referred by the Wetland Authority; and
  - (b) a grievance committee consisting of four members to provide a mechanism for hearing and forwarding the grievances raised by public to the Authority;
- (7) The Committees referred to in sub-rule (6) shall meet at least once in every quarter to perform their functions.
- (8) The Authority shall meet at least thrice in a year.
- (9) The term of non-official members of the Authority nominated by State Government or Union Territory Administration, shall be for a period not exceeding three years.

#### 6. Constitution of National Wetlands Committee.-

- (1) The Central Government, hereby constitutes the National Wetlands Committee with the following members, namely:—
  - (i) Secretary, Ministry of Environment, Forest and Climate Change, Government of India Chairperson;
  - (ii) Special Secretary or Additional Secretary dealing with wetlands, Ministry of Environment, Forest and Climate Change, Government of India-Vice Chairperson;
  - (iii) Additional Director General, Wildlife, Ministry of Environment, Forest and Climate Change, Government of India - Member ex-officio;
  - (iv) Adviser or Joint Secretary dealing with wetlands, Ministry of Environment, Forest and Climate Change Member ex-officio;

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- (v) Joint Secretary, Ministry of Tourism, Government of India- Member ex-officio;
- (vi) Joint Secretary, Ministry of Water Resources, River Development and Ganga Rejuvenation, Government of India- Member ex-officio;
- (vii) Joint Secretary, Ministry of Agriculture and Farmers Welfare, Government of India- Member exofficio;
- (viii) Joint Secretary, Ministry of Social Justice and Empowerment, Government of India- Member exofficio;
- (ix) Joint Secretary, Ministry of Urban Development, Government of India- Member ex-officio;
- (x) Joint Secretary, Ministry of Rural Development, Government of India- Member ex-officio;
- (xi) The Chairman, Central Pollution Control Board Member ex-officio;
- (xii) Director, Zoological Survey of India or Scientist F- Member ex-officio;
- (xiii) Director, Botanical Survey of India or Scientist F- Member ex-officio;
- (xiv) Director, Space Application Centre, Ahmedabad or Scientist F- Member ex-officio;
- (xv) Member, Central Water Commission Member ex-officio;
- (xvi) Adviser, Niti Aayog Member ex-officio;
- (xvii) Three representatives of State Government or Union Territory Administration on a rotational basis for a tenure of two years each;
- (xviii)One expert each in the fields of wetland ecology, hydrology, fisheries, landscape planning & socioeconomics; and
- (xix) Director/Additional Director/Joint Director dealing with wetlands, Ministry of Environment, Forest and Climate Change - Member Secretary.
- (2) The National Wetlands Committee may co-opt other members, not exceeding three in number, if required.
- (3) The National Wetlands Committee shall perform the following functions, namely:-
  - (a) advise the Central Government on appropriate policies and action programmes for conservation and wise use of wetlands;
  - (b) evolve norms and guidelines for integrated management of wetlands based on wise use principle;
  - (c) monitor implementation of these rules by the Authority;
  - (d) advise the Central Government on proposals received from State Governments or Union Territory Administrations for omission of the prohibited activities as referred in sub-rule (2) of rule 4;
  - (e) recommend designation of wetlands of international importance under Ramsar Convention;
  - (f) recommend trans-boundary wetlands for notification;
  - (g) review progress of integrated management of Ramsar sites and transboundary wetlands;
  - (h) advise on collaboration with international agencies on issues related to wetlands; and
  - (i) advise on any other matter suo-moto, or as referred by the Central Government.
- (4) The tenure of non-official members of the Committee shall not exceed three years.
- (5) The Committee shall meet at least once in every six months.

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### 7. Delegation of powers and functions to the State Governments and Union Territory Administrations.—

- (1) The concerned Department of the State Government or Union Territory Administration shall, within a period of one year from the date of publication of these rules, prepare a Brief Document for each of the wetland identified for notification, providing:—
  - (a) demarcation of wetland boundary supported by accurate digital maps with coordinates and validated by ground truthing;
  - (b) demarcation of its zone of influence and land use and land cover thereof indicated in a digital map;
  - (c) ecological character description;
  - (d) account of pre-existing rights and privileges;
  - (e) list of site-specific activities to be permitted within the wetland and its zone of influence;
  - (f) list of site specific activities to be regulated within the wetland and its zone of influence; and
  - (g) modalities for enforcement of regulation;
- (2) Based on the Brief Document, the Authority shall make recommendations to the State Government or Union Territory Administration for notifying the wetlands.
- (3) The State Government or Union Territory Administration shall, after considering the objections, if any, from the concerned and affected persons, notify the wetlands in the Official Gazette, within a period not exceeding 240 days from the date of recommendation by the Authority.
- (4) (a) In case of trans-boundary wetlands, the Central Government shall coordinate with concerned State Governments and Union Territory Administrations to prepare the Brief Document containing information as listed in sub-rule (1).
  - (b) Based on the Brief Document, the National Wetlands Committee shall make recommendations to the Central Government for notification of the wetland.
  - (c) The Central Government shall, after considering the objections, if any, from the concerned and affected persons, notify the wetlands in the Official Gazette, within a period not exceeding 240 days from the date of recommendation by the Committee.

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- (5) (a) The Central Government shall create a dedicated web portal for information relating to wetlands.
  - (b) The Central Government, State Government and Union Territory Administration shall upload all relevant information and documents pertaining to wetlands in their jurisdiction.

### [F. No. J-22012/78/2003-CS (W) Pt. V]

#### Dr. A. DURAISAMY, Scientist 'G'

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Designated Best Use	Class of Criteria	Criteria		
Drinking Water Source without conventional treatment but after disinfection	А	<ol> <li>Total Coliforms Organism MPN/100ml Shall be 50 of less</li> <li>pH between 6.5 and 8.5</li> <li>Dissolved Oxygen 6mg/l or more</li> <li>Biochemical Oxygen Demand 5 days 20°C 2mg/l of less</li> </ol>		
Outdoor bathing (Organised)	В	<ol> <li>Fecal Coliforms organism MPN/100 ml shall be 500 or less</li> <li>pH between 6.5 and 8.5</li> <li>Dissolved Oxygen Demand 5 mg/l or more</li> <li>Biochemical Oxygen Demand 5 days 20°C 3 mg/l or less</li> </ol>		
Drinking water source after conventional treatment and disinfection	С	<ol> <li>Total coliforms organism MPN/100 ml shall be 5000 or less</li> <li>pH between 6 to 9</li> <li>Dissolved oxygen 4 mg/l or more</li> <li>Biochemical Oxygen Demand 5 days 20°C 3mg/l or less</li> </ol>		
Propagation of Wild life and Fisheries	D	<ol> <li>pH between 6.5 to 8.5</li> <li>Dissolved Oxygen 4mg/l or more</li> <li>Free Ammonia (as N) 1.2 mg/l or less</li> </ol>		
Irrigation, Industrial Cooling, Controlled Waste disposal	Е	<ol> <li>pH between6.0 to 8.5</li> <li>Electrical Conductivity at 250C micro mhos/cm Max 2250</li> <li>Sodium absorption Ratio Max 26</li> <li>Boron Max 2 mg/l</li> </ol>		
	Below E	Not Meeting A, B, C, D, & E Criteria		

### Annexure IV: Designated Best Use Criteria for Surface Waters as Recommended by CPCB

National Plan for	Conservation	of Aquatic	Ecosystems (	(NPCA)	Guidelines
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# Annexure V: Format for preparing brief document

Stat	tate / Union Territory:					
Nar	Name and address of person(s) compiling this information					
Sect	ction 1: Identification, Location and Jurisdiction					
1.1	1 Name of the Wetland (Alternative names, including in local language should be given in parenthesis after official name)					
1.2	2 Name of the Village(s) , Tehsil(s), Municipal area (s)					
1.3	Name of the District(s) in which wetland complex is located					
1.4	Geographical coordinates (Latitude and Longitude, to degree, minutes and second)					
	Latitude: From to					
	Longitude: From to					
1.5	Name of the Department / Agency which has jurisdiction over	r the wetland / wetlands complex				

### Section 2: Site Characteristics

2.1 Area of wetland / wetlands category (ha)

Wetland type (Please tick appropriate categories and sub-categories)

Category	Subcategory
□ Natural (Inland)	Permanent lakes
	Seasonal/ intermittent lakes
	Permanent streams/ creeks
	Seasonal/ intermittent streams/ creeks
	Oxbow
	River floodplain
	Permanent freshwater marshes
	Seasonal/ intermittent freshwater marshes
	Shrub-dominated wetlands
	Tree-dominated wetlands
	Geothermal wetlands
	Karst and other subterranean hydrological systems

	Category	Subcategory	
🗌 Natural (Coastal)		Coastal lagoon	
		Estuary	
		Intertidal mud, sand or salt flats	
		Mangroves	
		Coral reefs	
	Human-made	Aquaculture pond	
		🗌 Tank	
		🗌 Saltpan	
		Dam / Reservoir	
2.2	Depth (m) Ave	erage Maximum	
2.3	Elevation (m above mean sea	level)	_ m
2.4	Water regimes		
	a) Main source of water (tick	all applicable)	
	Rainfall	Groundwater	
	Catchment runoff	Direct / indirect inflow from river	
	Others, please specify		
	b) Water permanence		
	Mostly permanent	Mostly intermittent	
	c) Destination of water from	wetland	
	E Feeds groundwater	To downstream catchment	
	To river	To sea	
	d) Water pH		
	Acid (< 5.5)	$\Box$ Circumneutral (5.5 – 7.4)	
	☐ Alkaline (> 7.4)	Not known	
	e) Water salinity		
	□ Fresh (< 0.5 g/l)	□ Brackish (0.5 – 30 g/l))	
	Euhaline (30- 40 g/l)	Hypersaline (>40g/l)	
	Not known		
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	f) Nutrient in water						
	<ul><li>Eutrophic</li><li>Oligotrophic</li></ul>	<ul><li>Mesotrophic</li><li>Not known</li></ul>					
2.5	Climatic setting						
	a) Annual Rainfall /Snowfa	ll(mm)					
	b) Temperature (°C)	Minimum	Maximum				
	c) Humidity (%)	Minimum	Maximum				
2.5	Area of zone of influence (i	n ha)					
2.6	Major land use within zone of	of influence (provide as	approximate % of catchment area)				
	Forests	%					
	Plantation	0⁄_0					
	Agriculture	0⁄_0					
	Settlements (Rural)	0⁄_0					
	Settlements (Urban)	0⁄/0					
	Industrial	0⁄_0					
2.7	Map of wetland complex and zone of influence (To be enclosed as Annex I and II to this proposal)						
Sect	ion 3: Biodiversity						
3.1	Notable plant species present in wetland						
3.2	Notable animal species present in wetland						
3.3	Species of conservation significance (rare, endangered, threatened, endemic species)						
3.4	Major plant invasive alien species						
3.5	Major animal invasive alien species						

Annexes

### Section 4: Ecosystem services

Importance	Relevant for the site (please tick yes or no)	If Yes, Details (upto 50 words for each category)
Source of drinking water for people living and around	Yes No	
Source of water for agriculture	Yes No	
Fisheries	Yes No	
Cultivation of aquatic food plants	Yes No	
For buffalo wallowing and use of domesticated animals	Yes No	
Medicinal plants	Yes No	
Is a recreational site	Yes No	
Buffering communities from extreme events as floods and storms	Yes No	
Groundwater recharge	Yes No	
Water purification	Yes No	
Acts as a sink for sediments	Yes No	
Has significant cultural and religious values	Yes No	
Is a site for recreation and tourism	Yes No	

National Plan for Conservation of Aquatic Ecosystems (NPCA) Guidel
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Importance	Relevant for the site (please tick yes or no)	If Yes, Details (upto 50 words for each category)
Supports noteworthy plants species	Yes No	
Supports noteworthy animal species	Yes No	
Site of high congregation of migratory water birds	Yes No	
Supports life cycle of fish or amphibians	Yes No	
Mining	Yes No	
Any other, please list		

# Section 5: Pre-Existing Rights and Privileges

Nature of right and privilege	Relevant for the site (please tick yes or no)	Does this negatively impact the wetland's ecological health?	Brief description (upto 50 words for each category)
Community Fishing (without any lease or permission from government department)	Yes No	Yes No	
Fishing under lease from government department	Yes No	Yes No	
		□Not assessed	
Harvest of plants (without any lease or permission from	Yes No	Yes No	
government department)		□Not assessed	
Harvest of plants under lease from government department	Yes No	Yes No	
		□Not assessed	
Agriculture or horticulture within wetland	Yes No	Yes No	
		□ Not assessed	
Grazing	Yes No	Yes No	
		□Not assessed	

Nature of right and privilege	Relevant for the site (please tick yes or no)	Does this negatively impact the wetland's ecological health?	Brief description (upto 50 words for each category)
Religious practices	Yes No	Yes No	
		□ Not assessed	
Withdrawal of water for domestic use	Yes No	Yes No	
		□ Not assessed	
Withdrawal of water for agriculture or fisheries	Yes No	Yes No	
		□ Not assessed	
Bathing or wallowing of domestic animals	Yes No	Yes No	
		□ Not assessed	
Plying of boats	Yes No	Yes No	
		□ Not assessed	
Any other, please list here	Yes No	Yes No	
		□ Not assessed	

### Section 6: Present and Potential Threats

Threat	Degree	Present or Potential	Additional information, if any
Changes in water inflow and outflow	□High □Medium □Low	☐ Present ☐ Potential	
Pollution	□High □Medium □Low	Present Potential	
Unsustainable harvest of biological resources	□High □Medium □Low	Present Potential	
Mining	□High □Medium □Low	Present     Potential	
Siltation	□High □Medium □Low	Present Potential	
Encroachment	□High □Medium □Low	Present Potential	

Threat	Degree	Present or Potential	Additional information, if any
Spread of invasive species	High Medium Low	Present Potential	
Any other, please list	High Medium Low	Present Potential	

### Section 7: Activities Proposed to be prohibited (other than those listed in Rule 4(2) of Wetlands Rules)

Activity	Prohibited within wetlands or zone of influence	Details of specific area wherein activity is prohibited	Name of department / agency responsible for regulation	Additional information, if any
	Wetland / Wetlands complex boundary Zone of influence			

### Section 8: Activities Proposed to be regulated

Activity	Place a tick mark if relevant	Regulation within wetlands or zone of influence	Level of regulation (in terms of people, restricted area or any other)	Name of department / agency responsible for regulation	Additional information , if any
Withdrawal of water / impoundment/diversion or any other hydrological intervention		<ul> <li>Wetland /</li> <li>Wetlands complex boundary</li> <li>Zone of influence</li> </ul>			
Harvesting of resources (living / non-living)		<ul> <li>Wetland /</li> <li>Wetlands complex boundary</li> <li>Zone of influence</li> </ul>			
Grazing		<ul> <li>Wetland / Wetlands complex boundary</li> <li>Zone of influence</li> </ul>			

Activity	Place a tick mark if relevant	Regulation within wetlands or zone of influence	Level of regulation (in terms of people, restricted area or any other)	Name of department / agency responsible for regulation	Additional information , if any
Discharge of treated sewage/ effluent / wastewater		<ul> <li>Wetland / Wetlands complex boundary</li> <li>Zone of influence</li> </ul>			
Construction of boat jetties, and facilities for temporary use , as pontoon bridges		<ul> <li>Wetland /</li> <li>Wetlands complex boundary</li> <li>Zone of influence</li> </ul>			
Aquaculture, agriculture and horticulture activities within the wetland boundaries.		<ul> <li>Wetland / Wetlands complex boundary</li> <li>Zone of influence</li> </ul>			
Any other, please list		<ul> <li>Wetland / Wetlands complex boundary</li> <li>Zone of influence</li> </ul>			

## Section 9: Activities Proposed to be permitted

Activity	Place a tick mark if relevant	Within wetlands or zone of influence	Additional information, if any
		<ul> <li>Wetland /</li> <li>Wetlands complex boundary</li> <li>Zone of influence</li> </ul>	
		<ul> <li>Wetland /</li> <li>Wetlands complex boundary</li> <li>Zone of influence</li> </ul>	
		Wetland / Wetlands complex boundary Zone of influence	

Activity	Place a tick mark if relevant	Within wetlands or zone of influence	Additional information, if any
		<ul> <li>Wetland /</li> <li>Wetlands complex boundary</li> <li>Zone of influence</li> </ul>	
		<ul> <li>Wetland /</li> <li>Wetlands complex boundary</li> <li>Zone of influence</li> </ul>	
		<ul> <li>Wetland /</li> <li>Wetlands complex</li> <li>boundary</li> <li>Zone of influence</li> </ul>	
		Wetland / Wetlands complex boundary Zone of influence	

#### Section 10: Listing of Available Scientific Resources Used

#### **CHECKLIST**

Responsible agency has been clearly identified and details of contact person included

- Wetland/ wetlands complex boundary has been delineated using GIS and firmed up by adequate ground truthing
- Wetland/ wetlands complex map has been provided at required scale
- Zone of influence has been delineated and included in wetland map or a separate map

Wetland zone of influence is sufficient to manage all activities

Site's importance have been listed, and for major categories, justification is provided

- Site's biodiversity values are listed, and for major categories, justification is provided
- List of pre-existing rights and privileges is provided
- Consistency or inconsistency of pre-existing rights and privileges is indicated to be best of available knowledge
- Threats to site are listed, and for major categories details are provided
- Activities prohibited, beyond those already listed in Rule 4(2) have been mentioned
- List of activities to be regulated within wetlands and zone of influence is provided
- List of activities to be permitted is provided

Annexes

### Stay in touch



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