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**BEFORE THE NATIONAL GREEN TRIBUNAL
PRINCIPAL BENCH, NEW DELHI**

EXECUTION APPLICATION NO.: 16 OF 2019
IN
ORIGINAL APPLICATION NO.: 153 OF 2014

IN THE MATTER OF:

Indian National Trust for Art and Cultural Heritage
...Applicant

Versus

Government of NCT of Delhi & Ors. ...Respondents

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Through



AKASH VASHISHTHA

(Advocate for the Applicants)

490, Lawyers' Chamber Block-II,

Delhi High Court, New Delhi-110002

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Email: akashvashishtha.official@gmail.com

Place:- New Delhi

Dated:- 15.11.2025

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**ADDITIONAL AFFIDAVIT ON BEHALF OF THE
APPLICANT**

MOST RESPECTFULLY SHOWETH:

1. That the Applicant had filed the above titled Original Application raising the threats to the Najafgarh Jheel, an important water body in the National Capital Region, arising from continuous encroachments, unauthorized constructions and diversion of the lake waters by the Respondents on the pretexts of flood-protection. The Original Application sought revival, protection and preservation of the interstate Najafgarh Jheel, which is extremely vital to meet the drinking and domestic needs of the water starved areas of Gurgaon and Delhi through groundwater recharge, moderating urban flooding, maintain biodiversity habitats, developing climate resilience.
2. That vide Order, dated: 01.05.2025, this Hon'ble Tribunal was pleased to observe as follows:

“ ...

7. Counsel for the Applicant has also relied upon the area of wetland disclosed in Annexure-3, a Framework of Integrated Environment Management Plan jointly submitted by the Government of Haryana and NCT Delhi (draft) filed alongwith the report of the CPCB dated 13.12.2021. Counsel for the State

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Wetland Authority has disputed the material which is shown by the Applicant.

8. The issue concerning the exact area of the Najafgarh lake on the Haryana side is required to be decided and the exact area is required to be determined by some independent competent body. Hence, we direct the Applicant to implead the National Wetland Authority in this execution application through the Chairman and serve the same.

...”

3. That Shri Devendra Singh Rawat, serving as Program Coordinator with the Applicant organization, filed an online RTI Application (bearing Registration No. MOENF/R/E/25/00856), dated: 17.06.2025, with the Ministry of Environment, Forest & Climate Change (MOEF&CC), seeking the following information:

“ ...

1. *Copy of the complete Joint Environment Management Plan (EMP) prepared for the Najafgarh Jheel for the states of Haryana and Delhi.”*

4. That the MOEF&CC (Wetlands Division) vide Letter, dated: 19.06.2025, responded to the RTI Applicant, Mr. Devendra Singh Rawat, appending the Framework Integrated Environment Management Plan 2021 for Najafgarh Jheel, jointly submitted by the Government of Haryana and NCT of Delhi as well as the Framework Environment Management Plan 2020 for the NCT of Delhi.

(A True Copy of the Letter dated: 19.06.2025 of the MOEF&CC (Wetlands Division) to the RTI Applicant, Mr. Devendra Singh Rawat is annexed herewith and marked as **ANNEXURE AA-1**)

5. That the aforesaid Framework Integrated Environment Management Plan 2021 for Najafgarh Jheel provided by MOEF&CC (Wetlands Division) vide Letter, dated:

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19.06.2025, is *pari materia* identical to the Framework of Integrated Environment Management Plan 2021 (draft) for Najafgarh Jheel jointly submitted by the Government of Haryana and NCT Delhi, vide Report of the CPCB dated 13.12.2021, filed before this Hon'ble Tribunal in the present matter, as also referred in Order, dated: 01.05.2025 with not a scrap of difference or divergence in respect of facts or otherwise.

6. That as per the said Framework Integrated Environment Management Plan 2021 for Najafgarh Jheel provided by MOEF&CC (Wetlands Division), the core zone of Jheel encompasses the area enclosed within contour 209m amsl as the zone of permanent inundation, while the zone of influence extends upto contour 211m amsl. Besides, the inundation area of the 100 Year High Flood Level extends to contour 212.5m amsl. The said EMP further discloses that in the state of Haryana, 5349 acres under 211m contour line [inclusive of area under lower contours], 3436 acres under 210m contour line and 917 acres under 209m contour line are available for holding flood waters.

The relevant parts of the Framework Integrated Environment Management Plan 2021 for Najafgarh Jheel provided by MOEF&CC (Wetlands Division) is reproduced as under:

"Executive Summary

1. The Wetland Authorities of Haryana and NCT Delhi have examined each other's environmental management plan and come up with this joint document stating shared vision on wetland notification, management objectives, actions, monitoring mechanisms and institutional arrangements.

...

Implementing Wetlands (Conservation and Management) Rules, 2017

5. The top priority is to notify Najafgarh Jheel and its area of influence under the Wetlands (Conservation and Management)

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Rules, 2017, which is an imperative under the several judicial directions, especially Supreme Court order of February 8, 2017. The notification will also act as a safeguard against the high developmental threats from galloping urbanisation in the region. The flood cushioning, groundwater recharge and waste treatment functions of the Najafgarh Jheel acquire high significance in the face of increasing water stress, and intensity and frequency of extreme events due to climate change and other stressors.

6. Both States agree that core zone of Jheel will encompass the area enclosed within contour 209m amsl as the zone of permanent inundation with seasonal variability extending further into the zone of influence which will extend upto contour 211m amsl. The zone of influence may be partially modified on the Haryana side by existing sectoral roads on east and west. [see Map 1]. Both sides note that the inundation area of the 100 Year High Flood Level extends to contour 212.5m amsl which also overlies zone of the highest soil liquefaction in the region and which is classified as Seismic Zone IV where buildings would be vulnerable to natural hazard.

7. The present wetland regime is a pale shadow of an extensive expanse, spanning nearly 24,000 ha until the 1960s. Regulation and fragmentation of flows of Sahibi River and construction of embankment on the Delhi side have led to a significant curtailment in wetland area and inundation. The creation of Bund along the Najafgarh Jheel on the Delhi side has resulted in massive reduction in the Jheel spread. Still, in Delhi 6500 acres under 211m contour level [inclusive of area under lower contours], 2200 acres under 210m contour line and 890 acres under 209m contour line would be potentially available for holding flood waters. Urbanization has also reduced the submergence area in Haryana. Still, in Haryana, 5349 acres under 211m contour line [inclusive of area under lower contours], 3436 acres under 210m contour line and 917 acres under 209m contour line are available for holding flood waters (Sinha et al, 2019). The area is also in conformity with wetland

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demarcation on Survey of India map submitted by Government of Haryana to the National Green Tribunal in 2015. Even in regulated conditions, the water levels at Dhansa regulator (upstream of Najafgarh Jheel) have been around 209.9 m amsl (average maximum for 2010-2020) and average 210.6m amsl [daily record from 20 July, 2021 – 9 October, 2021 – see Annexure A- source I & FC, Delhi].

...”

(Emphasis added)

7. That the area of submergence recorded in Haryana EMP and subsequently the Joint EMP [Haryana and NCT Delhi], furnished by CPCB on behalf of MoEF&CC, before this Hon’ble Tribunal, vide its Report, dated: 13.12.2021, are summed up as follows:
 - Submergence Area under contour 211m : 5349 acres
 - Submergence Area under contour 210m : 3436 acres
 - Submergence Area under contour 209m : 917 acres
8. That the minimum area in Haryana which is, therefore, required to be Notified as a Transboundary Wetland is the core submergence area of 209m contour [917 acres], buffer zone upto contour 211m and HFL upto 212.5m contour as noted in Joint EMP, along with the zone of influence extending up to 212.5 m., on the part of the Jheel, falling in Haryana.

PRAYER

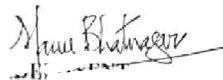
In light of the facts and circumstances stated herein-above, it is, most respectfully, prayed that this Hon’ble Tribunal may, graciously, be pleased to:

- A. Direct the State of Haryana to prepare the Brief Document and send the same to MOEFF&CC for Notification of Najafgarh Jheel as a Transboundary Wetland, with core submergence area of 209m contour [917 acres], buffer zone upto contour 211m and HFL upto 212.5m contour as noted

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in Joint EMP, along with the zone of influence extending up to 212.5 m., on that part of the Jheel, falling on the side of Haryana;

- B. Direct the State of Haryana to implement its part of the Joint EMP, dated: 13.12.2021, filed by the MoEF&CC before this Hon'ble Tribunal, wherein the concurrence of the State of Haryana is expressly noted and to which the State of Haryana has not objected in the last 4 years;
- C. Direct the above said compliances to be carried out within a period not exceeding 30 days;
- D. Pass any other Order(s) or direction(s) as this Hon'ble Tribunal may deem fit and proper on the facts and circumstances of the instant case.




INTACH
Natural Heritage Division
71, Lodhi Estate, New Delhi-110 003

APPLICANT

Through



AKASH VASHISHTHA

(Advocate for the Applicant)

490, Lawyers' Chamber Block-II,
Delhi High Court, New Delhi-110002

Ph.: 9717006866

Email: akashvashishtha.official@gmail.com

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**BEFORE THE NATIONAL GREEN TRIBUNAL
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...Applicant

Versus

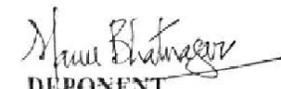
Government of NCT of Delhi & Ors.

...Respondent(s)

AFFIDAVIT

I, Manu Bhatnagar, S/o Lt. Sh. R.P. Bhatnagar, aged around 67 years,
R/o 24, Chitra Vihar, Delhi-110092 do hereby solemnly affirm and
declare as under:

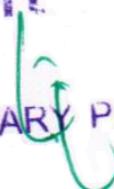
1. That I am currently employed as the Principal Director in the Applicant Organization and am conversant with the facts and circumstances of the case and competent to swear this affidavit.
2. That the contents of the accompanying Objection are true and correct to my knowledge as derived from the records of the case. No part of it is false and nothing material has been concealed therefrom.

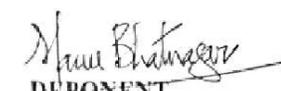

DEPONENT
I N T A C H
Natural Heritage Division
71, Lodhi Estate, New Delhi-110 003

VERIFICATION

Verified on this 15th day of November, 2025 that the contents of the present Affidavit are true and correct to my knowledge and belief and nothing material is concealed therefrom.



ATTESTED

NOTARY PUBLIC


DEPONENT
I N T A C H
Natural Heritage Division
71, Lodhi Estate, New Delhi-110 003

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Annexure AA-1

F. No. W-12/02/2024-WTL
GOVERNMENT OF INDIA
Ministry of Environment, Forest and Climate Change
(Wetlands Division)

Indira Paryavaran Bhawan
Vayu Tower, 3rd Floor
Aliganj, Jor Bagh Road
New Delhi-110003
Dated: 19th June, 2025

To,

Shri Devendra Singh Rawat
Qr No. 794/95, Guru Ram Das Nagar Ext,
Ramesh Park, Laxmi Nagar, Delhi-110092.

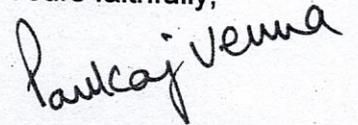
Subject: RTI application -reg.

Sir,

Please refer to your RTI application no. MOENF/R/E/25/00856 dated 17.06.2025 to provide information with regard to the Najafgarh Jheel i.e. copy of the complete Joint Environment management Plan (EMP) prepared for the Najafgarh Jheel for the states of Haryana and Delhi. .

2. A copy of the framework Environment management Plan available on Delhi Parks and Gardens Society, Government of NCT of Delhi i.e. <https://dpgs.delhi.gov.in/dpgs/emp-najafgarh-jheel> has been downloaded and is here by enclosed.

Yours faithfully,



(Pankaj Verma)
Scientist 'F'/CPIO

Encl: As Above

Copy to:

- (i) RTI Cell, IPB, MoEF&CC, Jor Bagh, New Delhi.
- (ii) FAA/ Dr. Motipalli Ramesh, Scientist 'F', IPB, MoEF&CC, New Delhi-110003.
- (iii) SO (Wetlands), MoEF&CC, New Delhi-110003.
- (iv) Guard file.

RTI REQUEST DETAILS (अप्रटीआई अनुरोध विवरण)

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Registration Number (पंजीकरण संख्या): MOENF/R/E/25/00856 **Date of Receipt (प्राप्ति की तारीख):** 17/06/2025

Type of Receipt (रसीद का प्रकार): Online Receipt **Language of Request (अनुरोध की भाषा):** English

Name (नाम): Devendra Singh Rawat **Gender (लिंग):** Male

Address (पता): Qr No. 794/95, Guru Ram Das Nagar Ext, Ramesh Park, Laxmi Nagar, Delhi, Pin:110092

State (राज्य): Delhi **Country (देश):** India

Phone Number (फोन नंबर): +91-9868951681 **Mobile Number (मोबाईल नंबर):** +91-9868951681

Email-ID (ईमेल-आईडी): devendra.srawat07@gmail.com

Status (स्थिति)(Rural/Urban): Urban **Education Status:** Graduate

Is Requester Below Poverty Line ? (क्या आवेदक गरीबी रेखा से नीचे का है?): No **Citizenship Status (नागरिकता):** Indian

Amount Paid (राशि का भुगतान): 10) (original recipient) **Mode of Payment (भुगतान का प्रकार):** Payment Gateway

Does it concern the life or Liberty of a Person? (क्या यह किसी व्यक्ति के जीवन अथवा स्वतंत्रता से संबंधित है?): No(Normal) **Request Pertains to (अनुरोध निम्नलिखित संबंधित है):** Pankaj Verma (Wetland)

Dear Sir/Madam,

Information Sought (जानकारी मांगी): Please provide me the following information with regard to the Najafgarh Jheel:

1. Copy of the complete Joint Environment Management Plan (EMP) prepared for the Najafgarh Jheel for the states of Haryana and Delhi.

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NAJAFGARH JHEEL

A Framework Integrated Environment Management Plan Jointly Submitted By
Govt. Of Haryana & NCT Delhi

2021



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Executive Summary

1. The Wetland Authorities of Haryana and NCT Delhi have examined each other's environmental management plan and come up with this joint document stating shared vision on wetland notification, management objectives, actions, monitoring mechanisms and institutional arrangements.
2. Najafgarh Jheel, a transboundary wetland shared between Haryana and NCT of Delhi, is a critical natural infrastructure for the region, buffering floods, treating wastewater, recharging groundwater [with high potential for water supply to significant population] and providing habitat to numerous plant, animal and bird species. The high ornithological value of the wetland is indicated by the presence of 281 bird species, including several threatened ones (such as Egyptian vulture, Sarus Crane, Steppe Eagle, Greater Spotted Eagle, Imperial Eagle) and those migrating along the Central Asian Flyway. Nearly a hundred species are winter migrants visiting the lake from Eurasian region the rest being resident Indian or local migrants. The wetland also supports heronries of Darters, Cormorants, Cattle Egrets and Ibises. The wetland also supports a good population of pisces, molluscs and gastropods which is why the Jheel supports a good population of avifauna
3. **Despite being the source of several benefits and sustaining habitats of diverse species, Najafgarh Jheel has been highly fragmented and transformed, built upon, used as a waste receptacle, and infested with invasive species.** The Sahibi River, of which Najafgarh Jheel was the natural floodplain, has been converted virtually into a drain. **The decimation of wetlands has exposed the neighbouring settlements in Haryana and NCT of Delhi to high risks of pluvial flooding and reduced groundwater levels.** Recent constructions within the wetlands, while impeding natural wetland functions, are precarious owing to high seismicity and liquefaction within the region.
4. **Conservation and wise use of Najafgarh Jheel is an imperative for sustainable urbanisation of the NCT of Delhi and Haryana region, while also securing the role of wetlands as a part of critical ecological networks, key being, a part of the migration corridor in the Central Asian Flyway.** The Government of India, through its numerous policies and programmes, is desirous of mainstreaming full range of ecosystem services and biodiversity values of wetlands within developmental planning at various levels.

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Implementing Wetlands (Conservation and Management) Rules, 2017

5. The top priority is to notify Najafgarh Jheel and its area of influence under the Wetlands (Conservation and Management) Rules, 2017, which is an imperative under the several judicial directions, especially Supreme Court order of February 8, 2017. The notification will also act as a safeguard against the high developmental threats from galloping urbanisation in the region. The flood cushioning, groundwater recharge and waste treatment functions of the Najafgarh Jheel acquire high significance in the face of increasing water stress, and intensity and frequency of extreme events due to climate change and other stressors.

6. Both States agree that core zone of Jheel will encompass the area enclosed within contour 209m amsl as the zone of permanent inundation with seasonal variability extending further into the zone of influence which will extend upto contour 211m amsl. The zone of influence may be partially modified on the Haryana side by existing sectoral roads on east and west. [see Map 1]. Both sides note that the inundation area of the 100 Year High Flood Level extends to contour 212.5m amsl which also overlies zone of the highest soil liquefaction in the region and which is classified as Seismic Zone IV where buildings would be vulnerable to natural hazard.

7. The present wetland regime is a pale shadow of an extensive expanse, spanning nearly 24,000 ha until the 1960s. Regulation and fragmentation of flows of Sahibi River and construction of embankment on the Delhi side have led to a significant curtailment in wetland area and inundation. The creation of Bund along the Najafgarh Jheel on the Delhi side has resulted in massive reduction in the Jheel spread. Still, in Delhi 6500 acres under 211m contour level [inclusive of area under lower contours], 2200 acres under 210m contour line and 890 acres under 209m contour line would be potentially available for holding flood waters. Urbanization has also reduced the submergence area in Haryana. Still, in Haryana, 5349 acres under 211m contour line [inclusive of area under lower contours], 3436 acres under 210m contour line and 917 acres under 209m contour line are available for holding flood waters (Sinha et al, 2019). The area is also in conformity with wetland demarcation on Survey of India map submitted by Government of Haryana to the National Green Tribunal in 2015. Even in regulated conditions, the water levels at Dhansa regulator (upstream of Najafgarh Jheel) have been around 209.9 m amsl (average maximum for 2010-2020) and average 210.6m amsl [daily record from 20 July, 2021 – 9 October, 2021 – see Annexure A- source I & FC, Delhi]. Owing to the

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extensive hydrological modifications, the wetland is mostly confined within the 210 m amsl contour wherein it is inundated for at least 15 days in a year although in 2021 monsoon there have been 90 continuous days of average 210.6m level [see Annexure A]. Groundwater is close to surface. Settlements in the region have naturally evolved around the inundation regime, mostly present outside 211m amsl elevation. Notably, some parts of newly built-up areas in Sectors 107 & 108 of Gurugram fall within this boundary, and being built on wetlands, are routinely submerged. On Delhi side, this area encompasses the Zone L of Masterplan, already designated as Jheel.

8. Developmental activities within the contour 211m amsl are most likely to adversely influence wetland functioning and should be considered as 'no construction buffer zone or zone of influence' as per provisions of the Wetlands (Conservation and Management) Rules, 2017. This zone spans 4,740 ha (2,600 ha in NCT of Delhi and 2,140 ha in Haryana). The area is also a hazard zone for construction due to high seismicity and soil liquefaction risks. (refer Map 1 at page 7 for extent of wetland and zone of influence)
9. Regulation under the Wetlands (Conservation and Management) Rules, 2017 within the wetland and its zone of influence is proposed to be as follows:

	Within Wetland	Within Zone Of Influence
Prohibited Activities	<ul style="list-style-type: none"> • Conversion for non-wetland uses including encroachment of any kind; • Setting up of any industry and expansion of existing industries; • Manufacture or handling or storage or disposal of: <ul style="list-style-type: none"> ○ 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 	<ul style="list-style-type: none"> • Diversion of inflowing water channels • Change in land use. <ul style="list-style-type: none"> • Poaching.

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	<p>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;</p> <ul style="list-style-type: none"> ○ electronic waste covered under the E-Waste (Management) Rules, 2016 <ul style="list-style-type: none"> • Solid waste dumping; • Discharge of untreated wastes and effluents from industries, cities, towns, villages and other human settlements; • 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; • Construction of new roads and widening of existing ones, and, • Poaching 	
<p>Regulated Activities</p>	<ul style="list-style-type: none"> • Subsistence level biomass harvesting (including traditional practices); • Culture fisheries practices (in private lands); • Plying of non-motorised boats; • Desilting; • Construction of temporary nature • Vehicular traffic on the embankment – especially during 	<ul style="list-style-type: none"> • Sinking borewells • Construction of new roads and widening of existing ones • Culture fisheries practices

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	bird migration seasons	
Permitted Activities	<ul style="list-style-type: none"> • Ecological rehabilitation and rewilding of nature ; • Wetlands inventory, assessment and monitoring; • Research; • Communication, environmental education and participation activities; • Management planning; • Habitat management and conservation of wetland-dependent species; • Community-based ecotourism (with minimum construction activities). 	

Recommended Management Actions

10. Management of Najafgarh Jheel should be based on the principle of 'wetland wise use' – maintenance of ecological character, achieved through the implementation of ecosystem approaches, within the context of sustainable development. Wise use of Najafgarh Jheel will be realised when the capability of the wetland to provide its full range of ecosystem services and sustain rich biota is maintained now as well as in future, on pathways that are aligned with ecosystem principles and guided by sustainable development. Management measures directed at preventing further degradation of Najafgarh Jheel, however, may not be sufficient, and thereby should in the long run culminate into ecological restoration measures to assist recovery of biodiversity and ecosystem functioning.

Immediate Measures (within 1st Year)

- **Notification under Wetlands (Conservation and Management) Rules, 2017**
- Boundary demarcation using geo-tagged pillars
- **Constitution of Najafgarh Wetlands Committee to :**
 - a) oversee compliance with extant regulations;
 - b) Coordinating formulation of integrated management plan and implementation strategy;

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- c) Establishing and maintaining an integrated wetland inventory, assessment and monitoring system;
- d) Reviewing development plans concerning the wetlands and its zone of influence, and making recommendations for preventing adverse ecological change;
- e) Communication and outreach on wetland values and functions;
- f) Promoting long term management-oriented multidisciplinary research to support wetland conservation and wise use, and
- g) Habitat restoration for enhanced ecological function
- Commissioning hydrological assessment to determine water, sediment and nutrient fluxes; groundwater recharge; and critically silted up areas needing desiltation
- Constituting 'Wetland Mitra' - an informal, voluntary and non-statutory network of concerned citizens to foster and promote community engagement in management and ecological restoration (including protection of heronries)
- Putting in place a wetland assessment and monitoring system to guide effective management planning
- Commissioning species inventory
- Feasibility assessment for: a) construction of a regulator at Jhateekra to regulate water levels within Najafgarh Jheel, and b) construction of sluices or ducts in the embankment to allow for inundation on Delhi side
- Developing a comprehensive stakeholder-endorsed wetlands management plan on the basis of framework environment management plan, including measures required for ecological restoration
- Carrying out testing of groundwater quality, surface water quality, bed soil deposits and establishing lithologs
- Establishing accurate GIS map base and establishing testing/monitoring grids over space

Medium-term Measures (within 2 – 3 Years)

- In-situ treatment of major inflowing drains, at least to the tertiary level in compliance with various judicial directives. Constructed wetland technologies may be used to complement the existing wastewater treatment plants
- Construction of regulator at Jhatikra on Delhi side and operating the structure to manage water levels for diverse species (based on outcomes of feasibility assessment).
- Construction of sluices and ducts in the Delhi side embankment (based on outcomes of feasibility assessment)

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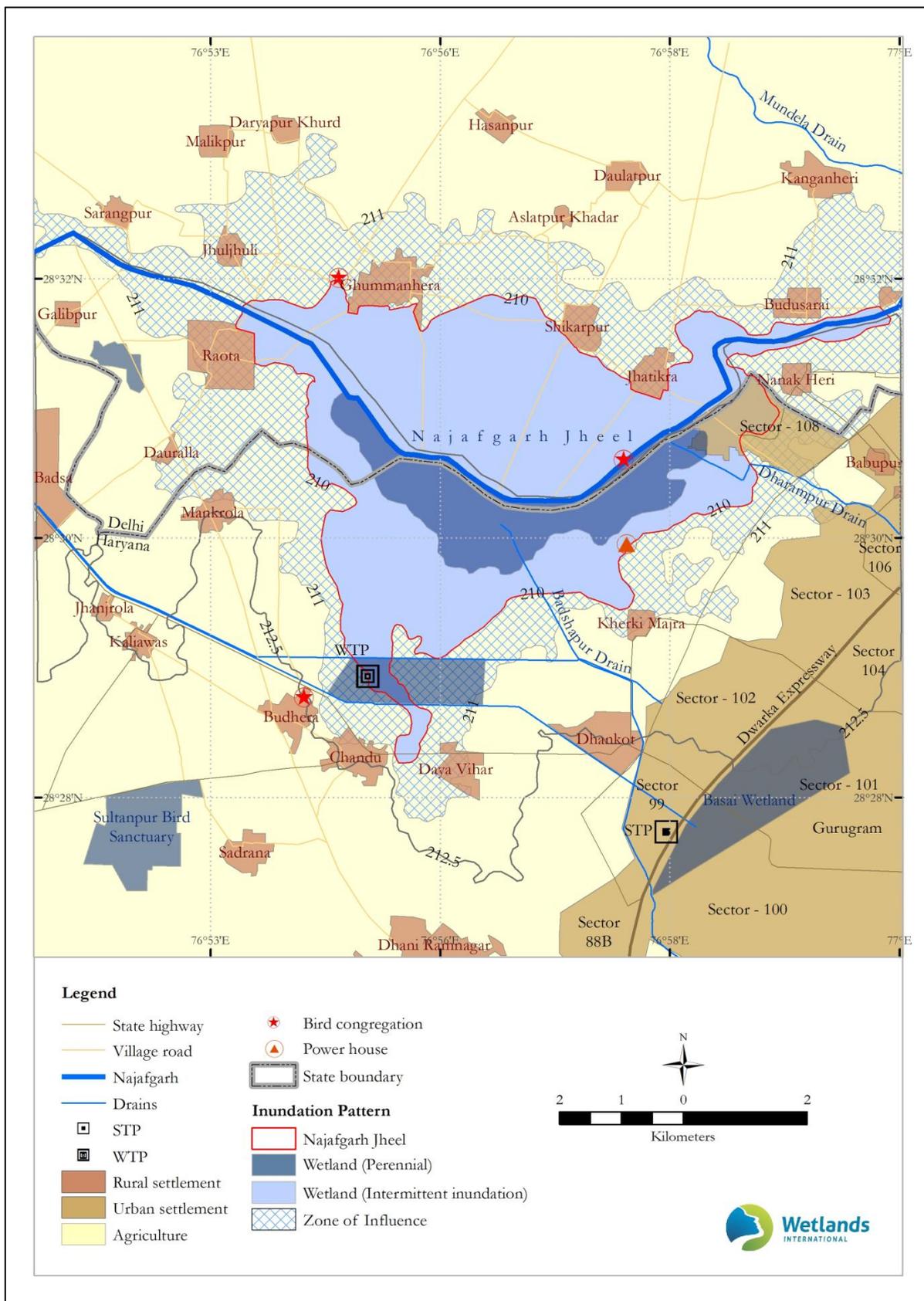
- Selective dredging and desilting to restore natural flow gradients of inflowing drainages (while taking caution not to disturb bird habitats) and to remove sediment and sludge deposits
- Relocating flow obstructions such as power sub-station
- Providing alternate road connectivity to the settlements at the two ends of the Najafgarh Jheel, thus reducing vehicular traffic on the embankment especially during peak migration season of waterbirds
- Manual removal of water hyacinth and other aquatic invasive species in select pockets, and developing enterprise for economic utilisation
- Piloting community micro-enterprise based on organic agriculture in zone of influence
- Training communities in bird watching
- Operationalising wetlands hydrological, ecological and socio-economic monitoring and reporting
- Regular monitoring of waterbird population following standard protocols as the Asian Waterbird Census at all the major congregation sites within and around Najafgarh Jheel
- Bird ringing and banding studies to assess movement patterns of key species and connections with other wetlands
- Carbon and Green House Gases flux assessments to determine role of Najafgarh Jheel in climate change
- Signage at entry and exit locations, and at key vantage points to communicate the value of Najafgarh Jheel, management arrangements, and dos and don'ts for people while in wetland
- Capacity development of line departments and communities on various aspects of wetlands management, responding to needs assessment
- Design of incentive systems (monetary and non-monetary) for communities holding private land titles within wetlands to promote their engagement in wetlands conservation and ecological restoration
- Planning for Eco-tourism and livelihood possibilities

Long-term Measures (within 3 - 5 Years)

- Hydrological regime restoration by water level regulation at Jhateekra, reoperating sluices on embankment, and (if required) diverting flows into the Jheel from upstream sources
- Implementing ecological restoration measures (as recommended in management plan)
- Implementing eco-tourism and livelihood plans

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- Construction of bund along the Najafgarh drain on Haryana side outside contour level 209m subject to the outcome of detailed integrated management plan and hydrological study
- The construction of remaining portion of Badshahpur drain subject to the outcome of detailed integrated management plan and hydrological study
- Constructing a wetland interpretation center (Haritima is a possible location in NCT Delhi and at **Sultanpur National Park**, Gurugram, already notified as Ramsar Site) to educate visitors on the diverse values and functions of the wetland, and create the basis of an affirmative behavior for conservation of wetlands



Map No 1 : Najafgarh Jheel (Recommended Wetland Boundary And Zone Of Influence) (Contours Have Been Digitised From Various Survey Of India Toposheets)

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1. Najafgarh Jheel – The Management Context

- I.1 Najafgarh Jheel, a transboundary wetland shared between Haryana and NCT of Delhi, is a critical natural infrastructure for the region, buffering floods, treating wastewater, recharging groundwater and providing habitat to numerous plant and animal species, including diverse migratory and resident waterbirds. Despite being source of critical benefits and sustaining high biological diversity, the wetland has been highly fragmented and transformed, used as a waste receptacle, and infested with invasive species. The Wetland Authority of NCT of Delhi, in compliance with the directions of Hon'ble National Green Tribunal, constituted an expert committee vide order dated October 29, 2020, to: a) recommend contour levels and delineated maps of Najafgarh Jheel and its zone of influence for notification under Wetlands (Conservation and Management) Rules, 2017 and recommend an Environment Management Plan including prohibited and regulated activities (order and constitution of expert committee at Annex 1). The NCT **Delhi** plan was drafted by a team comprising Mr. Manu Bhatnagar (Principal Director, Natural Heritage Division, INTACH), Ms Neha Sinha (Conservation and Policy Officer, Bombay Natural History Society) and Dr Ritesh Kumar (Director, Wetlands International South Asia). For **Haryana** the Environment Management Plan has been drafted by Shri. R.S. Verma, Director, Environment & Climate Change Department, cum-Member Secretary, State Wetland Authority, Haryana, Dr. R.K. Chauhan, Joint Director, Environment & Climate Change Department, Haryana and Shri Prince, Technical Expert, State Wetland Authority, Haryana under the able guidance of Shri Vijai Vardhan, Chief Secretary to Govt, Haryana and Shri S. N. Roy, Additional Chief Secretary, Environment & Climate Change, Department with the help of 2 Sub-Committees namely Engineering Sub-committee and Financial Sub-committee constituted for the matter of Najafgarh Jheel, in accordance and in compliance with the directions of Hon'ble National Green Tribunal.
- I.2 This Environment Management Plan responds to the terms of reference of the expert committee. In framing this plan, existing reports have been referred to (notably, the booklet – Najafgarh Jheel prepared by INTACH in 2018, a detailed note on status of Najafgarh Jheel and Action Plan for its Preservation and Wetland and Restoration by eminent ecologist Prof C R Babu), and maps, satellite images and datasets made available by various agencies. Field-visits to the wetland were also made on November 11, 2020 by NCT Delhi experts and on September 08, 2021 by the Engineering Sub-Committee, Haryana. The plan uses the management planning guidance of the National Plan for Aquatic Ecosystems

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of the Ministry of Environment, Forest and Climate Change as the reference framework.

- I.3 The expert committee refers to this document as a framework plan to be used as a guide for developing a comprehensive management plan based on a diagnostic evaluation of wetland features and related biodiversity and their governing factors, involving a multidisciplinary expert team and extensive stakeholder consultations. The plan also provides a basis of wetland demarcation for the purpose of notification under Wetlands (Conservation and Management) Rules, 2017. Given that this is an interstate wetland, the Wetland Authorities of both states have examined each other's environmental management plan and come up with this joint document stating shared vision on management objectives, actions, monitoring mechanisms and institutional arrangements.

Wetland Extent

- I.4 Straddling the border of Haryana and NCT of Delhi, the Najafgarh Jheel is a large wetland located in the Sahibi River Basin which spans 10,611 km² across Rajasthan, Haryana and NCT Delhi (Map 1). The wetland forms part of the course of the Sahibi River and is depicted in the maps of 1803, 1807, 1936, 1964, 1975, 1984, 1996, 2010 [Survey of India] and can be readily seen as an interstate waterbody in various satellite images. It is also mentioned on p. 94 of National Wetland Atlas [Haryana State], 2011, and as per the February 8, 2017 directions of the Supreme Court in matter related to Writ Petition(s)(Civil) No(s). 230/2001 is to be notified under the provisions of Wetlands (Conservation and Management) Rules, 2017.
- I.5 The current wetland regime is a fragment of large expanse, which was noted in the Delhi Gazetteer, 1883, as having a spread of 88 square miles [226 km² or 56500 acres] based on the Revenue Settlement Records [Maconachie, 1880]. In 1865 the Govt. of the North-West Province [later United Provinces] started draining the Jheel by excavating and widening the channel of Sahibi from the eastern end of the Jheel to the Yamuna. This channel then came to be known as the Najafgarh Nala or Najafgarh Drain having a length of 51 km in UT of Delhi.
- I.6 Being a shallow depression in a large catchment and with constricted outfall, the area surrounding the wetland is recurrently flooded. Floods are therefore a regular feature, and major floods have been recorded – 1958, 1964, 1977, 1988, 1995 with lesser floods in 1967, 1975, 1976, 1983, 1996, 2010, 2016, 2020 and even

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in 2021. Subsequently, after the floods of 1964, the Union Territory of Delhi built an embankment on its side of the Jheel to prevent inundation of its areas parting the Jheel into north and south segments. [Haryana cannot similarly do so as this is the only route for escape of flood waters from Gurugram to Yamuna River]. Again, after the massive floods of 1977 the Najafgarh Drain was widened to accommodate the flood and Delhi started constructing the Supplementary Drain to carry the excessive flood discharge to the Yamuna. The construction of embankment has thus curtailed the natural flood pulses, and also triggered land use change, with large swathes brought under agriculture, and fringes for urban development.

- I.7 Wetlands are defined in the text of Ramsar Convention (to which India is a signatory) 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 tide does not exceed six metres”. Wetlands are delineated based on their key indicators—namely presence of permanent or intermittent inundation (at least in excess of 15 days in a normal hydrological year), hydrophytes (of dominance above 50%), and saturated soil (with ground water levels less than 1 foot). A systematic delineation of wetland regime has not been done in case of Najafgarh Jheel, however the inundation patterns provide a robust indicator for the said purpose. The current regimes however are significantly modified by the embankment on the Delhi side, and operation of regulators at Dhansa (upstream of the wetland).
- I.8 In flood years vast areas of the Najafgarh Jheel depression have been submerged. Thus, in 1958 the Jheel submerged 145 km² [14,500 ha] and in 1964 the Najafgarh Jheel attained a spread of 240 km². [Source: Irrigation and Flood Control Department, NCT of Delhi].
- I.9 Data on the spread attained in 1977 is available, not in terms of area but in terms of contour levels reached by flood waters. The water levels are recorded at the depth gauges on various regulators and bridges by Dept. of Irrigation and Flood Control, Delhi [I & FC]. The following data regarding the 1977 [which may be taken as the once in a 100 year flood on the Sahibi] flood levels is available from I & FC website (also see Image no. 4 on. p.17) :

“The max level recorded D/s of Dhansa regulator was 212..80 m amsl (697.98 ft) on August 9, 1977 and the max. level recorded at Kakraula was 212.125 m amsl (695.77 ft) on August 16, 1977 and the same level was recorded at Basaidarapur on August 17, 1977. The rural area in Delhi remained under water for about 3½ months and were free from submersion only in the second week of November.”

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I.10 The water level data for 2010-2020 (Table 1) and for 2021 (Table 1A) indicates that even in the regulated condition, the average maximum water level attained at Jhatikra bridge [immediately downstream of the Jheel] over the last 11 years has been 209.90 m amsl and average minimum level has been 208.75 m. These levels are the result of intense rainfall events in Gurgaon and SW Delhi and do not cater to the basin level events which can occur in any year. While there is an impression that there is hardly any flow in the Sahibi river due to several checkdams in the Rajasthan side upstream of Masani Barrage the northern part of the Sahibi catchment [downstream of Masani Barrage], amounting to some 5000 km², is capable of generating massive inflows, well beyond the water holding capacity of the Jheel.

Table No 1: Water Level [m] And Discharge Of Najafgarh Drain Upstream & Downstream Of Najafgarh Jheel

NAJAFGARH DRAIN								
YEAR	RAINFALL (mm)		DHANSA DISCHARGE (Cusec)		DHANSA REGULATOR (Level)		JHATIKRA (Level)	
	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.
2010	5.40	98.80	364	1485	209.300	210.375	208.750	210.350
2011	2.10	62.20	13	330	209.275	209.800	208.500	209.750
2012	3.80	54.60	36	563	209.350	209.950	208.350	209.725
2013	2.40	83.60	7	653	209.250	210.000	208.750	209.925
2014	6.40	77.80	20	284	209.300	210.300	208.650	209.700
2015	1.60	62.40	36	330	209.350	209.800	208.800	209.700
2016	1.80	57.80	7	799	209.250	210.075	208.900	210.000
2017	3.20	26.20	36	158	209.250	209.950	208.750	209.625
2018	2.80	62.40	7	1365	209.250	210.325	208.900	210.125
2019	3.60	34.20	7	103	208.900	209.500	208.900	209.375
2020	3.20	102.60	144	2400	209.250	210.700	209.000	210.650

Source : I & FC, Delhi

Table No 2 : Water Level [in m amsl] Attained at Dhansa, Jhatikara, Kakraula (2021)
[Data for all days from 20/7/21 to 9/10/21 Available In Annexure A]

Date	Dhansa	Jhatikra	Kakraula
20/07/2021	210.350	210.250	210.300
29/07/2021	210.700	210.650	210.450
01/08/2021	210.800	210.750	210.575
08/08/2021	210.875	210.850	210.550
13/08/2021	210.800	210.775	210.500
22/08/2021	210.550	210.450	210.250
06/09/2021	210.650	210.575	210.350
12/09/2021	210.800	210.750	210.550
17/09/2021	210.950	210.400	210.650

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21/09/2021	210.950	210.875	210.650
30/09/2021	210.900	210.850	210.575
09/10/2021	210.650	210.600	210.325

Source : I & FC, Delhi



Map No 2 : Catchment of Sahibi River (Source: Irrigation and Flood Control Department, NCT Delhi)

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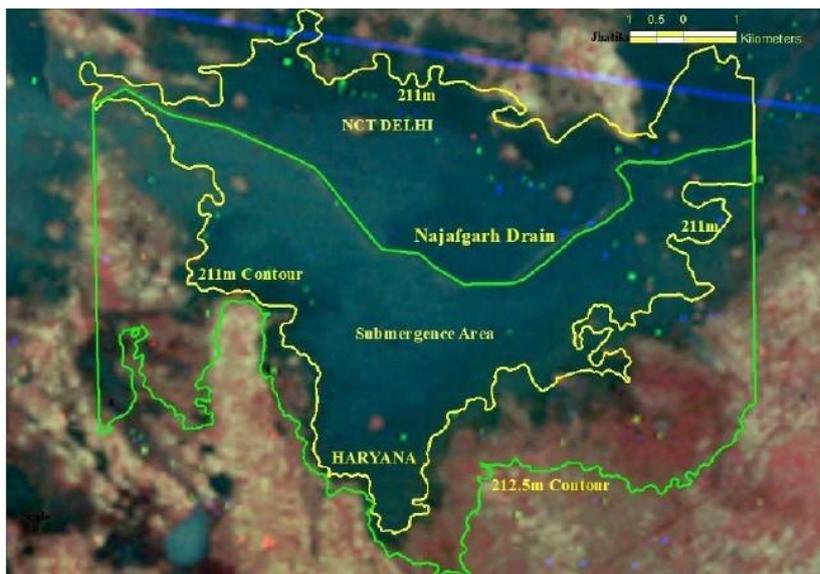


Image No. 1 : Inundation of 1977 floods (Landsat MSS Imagery, Sinha et al, 2019)



Image No. 2 : Vast Waterspread On Delhi Side In 1999 (Even As A Result Of Localised High Rainfall Event)

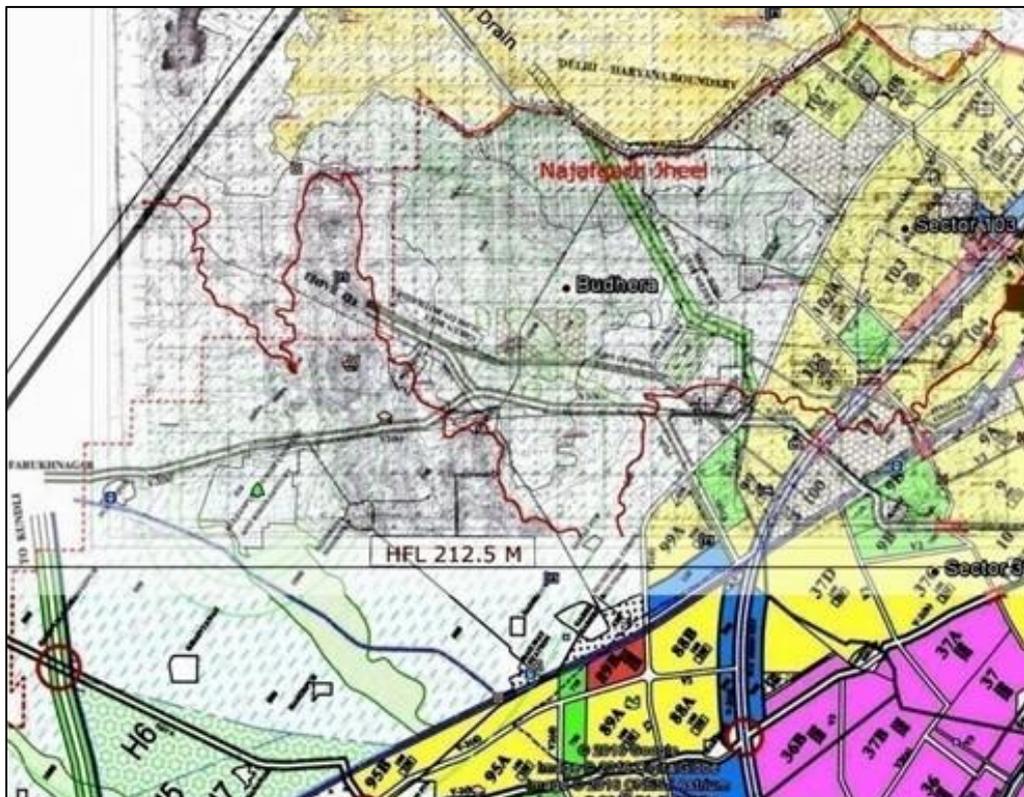


Image No. 3 : Submergence Patterns Along Najafgarh Jheel (September 9, 2016) (Source: Sinha Et Al., 2019)

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Image No. 4 : Inundation on August 20, 2020 on Delhi side (top left and right) and Haryana side (bottom left and right) (Credit: Ramesh Mumukshu)



Map No 3 : HFL Red Contour 212.5 M Amsl (100 Year Flood Level) Overlaid On Gurgaon Master Plan (2031)(Several Proposed Sectors Are In Flood Hazard And Soil Liquefaction Zone)

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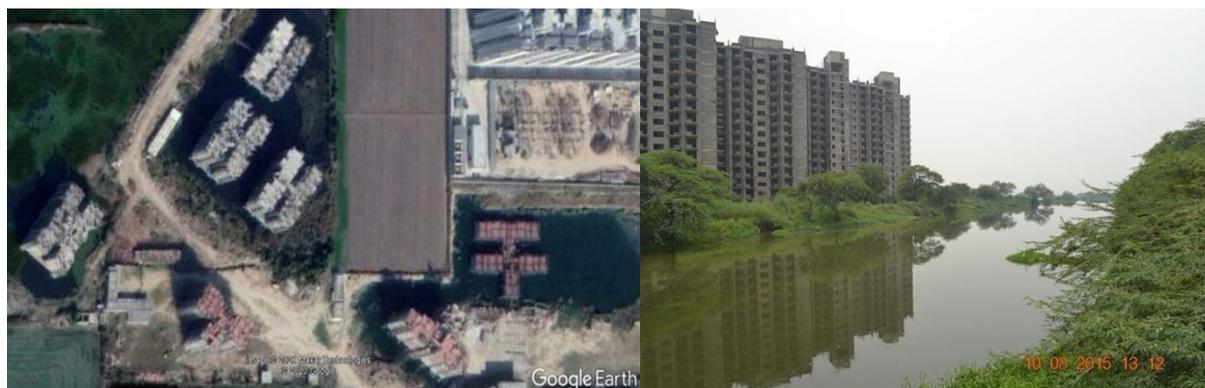
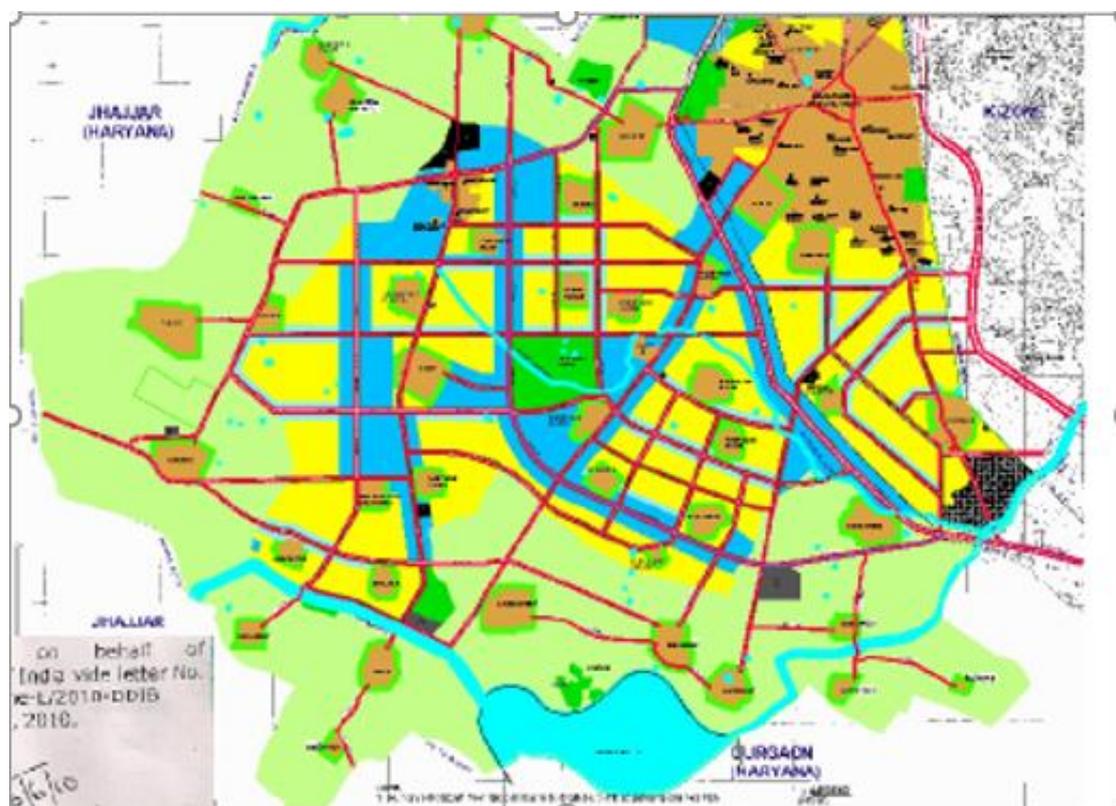


Image No. 5 : Wetland Areas Constructed Upon Are Routinely Under Water. Left: Apartments In Sector 107 Inundated; Right: Woodshire Apartments, Sector 108 Gurgaon With Basement And Lower Storey Inundated)



Map No 4 : Najafgarh Jheel marked in Zone L Plan of Master Plan of Delhi 2021

- I.11 Despite construction of an embankment on Delhi side, the area along the interstate boundary is inundated for a reasonable period in all major flood events and the floodwaters overtop the embankments (Picture 2). At Raota village, according to I & FC, in 2020, an area of approximately 244 acres [nearly 1 sq.km.] was submerged., i.e. upto nearly contour 210 m amsl and this year approximately 500 acres [2021] almost upto contour 211m amsl.
- I.12 The area of wetland constructed upon in Sectors 107 & 108 in Gurugram are routinely inundated (Image No. 5).

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- I.13 On behalf of the NGT a visit was made to Najafgarh Jheel by a team consisting of Hon'ble Member of Yamuna Monitoring Committee, Shri. B. S. Sajwan, two Monitoring Committee Members of Haryana, Shri. M. D. Sinha, Additional CEO, Gurgaon Metropolitan Development Authority and his team, the Member Secretary of CPCB and his team, Irrigation Department of Haryana and HSPCB Members and Professor C. R. Babu of the University of Delhi. The visit was made on January 25 2020. An excerpt from the report of Prof Babu is reproduced below :

“The left out Najafgarh Jheel is the only landform that ensures the safety to Gurugram and Delhi from the massive floodwaters during heavy rainfall resulting from climate change. In fact, it was pointed out that the frequent water logging of Gurugram city roads and submergence of flats in the submergible area enclosed by 212m contour line is the rule rather than the exception. Sector 108 of Gurugram and neighbouring areas, which were flooded and submerged in 2010, have been brought under construction and are in the core flood zone. Najafgarh Jheel is the only safeguard for both the cities against climate change and adaptation to extreme events – extreme temperature and rainfall.”

- I.14 As per the data and analysis of the topography of the area and surface hydrology, the high flood level in the area was at 212.5m contour level. Based on the chronological record, map series, water level data and visual evidences presented above the core area of the Jheel may be delineated outside contour 209 m amsl (Map 3). The area between contours 209 m amsl and 211 m amsl serve as the zone of influence, whereas the area upto 212.5 m amsl is a zone of high floods. It is also clear from the report of the Technical Committee of State Wetland Authority Haryana that the flood water usually covers the area under the 209m contour and seasonally go beyond the 210m contour. It is clear that the 209m contour level is crucial for the maintenance of this Jheel. The zone of influence is to act as a buffer zone for holding seasonal floods where the community can practice seasonal agriculture but no construction activity and mining are permitted, On the eastern and western sides [Gurugram], the major existing sector road intersecting the 211m contour may be the boundary of the zone of influence. This delineation takes into account:

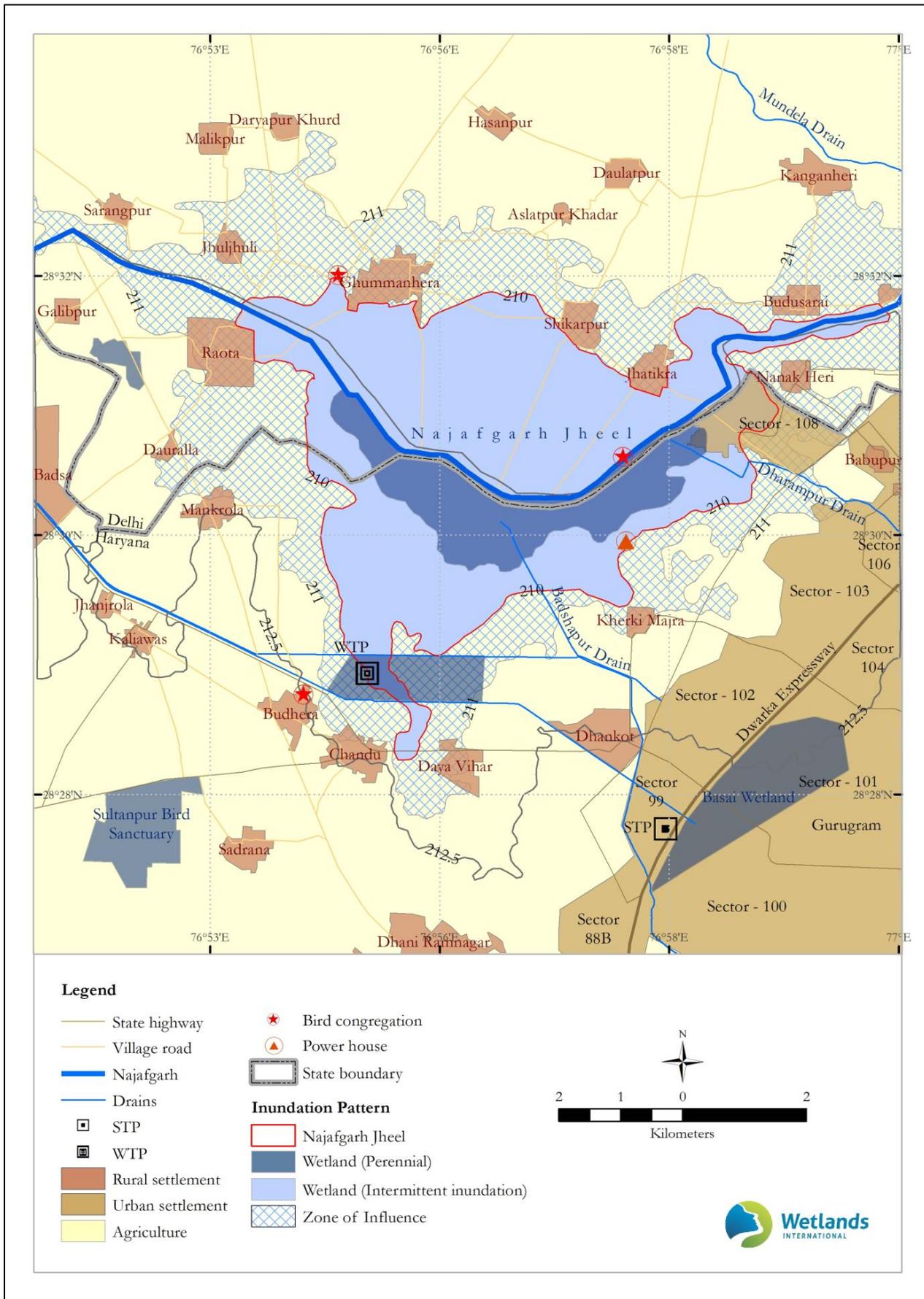
- Permanent and intermittent inundation areas, as well as the presence of hydrophytes.
- Zone L of the Masterplan of NCT Delhi which already reserves an area of 356 ha [890 acres] designated as Najafgarh Jheel (Figure 1). Masterplan also mandates that one revenue village depth along NCT Delhi boundary is to be maintained as green belt.

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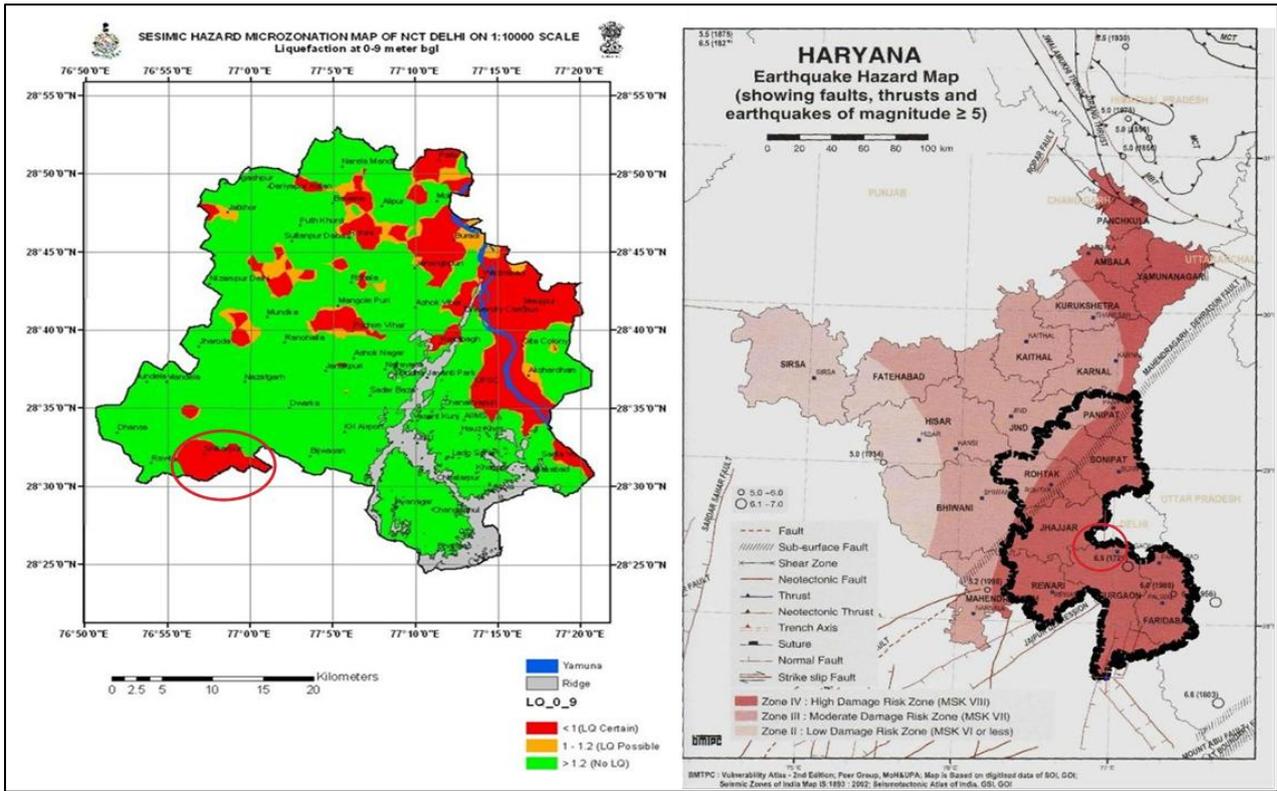
- The zone of influence [upto contour 211m amsl] excludes village settlements, which have naturally developed on the edges of the inundation.
- Sol Map submitted by Government of Haryana in National Green Tribunal in August 2015
- Detailed contour mapping presented in report of Prof C R Babu (especially Picture 1 and 3)
- Report of the Divisional Commissioner, Gurugram

1.15 Again, based on the record and evidences from the point of view of flood pulsation and public safety a two layer buffer zone is recommended. The first buffer will be provided by the zone of influence (area between 209m amsl and 211m amsl contours) and second buffer upto contour 212.5 m amsl. This will provide a large flood absorption area, which is vital considering the recurring frequency of extreme events, especially due to changing climate. The embankment, which presently isolates natural flood pulses on the Delhi side will be opened at places to allow for prolonged inundation, and thus enable groundwater recharge. This may be crucial to cushion the already depleting groundwater reserves of the NCT region. [see Map No. 5]

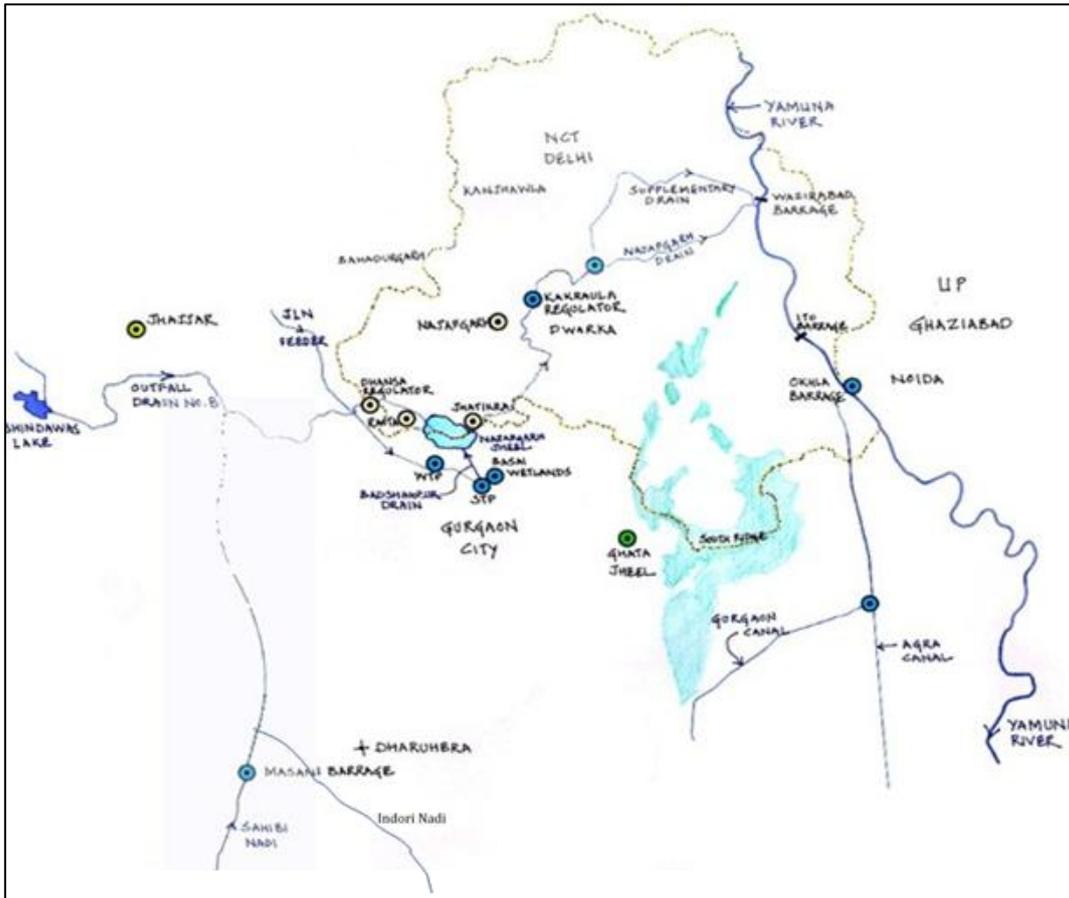
1.16 It is crucial that construction activity in and around the wetland region is completely curtailed given the high risk of liquefaction and earthquake hazards (Map no. 6).



Map No 5 : Najafgarh Jheel (Proposed Boundary Of Wetland And Zone Of Influence) (Prepared By Overlaying Contours From Survey Of India Toposheets Over Satellite Images Of November 2019)



Map No 6 : Seismic Hazard Maps For Delhi (Left) And Haryana (Right) - Clearly Zone Of Liquefaction Extends All Around The Jheel Area



Hydrological and Ecological set up

- 1.17 The hydrological regimes of Najafgarh Jheel are influenced by the water and land management in the basin of Sahibi River (Fig 2). The northern Haryana catchment lying in Rohtak, Jhajjar and Rewari Districts is generally sloping southwards and discharge surface runoff into the Najafgarh Jheel through Outfall Drain No.8 and Sahibi which have a common course of 24 sq.km. upstream of the Najafgarh Jheel. The southern catchment from Rajasthan and South-West Haryana slopes northwards and provides surface runoff to the Jheel through Sahibi [in years of heavy rainfall only]. Surface runoff and storm water inflows from Gurugram district provide major contribution to the Jheel in monsoons. NCT Delhi's segment of the basin is sloping southwards and provides surface runoff through sheet inflow to the Jheel. Major part of the catchment is in Rajasthan (65%) and Haryana (29%). The NCT of Delhi accounts for only 6% of the catchment area. Of the entire catchment, approximately 9,300 sq. km. area drains upstream of Najafgarh Jheel.
- 1.18 Water level measurements around Najafgarh Jheel are available for Dhansa Regulator (upstream) and Jhatikra (Downstream) (Figure 3). Currently records are maintained only for monsoon period, wherein a variation between 209.25 m amsl and 210.95 m amsl can be seen at Dhansa Regulator. There is general gradient of about 1m in 15000m or 7cm fall per km. towards River Yamuna resulting in the gentlest of outflows.

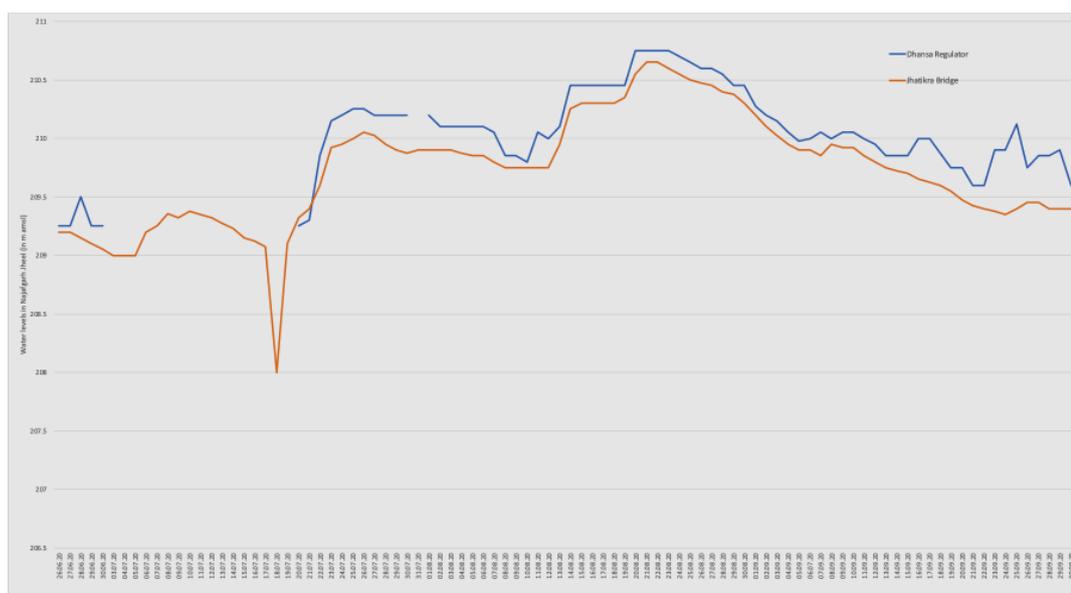


Figure No. 1 : Water Level Variation Upstream And Downstream Of Najafgarh Jheel (2020) (Data Source: Irrigation And Flood Control Department, NCT Of Delhi)

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- 1.19 The wetland, at 209m amsl inundation has a water holding capacity of 10 MCM (Figure 4). Maintenance, and enhancement of this capacity is crucial for flood buffering and groundwater recharge functions.

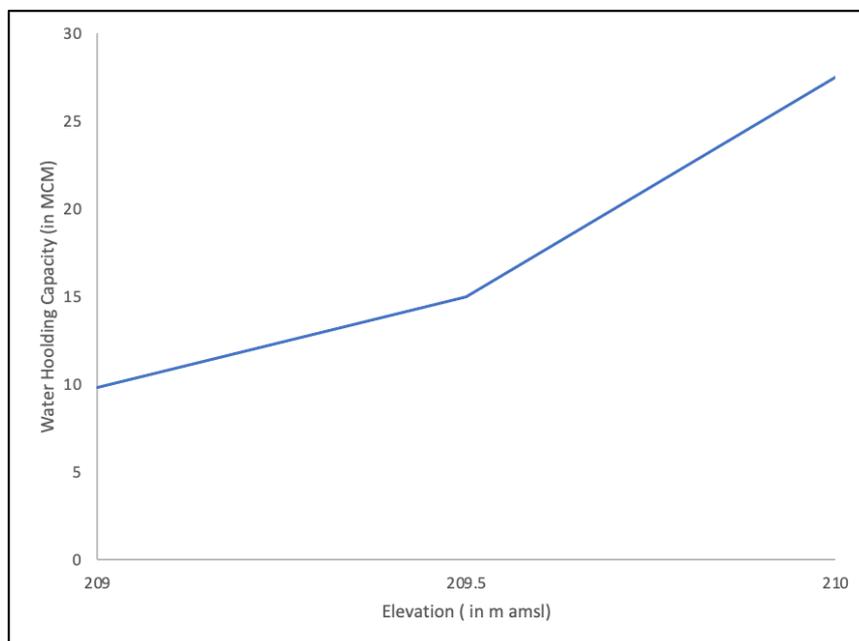


Figure No. 2 : Water Holding Capacity Of Najafgarh Jheel (Projected)

- 1.20 The Rajasthan segment of the basin has hardly contributed flow in recent years with their various retention structures and other interventions holding back waters. However, the possibility of occurrence of widespread rainfall of high intensity taking place cannot be ignored.
- 1.21 The average annual rainfall in the 5 basin districts is approximately 600 mm. With an average slope of 4% over a mixed urban and agricultural basin [with a sandy loam soil] such a rainfall a 10% runoff coefficient can be assumed [Source: Irrigation Engineering and Hydraulic Structures by S.K. Garg (2004)]. Annually, the runoff generated by the Haryana and NCT Delhi basin segments [2400 sq.km.] alone would amount to 144 MCM.
- 1.22 Of late intense rainfall events of >100mm in a few hours have occurred every 3rd year. Such occurrences can be localised or widespread. Both scenarios are considered here :
- I. Widespread 100mm + rainfall in the course of a day would generate a surface runoff of 30% or 72 MCM [2400 sq.km. x 100mm x 30%]
 - II. Localized rainfall of 100mm + in the course of a single day falling over NCT Delhi basin segment [100 sq.km.] and Gurgaon [urban area + Manesar + rural belt in between = 300 sq.km.] would generate a surface runoff of 20 MCM [400 sq.km. x 100mm x 50%]

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1.23 In addition, there is a small but continuous discharge from Dhansa Regulator, which is unquantified but contributes to the Jheel spread.

1.24 The Najafgarh Jheel receives a continuous input of sewage from Gurgaon as well as surrounding villages of Delhi. As per the report of Technical Committee [Haryana], nearly 350MLD of treated sewage or grey water from STP plants is being released into the Jheel area. Along with this, the excess rain water from Gurugram during the rainy season also drains in to the Jheel. This has converted a seasonal Jheel into a permanent waterbody sustained by the grey water from the city. Presently, Gurugram is generating 300 MLD [0.3 MCM] of raw sewage, whereas the official projections are 533 MLD for 2021.

“Estimates of how much sewage Gurugram produces vary. One set of data says the city generates about 225 MLD of sewage, and its treatment plants can process only 148 MLD. In 2007, the official estimate put the quantum of sewage generation at 129.6 MLD while the Joint Association of Federation of Residents Welfare Associations (JAFRA) estimated it to be about 260 MLD. The official forecast for the year 2021 projects sewage generation of 533 MLD, but JAFRA projects a figure of 864 MLD” – ‘Gurugram : A Framework For Sustainable Development’ by CSE, 2017

1.25 The daily percolation in the core zone [Gurgaon and NCT Delhi] may be assumed at 5mm column per day. In summers the daily evaporation loss is 1.5 cm column and in winters 0.5 cm column. Taken together with the daily loss in May would be 2 cm column and in December 1 cm column. In volumetric terms this amounts to for contour 209m amsl :

In May	: 131 MLD [0.13 MCM]
In December	: 65.5 MLD [0.065 MCM]

1.26 In the short term [say 5 years] treated wastewater flows from NCT Delhi side would also be available for discharge through the Jheel.

1.27 The Najafgarh Jheel region has high groundwater levels (Figure No. 2) indicating a significant role of groundwater in sustaining the wetland regime. In the NCT Delhi groundwater map the Jheel area has a high water table particularly on its upstream [west] end in the Raota village area. The water table surface is having an elevation of 208 m amsl whereas the central portion of the Jheel has a bed elevation of 206 m amsl and thus groundwater discharge from this side may contribute to the Jheel storage. With regards to Gurgaon it is well known that the water table has fallen considerably in the general area. However, in the Jheel area and its vicinity the water table is quite

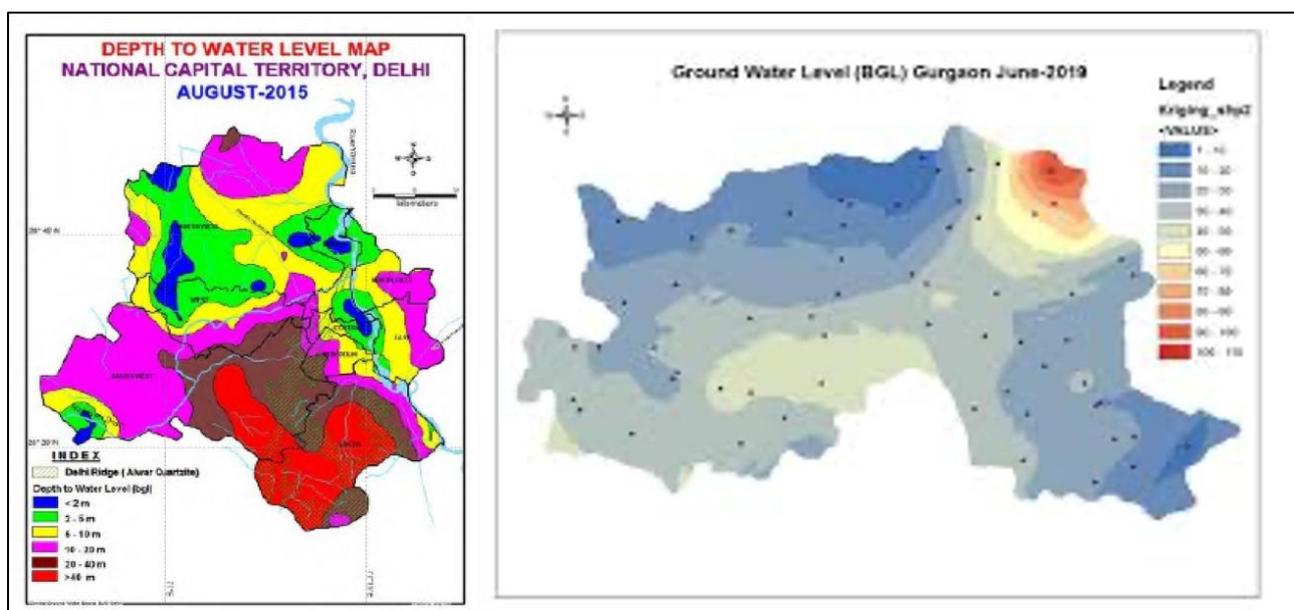
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high with the available data indicating that the water table here is between 1-10 mbgl. Thus, the possibility of return groundwater flow contribution cannot be ruled out.

- 1.28 The Jheel is shallow, with depths at the center upto >2.5 meters. Aquatic vegetation is well established on the Haryana side, with Phragmites stands on the margin and water hyacinth along the central areas.
- 1.29 Continuous discharge of sewage into the wetland has led to poor water quality conditions. Native vegetation is nearly absent, and dead vegetation patches and luxuriant growth of water hyacinth may indicate toxicity.

Table No 3 : Water Quality Of Najafgarh Jheel (Date Of Sampling: November 9, 2020)

Sampling location	pH	TSS [mg/l]	COD [mg/l]	BOD [mg/l]
Dhansa regulator	7.1	4	8	1.6
Najafgarh Jheel	7.5	8	52	5
Najafgarh Jheel downstream	7.3	12	48	8
<i>Sampling By Haryana State Pollution Control Board on 4 Sept/2021</i>				
Jheel Along Bundh	7.03	15.0	80.0	14.0
Inside Lake	7.09	9.0	64.0	9.0



Map No 8 : Groundwater Levels Are High In The Region Around Najafgarh Jheel As Can Be Seen From Depth To Water Level Maps Of Delhi (Left) And Gurgaon (Right)

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Image No. 6 : A Herony Of Cormorants At Najafgarh Jheel



Image No. 7 : An Imperial Eagle, a threatened and migratory species at Najafgarh in 2020.

Photo by Bhrigu Kumar

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Biodiversity Values

- 1.30 The Najafgarh Jheel is a habitat of range of biota, several of high conservation significance, globally and nationally. A comprehensive inventory is yet to be prepared, and much of available information pertains to few groups.
- 1.31 Najafgarh Jheel is inhabited by at least 281 bird species. These include resident species, migratory species, land birds, waterbirds, and birds of prey. This is likely to be National Capital Region's most important bird site. The area also has rich butterfly and dragonfly diversity [details in annex].
- 1.32 Threatened species found in Najafgarh Jheel include Egyptian vulture, Sarus Crane, Steppe Eagle, Greater Spotted Eagle, Imperial Eagle.
- 1.33 It is desirable to create a full species inventory for the area, with the following:
 a) survey and inventory of vegetation—trees, shrubs and plants. b) survey and inventory of hydrophytes and aquatic plants c) creation of butterfly list d) creation of dragonfly list e) further inventory of bird lists.
- 1.34 The site is inhabited by several resident species but is notable for the fact that a group of Greater Flamingos is here all year round in the wetland. This makes Najafgarh one of only two places in NCR to regularly have Greater Flamingos (the other is Okhla bird sanctuary in the Delhi-UP border).
- 1.35 Many migratory birds species come to Najafgarh. These include large groups of waterbirds like Ruffs and Bar-headed goose. Najafgarh wetland also gets raptors (birds of prey) which travel from the Central Asian Flyway – coming to India from Central Asia, like the Steppe eagle and the Greater Spotted Eagle. The Greater Spotted Eagle is listed as 'Vulnerable' as per the IUCN red list. The Steppe eagle is listed as 'Endangered' as per the IUCN red list. The wetland also serves as habitat for land birds that migrate here. Examples include the Wryneck, which is a kind of woodpecker that comes from Eurasia to Najafgarh.
- 1.36 Najafgarh Jheel has become an important heronry. Birds like Darter, Cormorants, Cattle Egrets and Ibis breed on large trees here (personal observation). More than 200 nests have been counted here. In this context, Haryana and NCT Delhi can assume a leadership role by declaring Najafgarh a wetland and protecting it as such. This will help India fulfil its commitments under the Convention on Migratory Species.

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- 1.37 Records of Asian Waterbird Census indicate that the wetland has regularly supported 30-40 waterbird species and counts upwards of 6,000 in the last five years (Figure 5). More than 10,000 birds were counted in 2020.



Image No. 8 : Migratory Black-tailed Godwits at Najafgarh. Photo by Bhriku Kumar

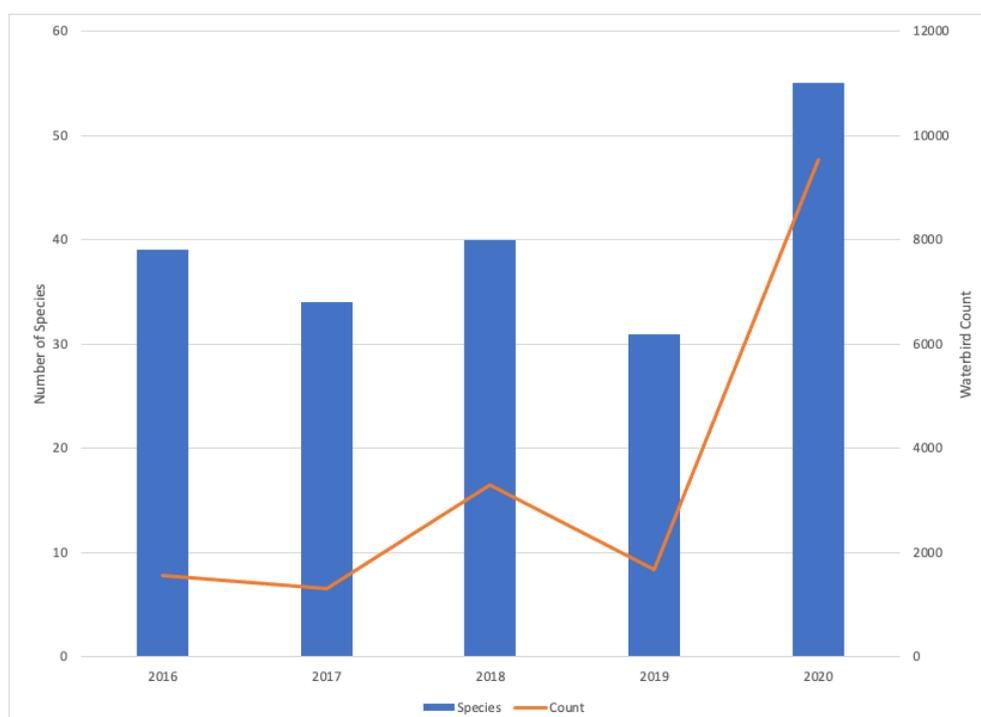


Figure No. 3 : Waterbird Species And Counts Recorded In Asian Waterbird Census (Data Source: Wetlands International South Asia And Bombay Natural History Society)

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- 1.38 **Flora** : The plant species found in Najafgarh jheel include algae species mainly *Azolla*, *Ceratophyllum*, *Chloris*, blue green algae, *Spirulina*, *Nostoc*, *Anabaenopsis* and plant species like Chara, prickly chaff flower (*Achyranthesaspera*), alligator weed (*Alternantherasp*), *Ecliptaprostrata*, water hyacinth (*Eichhorniacrassipes*), *Munj grass (sachharummunja)*, *Anstidaadscensionis*, *Cassia*, *Convolvulusarvensis*, *Nut Sedge (Cyperusrotundus)*, *Cynodondactylon*, *Polygonum*, *Abutilon indicum*, *Amaranthusspinosus*, *Amaranthusviridis*, *Anagallisarvensis*, *Barleriaprionitis*, *Boerhaviadiffusa*, *Calotropisprocera*, *Cocciniagrandis*, *Cordiadichotoma*, *Croton bonplandianus*, *Cynodondactylon*, *Daturastramonium*, *Ipomoea carnea*, *Oxalis corniculata*, *Partheniumhysterophorus*, *Physalis minima*, *Pongamiapinnata*, *Sidacordifolia*, *Suaedaacuminata*, *Tinosporasinensi*, *Solanumsurattense*, *Sachharumspontaneum [Jhunda]*, *Patera (Typhaelephanta)* waler chestnut, *Giant Reed (Arundodonax)*, *Neem (Azadirachtaindica)*, *Babool (Acacia nilotica)* and mesquite (*Prosopis juliflora*)
- 1.39 **Fauna** : Najafgarh Jheel is very rich in both terrestrial and aquatic biodiversity. A brief account of its faunal diversity is given as under:
- a) **Insects** : The insects recorded in Najafgarh Jheel comprise of water beetles, butterflies and dragonflies. The **butterflies** recorded are :
Dingy Swift, Common Red Flash, Plain Tiger, Common, Grass Yellow, Mottled Emigrant,
Common Emigrant, Sole flutter, Common Grass Yellow, Mottled Emigrant, Lemon Pansy, Grey Pansy, Danaid egg fly, Small blue, Yellow pansy, Tawny coster, Peacock pansy, Mottled immigrant, Indian Fritillary, Common rose. There is a possibility of presence of more butterfly species in Naiafgarh Jheel. About 70 seventy butterfly species have reported in Delhi. Accordingly, more explorations on the inventory of butterfly species of Najafgarh Jheel is required to be done.
- b) **Dragon and the damsel flies** are the indicators of a healthy aquatic ecosystem. The dragon and damselflies recorded in Najafgarh iheel are :
Vagrant Emperor, Trumpet tail, Scarlet Marsh Hawk, Ditch Jewel, Granite Ghost, Ruddy Marsh Skimmer, Black Ground Skimmer, Black Tipped Ground Skimmer, Pied Paddy Skimmer, CrimsonTailed Marsh Hawk, Wandering Glider, Common Picture wing, Long legged Marsh Glider, Pygmy Dartlet, Pixie Dartlet, Cormande Marsh Dart, Golden Dartlet, Senegal Golden Dartlet, Three Striped Blue Dart.
- c) **Amphibians** : Common frog and Toad

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- d) **Reptiles** : The reptiles found in Najafgarh include the Indian Cobra, Monitor lizard (Yellow and Bengal), Sand boa (red and common, Rat strake, Common krait, Trinket [water snake], Black spotted pond turtle, White spotted pond turtle, Soft shell turtle.
- e) **Mammals** : The area of Najafgarh Jheel towards Chandu and Makdola villages along the drain harbours mammalian population of jungle cat, jackal, fox and civet. The presence of *Scaccharummunja* and *Saccharumspontaneum* provides a good habitat for these mammalian species.
- e) **Avifauna** : 281 bird species have been recorded in Najafgarh Jheel. While nearly one hundred are winter visitors which visit this lake during winter and come from as far as Eurasian region- the rest are resident Indian or local migratory bird species. The Jheel supports a good population of pisces, mollusks and gastropods, and that is why the lake supports a good population of avifauna. The list of avifauna species found in Najafgarh has been annexed as Annexure 2. Najafgarh Jheel has become an important heronry. Indian pond heron is the most common species of heron in Najafgarh Jheel. Herons are the birds that are essentially non-swimming water birds that feed on the margins of lakes. These are the bird that use corners as their habitat. Threatened avifauna species found in Najafgarh Jheel include Egyptian vulture, Sarus Crane, Steppe Eagle, Greater Spotted Eagle, Imperial Eagle. It is a home to many raptors and other terrestrial birds like the Steppe eagle, Greater Spotted Eagle and Wryneck coming to India from Central Asia. Wryneck is a kind of passerine that comes from Eurasia.

Ecosystem Services

- 1.40 The Najafgarh Jheel moderates floods and serves as a flood buffer for Gurgaon and Delhi. The natural drainage pattern in the region is towards the wetland. With increasing runoff due to built-up areas and intense/extreme rainfall events resulting in increase in pluvial flooding, the buffer function is critical defence for these areas. Particularly, for Gurugram the Najafgarh Jheel's flood moderation function is vital as this is the only route of escape of flood waters to Yamuna.
- 1.41 The Najafgarh Jheel moderates the local climate and will be instrumental in mitigating the challenge of global warming and climate change. It also acts as a carbon sink and helps in attaining SDG 11 goal of inclusive, resilient and sustainable cities.

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- 1.42 The vast water spread allows for massive aquifer recharge ensuring potential raw water supply to significant populations.
- 1.43 The Jheel is a great biodiversity habitat and offers great potential for eco-tourism, fisheries based livelihoods.
- 1.44 In absence on sufficient wastewater treatment capacity, the wetland vegetation serves as sink for nutrients and heavy metals, in absence of which the water quality is likely to be further degraded. The wetland thus saves the neighbouring catchment water treatment costs.

The Jheel renders high aesthetic value and recreational value to the entire region. This in fact has been a major driver of property development especially on the Gurgaon side, also aided in part by weak land regulation.

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2. Major Threats and Management Needs

- 2.1 Extensive Land-Use Change Aided By Hydrological Fragmentation:** The natural inundation regimes of Najafgarh Jheel have been fragmented by upstream water diversions and construction of embankment along the left margin. On the Delhi side, the grasslands which prevailed in the sixties have been cleared for agriculture. On the Gurgaon side, the wetland margins have been developed for settlements and agriculture.
- 2.2 Pollution:** The wetland hydrology is no longer governed by Sahibi River catchment flows, but from sewage discharged from Gurgaon and Delhi. This includes industrial effluents discharged from Manesar. The wetland has thus become a receptacle of untreated wastewater.
- 2.3 Sedimentation:** Low gradients, hydrological fragmentation and absence of flushing flows have led to sedimentation, particularly along the peripheral areas, and sludge deposits towards the centre. This has been further aided by colonisation of emergent vegetation.
- 2.4 Linear Infrastructure:** The wetland regime is crisscrossed by number of roads and other infrastructure such as power station. High voltage power lines in a habitat of migratory waterbirds are also of high concern. and Power Dept. will take action accordingly and measures to protect the birds from any accident due to power lines.

3. Existing Institutional Arrangements, Gaps and Proposed Arrangements for Management

- 3.1 Effective institutional arrangements, with capability of steering decision-making for wetlands conservation and wise use, and addressing direct and indirect drivers of adverse change, are a necessary pre-condition for integrated wetlands management. In the case of Najafgarh Jheel, there is no single entity entrusted with wetlands conservation and wise use, thus creating an institutional void which has been exploited to encroach, degrade and convert this ecologically-fragile region for alternate usages.
- 3.2 Several Central Government acts and rules contain provisions relevant for conservation of Najafgarh Jheel. In 2017, the Ministry notified the Wetlands (Conservation and Management) Rules under The Environment (Protection) Act, 1986. As per these rules, the ultimate responsibility of securing Najafgarh Jheel rests with the Wetland Authorities of the governments of Haryana and NCT Delhi. The Authorities are expected to take necessary measures for delineation of the wetland boundaries and its zone of influence, demarcation on ground using appropriate mechanisms (such as placing boundary pillars), specifying regulation (activities prohibited, regulated and permitted within the wetland and its zone of influence), and formulation and implementation of an integrated management plan to secure its ecological character.
- 3.3 The Indian Wildlife (Protection) Act, 1972 is the crucial regulation protecting wildlife, including waterbirds. The Biological Diversity Act, 2002, and the rules thereunder empower the Central and State Governments to notify species which are on the verge of extinction or likely to become extinct in the near future as '**threatened species**' and prohibit or regulate collection thereof for any purpose and take appropriate steps to rehabilitate and preserve those species.
- 3.4 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. Sahibi River, and its transformed avatar Najafgarh Drain fall within the ambit of this regulatory framework. **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**

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in hundred years', and even to the tributaries of the main tributaries, and thus encapsulate areas upto 213 m amsl (water level at Dhansa regulator in 1977 floods) surrounding the current wetland extent. 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. There is no mechanism in place to ensure compliance is being done, especially when the 100-year flood zone is not properly demarcated, nor the boundaries of the wetland. Construction on the flood zone around Najafgarh Jheel should be completely prohibited on account of seismic and liquefaction risks.

- 3.5 India has launched a National Action Plan for Central Asian Flyway (CAF) in 2019. The Central Asian Flyway covers over 30 countries and has southward migration of birds in winter. India provides critical stopover sites to over 90% of the bird species known to use CAF migratory routes; including birds coming to India from Europe, central Asia, China, Tibet, and Russia. India's National Plan is the first updated Action Plan for the CAF, and provides a common strategic framework for regional collaboration and affirmative action for protecting, conserving, restoring, and sustainably managing populations of migratory bird species and their habitats in the Indian subcontinent falling under the Central Asian Flyway region. This National Action Plan is in line with the Convention on Migratory Species Strategic Plan for Migratory Species, 2015-2023.
- 3.6 India has shown its global leadership for conservation of wetlands and migratory birds by hosting the 13th Conference of Parties on the CMS [Convention on Migratory Species] in Gandhinagar, Gujarat. The meeting was in February 2020. At the meeting, India reaffirmed its commitments to conserve sites important for migratory animals and birds. At this meeting, the important decision of starting an institutional framework for the Central Asian Flyway in India was also taken. Decision 13.46 of the CMS says:

Range States of the Central Asian Flyway (CAF) are requested to: a) collaborate with the Government of India and the Secretariats of CMS and AEWA during the inter-sessional period between the 13th meeting of the Conference of the Parties (COP13) and COP14 to further advance the process initiated in 2018 between the Government of India and both Secretariats; b) establish, by COP14, under the umbrella of CMS, an institutional framework, under the leadership of India and in consultation with the other range states and relevant stakeholders with the aim to agree on, inter alia, conservation priorities and related actions.

- 3.7 There are a number of agencies which deal with different aspects of wetlands or have a bearing on the wetlands condition. A non-exhaustive listing is as follows:

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- a) The MoEF & CC has prime responsibility in the case of Najafgarh Jheel as it is a transboundary wetland. The MoEF would have to push the coordination and management strategy and implementation.
- b) The newly formed State Wetland Authorities would have the primary mandate for the Jheel while coordinating with each other, with the MoEF and with their own State agencies
- c) Within the boundaries of Delhi NCT, maintenance of irrigation and drainage infrastructure linked with the Najafgarh Jheel are placed within the mandate of Irrigation and Flood Control Department (Civil Division I). The primary management purpose is achieving flood control.
- d) Within the boundaries of Haryana, maintenance of irrigation and drainage infrastructure linked with the Najafgarh Jheel are placed within the mandate of Irrigation and Water Resources Department and urban drainage infrastructure linked with the Najafgarh Jheel falls in the jurisdiction of GMDA and MCG. The primary management purpose is achieving flood control.
- e) State Environmental Impact Assessment Authority, Haryana is responsible for environmental clearance of building proposals on Jheel floodplain
- f) The Delhi Development Authority and Town and Country Planning Office, Government of Haryana provide the overarching master plan governing land use. Najafgarh Jheel and its surrounding areas are included within Zonal Plan L of Master Plan of Delhi. Similarly, the Gurgaon Master Plan shows the Jheel and its adjoining areas as open spaces.
- g) The Delhi Jal Board and PHED [Haryana] and Gurgaon Municipal Corporation have the responsibility of managing the sewer network, sewage treatment system which ultimately drains into the Jheel.
- h) Haryana State Industrial Development Corporation is responsible for treatment of industrial effluents discharged in storm water network from Manesar and others reaching the Jheel
- i) The Development Department of Delhi Government issues licenses to fish in waters on payment of annual fee.
- j) The Development and Panchayats Department, Haryana in association with Fisheries Department decide on issue of licenses to fish in water on payment of annual fee.

3.8 INTACH is a prominent civil society organisation highlighting the importance of Najafgarh Jheel, seeking judicial intervention for wetland protection, and has also developed over a period, a rich information base for wetland rejuvenation. A network of bird watchers and enthusiasts under the aegis of Asian Waterbird Census Programme, Bombay Natural History Society and e-Bird Programme routinely conduct waterbird census. There are private land holdings in most part of the wetland (possibly excluding the area under permanent inundation), and the area inundated intermittently is cultivated.

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3.9 It is to be noted that the National Green Tribunal, in a September, 2020 order asked for status of significant wetlands and remedial action for the same for all states. The Court ordered that the same should be done within a period of three months. The order says:

“We also direct that the National Wetlands Committee may compile data of status of compliance of environmental norms in respect of all significant wetlands in the country to ensure remedial action. The State PCBs/PCCs and State/UT Wetland Authorities in India may give the status of management of wetlands in their respective States to the Secretary, MoEF & CC within three months.”

3.10 Institutional arrangements for management of Najafgarh Jheel as an ecological entity are non-existent at present, and are a major deterrent to conservation of this wetland. In absence of specific arrangements, crucial activities like enforcement of regulation, wetlands monitoring, preventing fragmentation of hydrological regimes and preventing anthropogenic disturbance to waterbird habitats, especially heronries, are not catered to.

3.11 To provide an enabling environment for integrated management of Najafgarh Jheel, it is recommended that a Najafgarh Jheel Wetlands Committee is constituted with following functions:

- a) Overseeing compliance with extant regulations
- b) Coordinating formulation of integrated management plan and implementation strategy
- c) Establishing and maintaining an integrated wetland inventory, assessment and monitoring system
- d) Reviewing development plans concerning the wetlands and its zone of influence, and making recommendations for preventing adverse ecological change
- e) Communication and outreach on wetland values and functions
- f) Promoting long term management-oriented multidisciplinary research to support wetland conservation and wise use

3.12 The interstate Najafgarh Jheel Management Committee may be chaired at an appropriate level by MoEF & CC, have Environment Secretaries of Delhi and Haryana and have representation from key line departments of the two states (irrigation and flood control, revenue, agriculture, tourism, GMDA/DDA, PHED/DJB and others) and key CSOs. Requisite govt. officials, representatives from local community, individual experts and other stakeholders can be invited when necessary.

4. Management Framework

- 4.1 Wetlands are managed to achieve their wise use. Article 3.1 of the Ramsar Convention, to which India is a signatory, commits the Contracting Parties to put in place management arrangements to ensure wise use of all wetlands within their jurisdiction. The text of the Ramsar Convention defines wise use as "the maintenance of their ecological character, achieved through the implementation of ecosystem approaches, within the context of sustainable development". Wise use is the longest established example amongst intergovernmental processes, implementation of which have become known as ecosystem approaches for conservation and sustainable development of natural resources, including wetlands. The approach recognises the human interdependency with wetland functioning and accommodates sustainable utilisation 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. The purpose of management planning is to outline the pathway through which wetland wise use can be achieved.
- 4.2 The term '**wise use**' is often interpreted to indicate that human use of all wetlands is promoted by the Ramsar Convention; however, this needs careful consideration. The most recent update of the wise use definition was in 2005, wherein along with the definition cited in the previous paragraph, two footnotes were also placed. The first clarifies that 'ecosystem approaches' include the elements elaborated by the Convention on Biological Diversity – integrated management, stakeholders' participation in decision-making, transparency about trade-offs, and equitability of the outcomes. The second footnote expands the phrase 'in the context of sustainable development' to recognise that development, though inevitable in most cases, is not an objective for every wetland. Wherever development is to take place, it has to be facilitated in sustainable ways by approaches elaborated in the Convention. Thus, when the concept of wise use is examined from the lens of sustainability, the elements of wetlands' conservation' and 'use' are reconciled to ensure that ecosystem retains capability for use now and into future, rather than 'using' or developing the wetlands at present. The onus of elaborating a pathway for achieving wise use outcome is on the management planning process.

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4.3 The Ramsar Convention, in its Resolution XI.11 of 2012 has laid down principles for planning and management of urban and peri-urban wetlands. The resolution recommends that:

- a) Thematic planning should be used as an essential tool to safeguard wetlands and their ecosystem services both within and beyond urban settlements;
- b) The consideration of wetlands within urban planning needs to be integrated fully with wider elements of spatial planning (such as Integrated River Basin Management, water resource management, the development of transport infrastructure, agriculture production, fuel supply, etc.), and
- c) Alternative locations need to be identified for planned urban developments (both formal and informal built development) which do not lead to wetlands, or other natural ecosystems, being degraded or lost.

It is suggested that environmental appraisal committees at government level should invariably involve wetland experts to gather valid opinion about the area before the site is granted clearance for developmental projects.

4.4 Management of Najafgarh Jheel needs to be on the basis of recognition of the full range of ecosystem services and biodiversity values of the wetland and their mainstreaming into developmental planning at all levels. The effectiveness of management will be reflected in the ability to sustain multiple use of the wetland, without undermining the key ecological and social processes that underpin the functioning of Najafgarh Jheel social-ecological system. Wise use of Najafgarh Jheel will be realised when the capability of the wetland to provide its ecosystem services and sustain rich biota is maintained now as well as in future, on pathways that are aligned with ecosystem principles and guided by sustainable development. Sustainable development framework, as adopted in 2015, calls for addressing five elements – People, Partnership, Planet, Peace and Prosperity.

4.5 As the impacts of climate change unfold over the urban environs of NCT of Delhi and Haryana, extreme rainfall events and increase in temperatures are highly likely to become more frequent. The ability of Najafgarh Jheel to buffer extreme events, regulate local hydrology, as well as prevent the release of harmful GHGs indicate the relevance of these wetlands in mitigation as well as adapting to climate change. At the same time, climate change and the ongoing developmental pressures, particularly rapid urbanisation may lead to intensification of exiting risks as well as creating new risks of the ecosystem, thereby calling for systematic monitoring, and periodic adaptation in

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management approaches on the basis of new information that is generated in the process.

Goal and Purpose

- 4.6 The goal of management is to '*maintain Najafgarh Jheel in a healthy condition to enable delivery of its full range of ecosystem services and sustain biological diversity values*'.
- 4.7 The purpose of management is to '*enable natural infrastructure services to the urban environs of NCT of Delhi and Haryana in the form of flood buffering, groundwater recharge and climate regulation; providing recreational and nature education opportunities; and sustain diversity of biota in the landscape*'.

Management Strategy

Management Zoning For Multiple Use

- 4.8 The ability of Najafgarh Jheel to provide the diverse ecosystem services while also harbouring diverse biota is linked with multiple use the wetland is put to. The balance of land use between wetland environs and non-aquatic usages (agriculture and settlements) is key to ecosystem functioning. The land use regulation provided within the Master Plan of NCT of Delhi and Masterplan of Gurugram, when supplemented with demarcation of wetland and its zone of influence as recommended under Wetlands (Conservation and Management) Rules, 2017 provide the regulatory architecture under which management zoning of Najafgarh Jheel can be framed for meeting conservation, development and regulation related outcomes.

Building with Nature

- 4.9 Building with Nature (BwN) is a comprehensive engineering approach that seeks to enhance the use of natural ecological processes to achieve efficient and sustainable infrastructural designs to provide a set of desired benefits. The BwN concept for Najafgarh is motivated and supported by nature that may also offer environmental, economic, and social benefits, while increasing resilience.
- 4.10 Najafgarh Jheel offers wide range of natural infrastructure that have multiple functionalities like that of a flood buffer, water treatment plant, flood buffer, carbon sink, sediment trap, temperature regulators, and serving as biodiversity hotspot. By recognising Jheel as an integral part of urban environs of Gurugram and NCT Delhi, and ensuring that land use planning protects ecosystem functioning, rather than creating adverse ecological impacts, the natural

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infrastructure can be blended with existing urban infrastructure towards sustainable urban development.

Adaptive Management

4.11 Najafgarh Jheel, as several other wetland ecosystems, have an inherent uncertainty and unpredictability in their behaviour owing to complex and multi-scalar ecological, social and institutional interactions that shape their features and governing factors. There are a number of reasons, including :

- Environmental variation that is uncontrollable (such as increasing intensity of precipitation)
- Partial observability (as not all wetland features and factors can be monitored)
- Partial controllability of actions (as management interventions are implemented through a number of agencies)
- Structural uncertainty arising out of lack of complete understanding of how the ecosystem functions

4.12 Given that the knowledge on ecosystem is always likely to be incomplete, adaptive management based on iterative learning, and using that learning to improve management using a goal-oriented and structured process shall be applied. Adaptive management will be enabled in management of Najafgarh Jheel by a combination of processes, such as:

- Structured decision making to clarify management goals, objectives and actions, involving stakeholders
- Investing into monitoring and learning for management. Each management intervention in reality is an experiment based on a working hypothesis of ecosystem functioning. Monitoring enables assessment whether the hypothesis works in reality (for example, whether changing sewage composition is leading to epidemiological concerns for the wetlands communities)
- Investing into cross-scale communication. Understanding change at multiple scales (such as City Environments) may help get a better understanding of ecosystem functioning and variability.
- Adaptive governance, based on collaborative and participatory management which has the flexibility of sharing management responsibilities. Successful adaptive governance has required leadership with a vision, systematic monitoring, complementary legislation framework which allows for adaptive management, information flow amongst stakeholders, and clear opportunities for stakeholders to collaborate.

Multiple Values Of Nature And Nature's Contribution Of People

4.13 Management plan implementation will take into account the diverse ways in which nature and nature's contribution to people support well-being. These will

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include intrinsic values (the value of Najafgarh Jheel as an ecosystem with its complex ecological functions), instrumental values (the value of Najafgarh towards meeting flood buffering, groundwater recharge, water quality regulation and climate moderation), and relational values (the values linked with sense of place and cultural identity). The management plan will be built on the full range of values to bring in multiple perspectives in decision-making and implementation of programmes.

Focus On Behaviour Change

4.14 The management plan entails a complementing wetland regulation with inducing positive behaviour within stakeholders which are aligned with wise use. The Wetland Authorities of NCT of Delhi and Haryana will use strategic communication to inform stakeholders on the role of Najafgarh Jheel in their overall well-being, and the ways these groups can engage in ensuring that the wetland continues to deliver their wide-ranging services. Information, education and communication tools, tailor-made to the needs of various stakeholder groups, would be proactively used to trigger behaviour change, along with building capacities and opportunities for participation in wetlands management.

Objectives And Performance Indicators

4.15 The management strategies have been translated into eight objectives which reflect the desired state of key features of wetlands. For each feature, the performance indicators are the attributes which can indicate change. The desired outcome reflects the target which the management plan envisages to achieve within five years, thus providing a monitoring framework to assess effectiveness.

Table No 4 : Management Objectives, Performance Indicators And Targets

Objectives	Performance Indicators	Desired Outcome
Objective 1. Land use and land cover of the wetland is maintained in line with regulatory requirements under Wetlands (Conservation and Management) Rules, 2017 and in concordance with Master Plans of NCT of	Land use and land cover change in comparison with the 2000 baseline Number of violations of the Wetlands (Conservation and Management)	No illegal transformation of land use No violations of regulatory regime No building activity in hazard zone [i.e. zone of influence or the flood

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Delhi and Gurgaon.	Rules, 2017	zone and soil liquefaction zone]
Objective 2. Sewage received within the wetland is efficiently treated.	Quality of sewage	<p>Sewage received in the wetland meets quality criteria for maintaining aquatic life (for example, DO is between 3 – 6 mg/ liter)</p> <p>Only tertiary class treated wastewater to enter Jheel in line with Court directives</p>
Objective 3. Diversity of biota within Najafgarh Jheel is maintained.	<p>Species richness</p> <p>Population of migratory waterbirds</p>	<p>No species extirpation</p> <p>Counts are maintained in the range of 20% deviation from average of last five years</p>
Objective 4. Individual and collective capacity and opportunities for stakeholders and to participate in wetland management and contribute to wetland wise use is enhanced.	<p>Participation of wetland communities in management plan implementation</p> <p>Evidence of affirmative behaviour change within communities living around Najafgarh Jheel supporting wise</p>	<p>Integration of community, rights and capacities in management plan implementation and monitoring</p> <p>Local action for addressing solid waste or preventing encroachment</p> <p>Community norms for preventing land use</p>

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	<p>use of wetlands</p> <p>Evidences of community-led collaborative action for wise use of wetlands</p>	<p>change or overharvesting of resources</p>
<p>Objective 5. Systematic wetlands inventory, assessment and monitoring system is used to inform management decisions and assess effectiveness.</p>	<p>Availability of time-series data on wetland ecological character</p> <p>Availability of data on threats leading to an adverse change in ecological character.</p> <p>Evidences of use of data generated from wetlands inventory, assessment and monitoring system in decision-making.</p>	<p>Data is available on all priority wetland features</p> <p>Data is available on threats</p> <p>Data is systematically analysed and presented in meetings of Wetlands Authorities of Haryana and NCT of Delhi and of the Najafgarh Management Committee</p>
<p>Objective 6. Integration of multiple values of wetlands in sectoral developmental planning is enhanced.</p>	<p>Number of sectoral policies (wherein integration of wetlands is relevant) which take into account wetlands values.</p>	<p>Najafgarh Wetlands Committee meets regularly and considers implications of sectoral plans.</p> <p>Najafgarh Wetlands Committee enables</p>

		integration of role of wetlands in programmes and actions plans on urban development, linear infrastructure development, disaster risk reduction, climate change adaptation and others.
Objective 7. Restoration of wetland habitat and removal of invasive species	Increase in native biota and species diversity	A time-bound plan to remove invasive species and ecological restore the habitat is followed, invasive species are removed or managed.

Management Components and Actions

Component 1. Institutional arrangements

1.1 Notification under Wetlands (Conservation and Management) Rules, 2017

For the purpose of regulation under the provisions of Wetlands (Conservation and Management) Rules, 2017, the area falling under contour 209 m amsl, on the either side of the Najafgarh embankment is demarcated as a wetland. The area between contours 209 m amsl and 211 m amsl may be designated as the 'zone of influence' wherein developmental activities are to be regulated and construction activities disallowed to ensure that ecological character of wetland is maintained, and not adversely affected. A regulatory framework indicating activities prohibited, regulated and permitted within the wetland and its zone of influence is outlined in Table 4, and can serve as the basis of issuing the draft notification under Wetlands (Conservation and Management) Rules, 2017. It is understood that as per the procedure recommended under the Guidelines for Implementation of Wetlands (Conservation and Management) Rules, 2017, the draft notification will be issued by the Ministry of Environment, Forest and Climate Change, based on the brief documents submitted by the Wetlands Authorities of NCT Delhi and Haryana.

Table No 5 : Regulatory framework for Najafgarh Jheel

	Within wetland	Within zone of influence
Prohibited activities	<ul style="list-style-type: none"> • Conversion for non-wetland uses including encroachment of any kind; 	<ul style="list-style-type: none"> • Diversion of inflowing water channels

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	<ul style="list-style-type: none"> • Setting up of any industry and expansion of existing industries; • Manufacture or handling or storage or disposal of: <ul style="list-style-type: none"> ○ 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 • Solid waste dumping; • Discharge of untreated wastes and effluents from industries, cities, towns, villages and other human settlements; • 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; • Construction of new roads and 	<ul style="list-style-type: none"> • Change in land use. <ul style="list-style-type: none"> • Poaching.
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	widening of existing ones, and, <ul style="list-style-type: none"> • Poaching. 	
Regulated activities	<ul style="list-style-type: none"> • Subsistence level biomass harvesting (including traditional practices); • Culture fisheries practices (in private lands); • Plying of non-motorised boats; • Desilting; • Construction of temporary nature • Vehicular traffic on the embankment – especially during bird migration seasons 	<ul style="list-style-type: none"> • Sinking borewells • Construction of new roads and widening of existing ones • Culture fisheries practices
Permitted activities	<ul style="list-style-type: none"> • Ecological rehabilitation and rewilding of nature ; • Wetlands inventory, assessment and monitoring; • Research; • Communication, environmental education and participation activities; • Management planning; • Habitat management and conservation of wetland-dependent species; • Community-based ecotourism (with minimum construction activities). 	

1.2 Wetland Demarcation

It is recommended that the wetland boundaries in NCT Delhi and Haryana are marked on ground with geo-tagged boundary pillars. The pillars may be placed at an interval of 200 meters.

1.3 Constitution of Najafgarh Wetlands Committee

Najafgarh Jheel Wetlands Committee may be constituted with following functions:

- a) Overseeing compliance with extant regulations

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- b) Coordinating formulation of integrated management plan and implementation strategy
- c) Establishing and maintaining an integrated wetland inventory, assessment and monitoring system
- d) Reviewing development plans concerning the wetlands and its zone of influence, and making recommendations for preventing adverse ecological change
- e) Communication and outreach on wetland values and functions
- f) Promoting long term management-oriented multidisciplinary research to support wetland conservation and wise use
- g) Habitat restoration for enhanced ecological function

1.45 The interstate Najafgarh Jheel Management Committee may be chaired at an appropriate level by MoEF & CC, have Environment Secretaries of Delhi and Haryana and have representation from key line departments of the two states (irrigation and flood control, revenue, agriculture, tourism, GMDA/DDA, PHED/DJB and others) and key CSOs. Requisite govt. officials, representatives from local community, individual experts and other stakeholders can be invited when necessary.

1.4 Wetland Inventory, Assessment And Monitoring System

Developing a monitoring plan for Najafgarh Jheel requires addressing the following inter-related requirements of wetland inventory and wetland assessment. 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. The ambit of monitoring is also envisaged to include assessment of management effectiveness. The follow are the specific objectives for establishing WIAMS:

- Developing up-to-date and scientifically valid information on status and trends of wetland features and influencing factors
- Establishing a baseline for measuring 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 to national and state legal requirements and regulatory regimes
- Determining impacts of developmental projects on ecosystem components, processes and services

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- Identifying risks to ecological character and support development of response strategies
- Assessing effectiveness of wetland management

1.4.1 Establishment Of Wetland Monitoring And Research Centre

A wetland monitoring center is proposed to be set up as part of the Najafgarh Jheel interpretation center to function as a nodal unit for all monitoring, education and research actions.

1.4.2 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

1.5 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 summarises indicators along major indices (water quality, catchment status, biodiversity status) which represent various ecosystem features of the lake, and are reported against respective thresholds set in line with management goals.

1.6 Integrated Management Plan

The framework presented in this environment management plan, alongwith diagnostic evaluation of information on wetland features and governing factors should be used as basis for formulating an integrated management plan. The plan should be endorsed by all stakeholders, and recommend specific actions for preventing further adverse change in wetland character. Measures for ecological restoration for recovery of biodiversity and ecosystem functioning should also be listed as part of the management plan.

Component 2. Water Management

2.1 Construction Of Regulator At Jhatikra

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A regulator is proposed to be constructed at Jhatikra just downstream of the Jheel in NCT Delhi to allow for maintenance of inundation regime of the wetland to meet diverse ecological needs (for example, diversity of habitats for waterbirds) and human needs (such as flood control and availability of water for domestic use) subject to the outcome of detailed integrated management plan and comprehensive hydrological studies.

2.2 Construction Of Bund Along The Najafgarh Drain

The bunding of Najafgarh Jheel on Haryana side along contour 209 m amsl will be considered by the Najafgarh Jheel Management Committee subject to the outcome of detailed integrated management plan and comprehensive hydrological studies.

2.3 Construction Of Remaining Portion Of Badshahpur Drain

The regular inflow of water into Najafgarh Jheel comes from three main drains from Gurugram under jurisdiction of GMDA known as leg-1, II, III (popularly known as Badshahpur Drain) other than overflow of Najafgarh Drain. The construction of remaining portion of Badshahpur drain and leg-II upto the Najafgarh Drain is still pending. There is length of 3270m in leg-III and 550m of leg-II which has not been constructed. The balance length of Badshahpur Drain shall have to be considered for construction by GMDA after the bunding of Najafgarh Jheel on Haryana side. This matter will be considered by the Najafgarh Jheel Management Committee subject to the outcome of detailed integrated management plan and comprehensive hydrological studies.

2.4 Sediment Removal

The natural flow gradient of the inflowing drainages may be desilted to achieve the desired inundation levels in the wetland as well as prevent waterlogging in the upstream stretches. Highly silted up areas of the wetland may be selectively desilted; however, due caution must be given to the species habitats and management of dredged material.

2.5 Restoring Flood Pulses And Hydrological Connectivity

Sluices and ducts may be constructed on the embankment on Delhi side (between Shikarpur and Jhuljhuli villages) to allow for spreading peak monsoon flow pulses and groundwater recharge.

Flow obstructions, such as power sub-station may be relocated. Drains feeding stormwater into the Jheel may not be obstructed or diverted.

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The road on the embankment may not be further developed, and alternate connectivity provided. Vehicular traffic on the road also needs to be regulated, especially during peak migration season of waterbirds.

2.6 Pollution Abatement

In-situ treatment of major inflowing drains into the wetland through use of appropriate technologies, including constructed wetlands should be ensured. The treated inflows should at least meet the standards for sustaining aquatic life. Industrial effluents from drain flowing from Manesar will be appropriately treated before being released into Najafgarh Jheel. Haryana Authorities will ensure the sewage discharged into the wetland is treated to tertiary level. in compliance with various judicial directives. NCT Delhi will also ensure that any kind of sewage water entering into the Jheel from their side will be treated to tertiary levels before being released into Najafgarh Jheel.

Component 3. Biodiversity conservation

3.1 Species inventory

A comprehensive species inventory (animal and plants) for the wetland and its adjoining habitats should be made. For key species such as waterbirds, fish and butterflies, their habitat preferences should be determined and wetland management must strive to maintain these conditions.

3.2 Protection of Heronries

Najafgarh Jheel is an important heronry for North India and particularly for NCR. There are large trees in several parts of the wetland. These include trees growing on the boundaries of the wetland on the Bund road, and trees growing in portion of the Jheel which forms a 'double channel' (some of these trees are indicated as heronries on the map). Trees along the upstream of Jheel and downstream of Dhansa regulator are also heronries. It is important that these trees be protected. Where birds are actively breeding, the impenetrable nature of shrubbery and ground vegetation should be maintained. This reduces disturbance to breeding birds and hatchlings.

3.3 Managing Water Levels For Diverse Species

Najafgarh Jheel has varying depths and forms suitable habitat for various kinds of wading and diving birds. Avocet, Pheasant-tailed iacana, herons, Greater Flamingos require shallow water, and presently move in shallow areas of the Jheel (often observed close to Bahadurgarh drain, this has been marked on the map). Other birds found in shallow water such as Black-winged stilts, Red-wattled lapwings, migratory White-tailed lapwing, Grey-headed Swamphen, Moorhens, Greenshanks and

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Sandpipers are found in shallower parts of the wetland. Ducks, Pochards and migratory Bar-headed Geese are found in deeper parts of the water.

These banks require protection. It is also imperative the shores of the wetland should not be made into hard edges by civil works. The transition zone of mud/marsh into the water is an important foraging area for migratory and resident birds. From an ecological perspective, these 'banks' require protection.

3.4 Management Of Invasive Species

Continuous discharge of sewage and untreated effluents and fragmented hydrological regimes have created conducive conditions for the proliferation of invasive species, particularly water hyacinth in most parts of the wetland. Its rapid spread can create several adverse implications for key wetland processes, such as availability of light and oxygen for aquatic life, siltation and diminution of open water habitats. Comprehensive removal of water hyacinth is neither feasible, nor desired in absence of insufficient wastewater treatment capacity.

Hyacinth needs management from both Delhi and Haryana side. This will include manual removal, as well as reducing untreated sewage runoff into the waters. Enterprise for economic utilization of water hyacinth, such as production of handicrafts, can be set up after due feasibility assessment. Introduction of weevils [insects] can be considered for hyacinth control.

Several Mesquite [*Prosopis Juliflora*] trees are seen at the site. However, some of these trees are being used in the heronries as breeding sites by birds. The mature trees should not be disturbed. Instead, the site should be periodically checked to prevent the regeneration of new *Prosopis Juliflora* trees and saplings.

Several phragmites reeds are seen in the wetland. Such reeds and grasses are habitat for birds such as herons, bitterns and moorhens. These should not be cleared in the name of 'beautification'.

3.5 Management Of Agricultural Land Around The Wetland

Cultivated land around the wetland are foraging areas for Sarus Crane, Greater Flamingos, land birds and migratory birds. The threatened Sarus Crane and the Common Crane both use submerged lands for foraging. Migratory birds coming from Central Asia, like Siberian stonechats, use the dry farmlands. For the sake of environment and human health as a whole, least amounts of pesticide and fertilizers should be used in agriculture around the wetland. This will also reduce chemical runoff

to the wetland. The farmers around the Najafgarh Jheel should be incentivized to embrace organic agriculture.



Image No. 9 : Greater Flamingos and Spoonbills recorded on Expert Committee site visit on 11 November, 2020. Greater Flamingos forage in Najafgarh jheel and surrounding farmlands. Photo by Neha Sinha

3.6 Waterbird Census

Regular monitoring of waterbird population following standard protocols as the Asian Waterbird Census at all the major congregation sites within and around Najafgarh Jheel shall be maintained in a coordinated manner so as to understand comprehensively the significance of the wetlands for waterbirds (both resident and migratory) and to plan and monitor habitat management strategies and actions.

The management plan will support mid-winter counts of waterbird as per Asian Waterbird Census protocol. The census may be carried out in collaboration with BNHS and Wetlands International South Asia, with prior experience in conducting such census. Census programmes will include training of prospective census participants and local waterbird enthusiasts.

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Data collected during this monitoring work will include collection of detailed information on habitat structure and seasonal abundance and changes in different prey items (aquatic flora and fauna). Information collected should enable realistic population estimates of the different waterbirds and trends to be developed and provide guidance for management activities.

3.7 Management of Fish

The fish inventory of Najafgarh Jheel will be assessed and thereafter a program to increase the herbivorous fish populations will be considered. This would help in supporting bird populations as well as generate employment.

3.8 Construction of Soil/Mud Mounds

The aquatic birds besides loving water also, relish basking in the sun during winter. This element of habitat is almost missing in Najafgarh Jheel. The birds after feeding congregate and sit on these mounds. Creation of mud/soil mounds will be particularly beneficial for flamingos which lay eggs here but the young ones are unable to hatch as the area gets inundated with water during the rainy season.

3.9 Planting of Reeds

Reeds are perennial grasses which are classically distinguished by having hollow stems and broad leaves. These grasses typically grow in wetlands and are an important component of the aquatic ecosystem, providing numerous ecosystem services which help to maintain ecosystem stability. They are a keystone species and serve as an important food source for many animals. The reeds namely Giant Reed (*Arundo donax*), Cat tail (*Typha*), *Phragmites* are an essential part of aquatic ecosystem as they form a buffer zone between aquatic part and the terrestrial part. This part is called ecotone. It harbours sensitive species of plants and animals. Accordingly, it is proposed to consider planting reeds towards the peripheries of the lake.

3.10 Protection/Improving The Habitat Of Jungle Cat And Jackal

Chandu and Makdola villages on Haryana side harbour jungle cat and jackal. These animals and their habitat will be protected and improved by planting reeds and *Scachharum* species.

3.11 Management of Miscellaneous Items related to Bio diversity

Effluent water besides containing poisonous chemicals also contains heavy metals. These chemicals enter into the body of birds via food chain, affecting the kidneys of birds. Efforts will be made to control the chemicals in water. Najafgarh Jheel harbours a good population of flap shell turtles. These creatures love sandy banks. Hence,

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sandy banks will be created for these creatures. A number of birds while landing, get entangled in the electricity wires. They also get electrocuted during landing and flying. Bird diverters help diverters help birds divert their flight to prevent collision with electricity wires and poles as they can clearly see the electricity wires. Accordingly, the bird accidents will be prevented by installing bird diverters near the lake on Haryana side in a phased manner.

Component 4. Communication, Education and Capacity Development

4.1 Interpretation Center

A wetland interpretation center should be constructed by each state (Haritima is a possible location in Delhi, and in Haryana - Sultanpur National Park or a location closer to Jheel) to educate visitors on the diverse values and functions of the wetland, and create the basis of an affirmative behaviour for conservation of wetlands. The center should have facilities such as audio visuals, interactive displays, meeting and workshop space, viewing galleries and other facilities to provide complete visitor experience.

4.2 Signage

Signage at entry and exit locations, and at key vantage points around the wetland may be placed to communicate the value of Najafgarh Jheel, management arrangements, and dos and donts for people while in wetland.

4.3 Wetland Mitra

'Wetland Mitra' is conceived as an informal, voluntary and non-statutory network of concerned citizens to foster and promote community engagement in wetlands conservation and management efforts. An effective 'wetland mitra' network enables wetlands managers to gain access to local views, rights and capacities for supporting wetlands management. The network is also aimed as a communication and outreach vehicle for promoting awareness on the value of wetlands, and management and conservation efforts. By involving themselves within the wetland mitra network, citizens gain an opportunity of shaping wetlands management by bringing onboard indigenous and local knowledge, and views of diverse stakeholder groups. As wetland mitra network member, the communities also built their capacity on various dimensions of wetlands management.

4.4 Environmental Education And Awareness Generation Programs

The interpretation center can be used as node for environment education and awareness generation programs for diverse stakeholder groups on the values and

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functions of wetland, and the ways they can engage in conservation and wise use. These programs should be designed on the basis of needs assessment.

4.5 Incentive Systems To Support Community Engagement

Given prevalence of private land rights on major parts of the wetland, incentive mechanisms (monetary as well as non-monetary) may be piloted based on comprehensive needs and feasibility assessment.

Component 5. Research and Capacity Development

5.1 Research Studies

Following specific research studies are proposed to be commissioned to address the knowledge gaps in supporting integrated management of Najafgarh Jheel :

- **Water balance** – to assess the contribution of various inflow sources, uptake within plants and other ecological processes, contribution to groundwater, and outflow.
- **Bird ringing and banding** – to understand bird habitat use and migration patterns
- **Carbon and GHG Flux assessment** – to assess the role of Najafgarh Jheel in sequestering carbon and GHG, and thus integrate role of these wetlands in climate change mitigation strategies
- **Nutrient budget** - to assess the quantity of nutrients entering Najafgarh Jheel, its uptake within wetland and discharge downstream
- **Multiple values assessment** – to assess multiple values communities living in and around Najafgarh Jheel associate with the wetland, the underlying reasons and the ways in which this value can be orientated towards behaviour change for wetland wise use

5.2 Capacity Development

To support integrated management of Najafgarh Jheel, the human capacity of concerned line departments as well as stakeholders may be enhanced by training workshops on :

- Integrated wetland 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

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5.3 Monitoring and Evaluation Mechanisms

Monitoring strategy responds to the following information needs for managing Najafgarh Jheel :

- **Inventory** - to establish the ecological character baseline
- **Assessment** – to establish status, trends and threats to wetland using inventory information
- **Monitoring** – to assess changes in status and trends, including reduction in existing threats or appearance of new threats, or even changes in management effectiveness

As this information pertains to various spatial scales, the overall information requirements can be classified into three hierarchical levels :

- the Najafgarh Jheel
- the zone of influence of Najafgarh Jheel
- Sahibi Basin

This monitoring information adequately addresses the needs of East Kolkata Wetlands (Conservation and Management) Act, 2006 and Wetland (Conservation and Management) Rules, 2017 of the Ministry of Environment, Forests and Climate Change. A list of wetland features, indicators and corresponding methodology and data collection frequency is provided as Annex 5.

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.

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/Department of Water Resources/I & FC, Delhi/NRSA; groundwater quality and quantity from Central Ground Water Board; select surface water quality parameters from Central Pollution Control Board; and fish production from Fisheries Department) can be accessed and shared. Similarly, provision for participation of NGOs and civil society in monitoring programme has also been built, especially for socioeconomics and livelihoods aspects and biodiversity monitoring (for example, waterbird census being implemented by NGOs under the aegis of Asian Waterbird Census).

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Table No 6 : Inventory, Assessment And Monitoring Needs For Managing Najafgarh Jheel

Information Purpose			
Information Scale	Inventory	Assessment	Monitoring
Najafgarh Jheel	<p>Physical setting (area, boundary, connectivity)</p> <p>Water regime (sewage flows, inflow -outflow balance, surface-groundwater interactions, inundation regimes, quality, regulation)</p> <p>Sewage quantity and quality</p> <p>Biota (plant and animal species)</p>	<p>Water quality improvement (extent of reduction in BOD, COD, nutrients and heavy metals)</p> <p>Carbon sequestration (carbon stored in various forms)</p> <p>Trends in invasive species</p>	<p>Land use and Land cover change in Najafgarh Jheel</p> <p>Sewage quality (presence of heavy metals and toxic chemicals)</p>
Zone of influence	<p>Physical extent (area, depth)</p> <p>Groundwater (level, abstraction and quality)</p> <p>Biota (plant and animal species)</p> <p>Sectoral programmes and institutional arrangements for management of land and water resources and biodiversity conservation</p>	<p>Ecological character change (change in ecosystem components, processes and services – can also be derived based on assessment of indicators related to ecosystems, habitat, species and / or management)</p> <p>Soil quality trends</p> <p>Inundation trends</p> <p>Groundwater level</p>	<p>Land use and Land cover change (with respect to 2000 baseline)</p>

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		and quality trends Trends in herenories (species, nests)	
Sahibi River & Northern Catchment	Geology and Geomorphology (Soils, elevation, slope, drainage pattern) Climate (Precipitation, Temperature) Land use and land cover Water regimes (river flows, runoff, upstream abstraction)	Climate risk and vulnerability (changes in runoff and implications for Najafgarh Jheel)	Urban planning (water regulating structures and water allocation, sewage treatment infrastructure development, expansion of settlements) and implications for Najafgarh Jheel

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5. Budget and Financing

The budget may be firmed up in consultation with Wetlands Authorities of NCT of Delhi and Haryana. The MoEF & CC guidelines recommend financing based on convergence basis – wherein the activities identified in management plan are assessed for complementarity with existing central or state government funded programmes, and synergies developed.

Annexure A

Water Levels at Dhansa, Jhatikra, Kakraula 20th July, 2021 – 9th October, 2021

Date	Dhansa	Jhatikra	Kakraula				
20-7-21	210-350	210-250	210-300	20-7-21	210-200	210-100	200-150
21-7-21	210-450	210-380	210-200	21-7-21	210-100	210-050	200-000
22-7-21	210-450	210-350	210-175				
23-7-21	210-500	210-450	210-175				
24-7-21	210-500	210-400	210-175	01-07-21	210-200	210-200	200-150
25-7-21	210-500	210-400	210-200	02-07-21	210-150	210-175	210-200
26-7-21	210-500	210-450	210-200	03-07-21	210-150	210-200	210-200
27-7-21	210-450	210-450	210-250	04-07-21	210-100	210-200	210-200
28-7-21	210-400	210-550	210-325	05-07-21	210-100	210-200	210-200
29-7-21	210-700	210-600	210-450	06-07-21	210-100	210-275	210-350
30-7-21	210-750	210-700	210-450	07-07-21	210-150	210-275	210-325
31-7-21	210-800	210-775	210-450	08-07-21	210-100	210-275	210-350
				09-07-21	210-150	210-250	210-300
01-8-21	210-800	210-750	210-575	10-07-21	210-100	210-250	210-300
02-8-21	210-850	210-750	210-550	11-07-21	210-100	210-250	210-300
03-8-21	210-850	210-800	210-500	12-07-21	210-100	210-250	210-300
04-8-21	210-850	210-800	210-550	13-07-21	210-100	210-250	210-300
05-8-21	210-850	210-825	210-550	14-07-21	210-100	210-250	210-300
06-8-21	210-850	210-825	210-550	15-07-21	210-100	210-250	210-300
07-8-21	210-850	210-825	210-550	16-07-21	210-100	210-275	210-300
08-8-21	210-875	210-800	210-550	17-07-21	210-100	210-200	210-300
09-8-21	210-900	210-850	210-600	18-07-21	210-150	210-200	210-300
10-8-21	210-900	210-850	210-600	19-07-21	210-150	210-200	210-300
11-8-21	210-800	210-825	210-550	20-07-21	210-150	210-200	210-300
12-8-21	210-850	210-800	210-550	21-07-21	210-150	210-275	210-300
13-8-21	210-800	210-775	210-500	22-07-21	210-100	210-275	210-325
14-8-21	210-800	210-825	210-475	23-07-21	210-100	210-275	210-300
15-8-21	210-750	210-675	210-400	24-07-21	210-100	210-275	210-300
16-8-21	210-700	210-650	210-375	25-07-21	210-100	210-275	210-300
17-8-21	210-600	210-575	210-300	26-07-21	210-100	210-275	210-300
18-8-21	210-450	210-500	210-250	27-07-21	210-100	210-275	210-300
19-8-21	210-500	210-450	210-225	28-07-21	210-100	210-275	210-300
20-8-21	210-450	210-375	210-150	29-07-21	210-100	210-275	210-300
21-8-21	210-400	210-325	210-250	30-07-21	210-100	210-200	200-150
22-8-21	210-550	210-450	210-200	31-07-21	210-100	210-200	210-200
23-8-21	210-550	210-450	210-200	01-08-21	210-100	210-275	210-200
24-8-21	210-500	210-450	210-200	02-08-21	210-150	210-275	210-200
25-8-21	210-500	210-425	210-150	03-08-21	210-100	210-200	210-200
26-8-21	210-450	210-375	210-100	04-08-21	210-100	210-200	210-200
27-8-21	210-400	210-325	210-050	05-08-21	210-100	210-200	210-200
28-8-21	210-350	210-275	210-000	06-08-21	210-100	210-200	210-200
29-8-21	210-350	210-150	210-050	07-08-21	210-100	210-200	210-200
30-8-21	210-350	210-150	210-050	08-08-21	210-100	210-200	210-200
31-8-21	210-350	210-150	210-050	09-08-21	210-100	210-200	210-200

Conf. with the Director of the Deptt. of Irr. & Flood Control Deptt., Govt. of NCT of Delhi

Executive Engineer,
Chief Engineer,
Irr. & Flood Control Deptt.,
Govt. of NCT of Delhi

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A1. Committee Constitution and Terms of Reference

OFFICE OF THE WETLAND AUTHORITY
DEPARTMENT OF ENVIRONMENT, GOVT. OF N.C.T. OF DELHI
 "C" Wing, 6th Level, Delhi Secretariat, I.P. Estate, New Delhi - 110002
 Tele-Fax : 011-23392736, Email : ccodpgseny.delhi@nic.in
 Website: <http://dpgs.delhigovt.nic.in>

No. F.1(15)/DPGS/CC/2018-19/828-836

Dated: 29/10/2020

ORDER

I. Conservation of Najafgarh Jheel is subject of Hon'ble NGT OA No. 153/2014, Indian National Trust for Art & Cultural Heritage Vs. Govt. of NCT of Delhi & Ors. and to aid preparation of Environment Management Plan of the Jheel, an Expert Committee is formed of the following members:-

1.	Sh. Ishwar Singh, Principal Chief Conservator of Forests, GNCTD	Chairperson
2.	Dr. C.R. Babu, Professor Emeritus, Centre for Environmental Management of Degraded Ecosystems (CEMDE)	Member
3.	Sh. Manu Bhatnagar, Director, Indian National Trust for Art and Culture Heritage (INTACH)	Member
4.	Dr. Ritesh Kumar, Director, Wetlands International South Asia (WISA)	Member
5.	Ms. Neha Sinha, Advocacy Officer, Bombay Natural History Society (BNHS, India)	Member

II. The terms of reference of the above Expert Committee will be:-

1. To recommend contour level, delineated maps of Najafgarh Jheel and its zone of influence and the total area of Najafgarh Jheel which needs to be notified under Wetlands (Conservation and Management) Rules, 2017.
2. To recommend an Environment Management Plan of Najafgarh Jheel which will also include prohibited and regulated activities.

III. The following members would assist the Expert Committee through field information, data and maps required for the exercise:-

1.	Representative of District Magistrate (South West), GNCTD
2.	Representative of I&FC Department, GNCTD
3.	Representative of GSDL, GNCTD
4.	Representative of Wetland Authority of Delhi, GNCTD

The Committee is requested to submit its recommendations before 30th November' 2020.

This issues with the approval of Hon'ble Minister, Environment and Forest.


 (Sanjeev Khosla)
 Principal Secretary
 (Environment, Forests & Wildlife)

Dated: 29.10.2020

To,

1. Sh. Ishwar Singh, Principal Chief Conservator of Forests, GNCTD
2. Dr. C.R. Babu, Professor Emeritus, Centre for Environmental Management of Degraded Ecosystems (CEMDE)
3. Sh. Manu Bhatnagar, Director, Indian National Trust for Art and Culture Heritage (INTACH)
4. Dr. Ritesh Kumar, Director, Wetlands International South Asia (WISA)
5. Ms. Neha Sinha, Advocacy Officer, Bombay Natural History Society (BNHS, India)
6. Distt. Magistrate (South West), GNCTD
7. Chief Engineer (I&FC), GNCTD
8. MD, GSDL, GNTCD
9. Member Secretary (Wetland Authority of Delhi)

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A2. List of birds recorded at Najafgarh Jheel

This bird list has been contributed to by a range of citizen scientists and birdwatchers, and has been peer-reviewed. A portion of it is available on ebird.org

281 Bird species**Waterbirds**

Lesser Whistling-Duck

Bar-headed Goose

Graylag Goose

Greater White-fronted Goose

Knob-billed Duck

Ruddy Shelduck

Common Shelduck

Cotton Pygmy-Goose

Garganey

Northern Shoveler

Gadwall

Eurasian Wigeon

Indian Spot-billed Duck

Mallard

Northern Pintail

Green-winged Teal

Garganey/Green-winged Teal

teal sp.

Red-crested Pochard

Common Pochard

Ferruginous Duck

Tufted Duck

Aythya sp.

duck sp.

waterfowl sp.

Grouse, Quail, and Allies

Indian Peafowl

Rain Quail

Black Francolin

Gray Francolin

francolin sp.

Flamingos

Greater Flamingo

flamingo sp.

Grebes

Little Grebe

Great Crested Grebe

grebe sp.

Pigeons and Doves

Rock Pigeon

Oriental Turtle-Dove

Eurasian Collared-Dove

Red Collared-Dove

Spotted Dove

Laughing Dove

Yellow-footed Green-Pigeon

pigeon/dove sp.

Sandgrouse

Pin-tailed Sandgrouse (Historic record from 1874 by F.R.Blewitt)

Chestnut-bellied Sandgrouse

Cuckoos

Greater Coucal

Pied Cuckoo

Asian Koel

Grey-bellied Cuckoo

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Cacomantis sp.

Common Hawk-Cuckoo

Common Cuckoo

Swifts

Little Swift

swift sp.

Rails, Gallinules, and Allies

Water Rail

Eurasian Moorhen

Eurasian Coot

Gray-headed Swamphen

moorhen/coot/gallinule sp.

Watercock

White-breasted Waterhen

Ruddy-breasted Crake

Brown Crake

Baillon's Crake

Cranes

Demoiselle Crane

Sarus Crane

Common Crane

Shorebirds

Indian Thick-knee

Black-winged Stilt

Pied Avocet

Pacific Golden-Plover

Northern Lapwing

River Lapwing

Yellow-wattled Lapwing

Gray-headed Lapwing

Red-wattled Lapwing

White-tailed Lapwing

Lesser Sand-Plover

Kentish Plover

Little Ringed Plover

Greater Painted-Snipe

Pheasant-tailed Jacana

Bronze-winged Jacana

Whimbrel

Eurasian Curlew

Black-tailed Godwit

Ruff

Sharp-tailed Sandpiper (spotted after 137
years by Rohit Kumar)

Curlew Sandpiper

Temminck's Stint

Dunlin

Little Stint

peep sp.

Jack Snipe

Common Snipe

Common Sandpiper

Green Sandpiper

Spotted Redshank

Common Greenshank

Marsh Sandpiper

Wood Sandpiper

Common Redshank

Tringa sp.

Barred Buttonquail

buttonquail sp.

Oriental Pratincole

Small Pratincole

pratincole sp.

shorebird sp.

Gulls, Terns, and Skimmers

Black-headed Gull

Brown-headed Gull

Black-headed/Brown-headed Gull

Pallas's Gull

gull sp.

Little Tern

Gull-billed Tern

Whiskered Tern

River Tern

tern sp.

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Storks

Asian Openbill
 Woolly-necked Stork
 Black-necked Stork
 Painted Stork

Cormorants and Anhingas

Oriental Darter
 Little Cormorant
 Great Cormorant
 Indian Cormorant
 Little/Indian Cormorant
 cormorant sp.

Pelicans

Great White Pelican

Hérons, Ibis, and Allies

Great Bittern
 Yellow Bittern
 Cinnamon Bittern
 Black Bittern
 Gray Heron
 Purple Heron
 Great Egret
 Intermediate Egret
 Little Egret
 Cattle Egret
 white egret sp.
 Indian Pond-Heron
 Striated Heron
 Black-crowned Night-Heron
 heron sp.
 Glossy Ibis
 Black-headed Ibis
 Red-naped Ibis
 ibis sp.
 Eurasian Spoonbill

Vultures, Hawks, and Allies

Osprey
 Black-winged Kite
 Egyptian Vulture

Oriental Honey-buzzard
 Crested Serpent-Eagle
 Short-toed Snake-Eagle
 Indian Spotted Eagle
 Greater Spotted Eagle
 Booted Eagle
 Steppe Eagle
 Imperial Eagle
 Bonelli's Eagle

Aquila sp.
 White-eyed Buzzard
 Eurasian Marsh-Harrier
 Shikra
 Accipiter sp.
 Black Kite
 Brahminy Kite
 Common/Himalayan Buzzard
 Long-legged Buzzard
 Buteo/eagle sp.
 eagle sp.

Owls

Barn Owl
 Indian Scops-Owl
 Spotted Owlet
 Short-eared Owl
 owl sp.

Hoopoes

Eurasian Hoopoe

Hornbills

Indian Gray Hornbill

Kingfishers

Common Kingfisher
 White-throated Kingfisher
 Pied Kingfisher

Bee-eaters, Rollers, and Allies

Green Bee-eater
 Blue-cheeked Bee-eater
 Blue-tailed Bee-eater

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bee-eater sp.

European Roller

Indian Roller

Barbets and Toucans

Coppersmith Barbet

Brown-headed Barbet

Psilopogon sp.

Woodpeckers

Eurasian Wryneck

Yellow Crowned Woodpecker

Black-rumped Flameback

Falcons and Caracaras

Eurasian Kestrel

Red-necked Falcon

Eurasian Hobby

Peregrine Falcon

Parrots, Parakeets, and Allies

Alexandrine Parakeet

Rose-ringed Parakeet

Plum-headed Parakeet

parakeet sp.

Cuckooshrikes

Long-tailed Minivet

Old World Orioles

Indian Golden Oriole

Vangas, Helmetshrikes, and Allies

Common Woodshrike

Fantails

White-browed Fantail

Drongos

Black Drongo

Ashy Drongo

White-bellied Drongo

drongo sp.

Monarch Flycatchers

Indian Paradise-Flycatcher

Shrikes

Isabelline Shrike

Brown Shrike

Red-tailed/Isabelline/Brown Shrike

Bay-backed Shrike

Long-tailed Shrike

Great Gray Shrike

Iberian Gray/Great Gray Shrike

shrike sp.

Jays, Magpies, Crows, and Ravens

Rufous Treepie

House Crow

Large-billed Crow

Fairy Flycatchers

Gray-headed Canary-Flycatcher

Larks

Ashy-crowned Sparrow-Lark

Bengal Bushlark

Indian Bushlark

Singing/Indian Bushlark

Greater Short-toed Lark

Greater/Sykes's Short-toed Lark

Greater Short-toed/Hume's Lark

Oriental Skylark

Crested Lark

lark sp.

Cisticolas and Allies

Common Tailorbird

Gray-breasted Prinia

Graceful Prinia

Jungle Prinia

Yellow-bellied Prinia

Ashy Prinia

Plain Prinia

prinia sp.

Zitting Cisticola

Reed Warblers and Allies

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Booted Warbler

Sykes's Warbler

Moustached Warbler

Paddyfield Warbler

Blyth's Reed Warbler

Clamorous Reed Warbler

Acrocephalus sp.

Grassbirds and Allies

Common Grasshopper-Warbler

Bristled Grassbird

Martins and Swallows

Gray-throated Martin

Bank Swallow

Dusky Crag-Martin

Barn Swallow

Wire-tailed Swallow

Red-rumped Swallow

Streak-throated Swallow

swallow sp.

Bulbuls

Red-vented Bulbul

Red-whiskered Bulbul

White-eared Bulbul

Leaf Warblers

Hume's Warbler

Sulphur-bellied Warbler

Common Chiffchaff

Greenish Warbler

Phylloscopus sp.

Sylviid Warblers

Lesser Whitethroat

Parrotbills, Wrenit, and Allies

Yellow-eyed Babbler

White-eyes, Yuhinas, and Allies

Indian White-eye

Laughingthrushes and Allies

Common Babbler

Striated Babbler

Large Gray Babbler

Jungle Babbler

Starlings and Mynas

European Starling

Rosy Starling

Asian Pied Starling

Brahminy Starling

Common Myna

Bank Myna

Thrushes

Black-throated Thrush

Old World Flycatchers

Indian Robin

Oriental Magpie-Robin

Verditer Flycatcher

Bluethroat

Taiga Flycatcher

Red-breasted Flycatcher

Ficedula sp.

Black Redstart

Blue Rock-Thrush

Siberian Stonechat

White-tailed Stonechat

Pied Bushchat

Isabelline Wheatear

Desert Wheatear

Brown Rock Chat

Variable Wheatear

Sunbirds and Spiderhunters

Purple Sunbird

Weavers and Allies

Streaked Weaver

Baya Weaver

Black-breasted Weaver

Ploceus sp.

Estrildids

Red Avadavat

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Indian Silverbill
 Scaly-breasted Munia
 Tricolored Munia

Old World Sparrows

House Sparrow
 Spanish Sparrow
 Sind Sparrow
 Passer sp.
 Yellow-throated Sparrow

Wagtails and Pipits

Gray Wagtail
 Western Yellow Wagtail
 Citrine Wagtail
 White-browed Wagtail
 White Wagtail
 wagtail sp.
 Paddyfield Pipit
 Long-billed Pipit
 Tawny Pipit
 Rosy Pipit
 Tree Pipit
 Olive-backed Pipit
 Water Pipit
 pipit sp.

Finches, Euphonias, and Allies

Common Rosefinch

Old World Buntings

Crested Bunting
 Red-headed Bunting
 White-capped Bunting

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A3. List of Butterflies recorded at Najafgarh Jheel

LEPIDOPETRA PAPILIONOIDEA

Longer list is under preparation. A non-exhaustive list is below, as noted by Neha Sinha, BNHS

1. Common Grass Yellow
2. Mottled Emigrant
3. Lemon Pansy
4. Grey Pansy

A4. List of Dragonflies recorded at Najafgarh Jheel

ANISOPETRA

1. Vagrant Emperor
2. Trumpet tail
3. Scarlet Marsh Hawk
4. Ditch Jewel
5. Granite Ghost
6. Ruddy Marsh Skimmer
7. Black Ground Skimmer
8. Black Tipped Ground Skimmer
9. Pied Paddy Skimmer
10. Crimson Tailed Marsh Hawk
11. Wandering Glider
12. Common Picturewing
13. Long legged Marsh Glider

ZYGOPETRA

1. Pygmy Dartlet
2. Pixie Dartlet
3. Coromandel Marsh Dart
4. Golden Dartlet
5. Senegal Golden Dartlet
6. Three Striped Blue Dart

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A5. Recommended monitoring parameters for Najafgarh Jheel

Parameter	Indicator	Priority	Monitoring Method	Monitoring Frequency
Land Use and Land Cover				
Land use and land cover change within Najafgarh Jheel and zone of influence	% area under various land use and cover classes (agriculture, settlements, wetlands)	High	GIS and Remote Sensing Radar sensed data	Once every year
Compliance with Wetlands (Conservation and Management) Rules, 2017 and Master Plans for NCT of Delhi and Gurgaon.	Violations	High	Mobile based surveillance system operated by communities' wardens Drone mapping and other technologies for surveillance of land use change .	Daily One every six months
Hydrological Regimes				
Water flux	Sewage inflow	High	Monitoring stations at Dhansa and Jhatikra	Daily
	Sewage outflow	High		Daily
	Sediment inflow	High		Annual
	Sediment outflow	High		Annual
Water holding capacity	Bathymetry	High	Bathymetric surveys	Once in 5 years
Inundation Regime	Seasonal fluctuation in waterspread area	High	Remote sensing	Once in 5 years
Sewage quality	Temperature	Medium	Standard procedures of APHA	Monthly
	pH	High		Monthly
	Dissolved Oxygen	High		Monthly

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	Specific Conductance	High		Monthly
	Nutrients and Nutrient Cycling (Nitrate, Phosphate, Silicate)	High		Monthly
	Cations and Anions (Calcium, Magnesium, Sulphate, Chloride, Fluoride, Sulphite)	High		Monthly
	Chemical Oxygen Demand	High		Monthly
	Heavy metals (Arsenic, Mercury, Cadmium, Chromium, Lead)	High		Monthly
	Biological oxygen demand	Medium	Standard procedures of APHA	Monthly
	Total Coliform	Medium		Annual
	Faecal coliform	Medium		Annual
Wetland soils	Texture	Low	Standard procedures of APHA	Annual
	pH	High		Annual
	Organic carbon	High		Annual
	Available nitrogen	High		Annual
	Available phosphorus	High		Annual
	Available calcium carbonate	Medium		Annual
	Heavy metals (Arsenic, Mercury, Cadmium, Chromium, Lead)	High		Annual
Ground water	Water level	High	Methodology approved by Groundwater Estimation Committee (1997)	Seasonal (Summer, Monsoon, Post-monsoon, Winter)

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	Conductivity	Medium		Annual
	Total hardness	Medium		Annual
	Chloride	Medium		Annual
	Fluoride	High		Annual
	Arsenic	High		Annual
	Heavy metals	High		Annual
Water abstraction	Water abstracted for irrigation	Medium	Survey	Annual
	Water abstracted for domestic use	Medium		
Air quality	Suspended Particulate Matter (PM 2.5, PM 10)	High	Standard procedures laid by CPCB for air quality monitoring	Daily
	Temperature and Relative Humidity	High		
Ecosystem Processes and Biodiversity				
Flora	Phytoplankton (diversity and abundance)	Medium	Taxonomic studies, Standard procedures in	Seasonal
	Periphyton	Medium	Central Inland Fisheries Research Institute Bulletin No. 10	Seasonal
	Macrophytes (diversity and abundance)	High		Seasonal
	Species invasion	High	Habitat Sampling and Remote sensing (using high resolution data)	Once in 2 years
	Primary production	High	Standard procedures in Central Inland Fisheries Research Institute Bulletin No. 10	Seasonal
	Zooplankton (diversity and abundance)	Medium	Taxonomic studies, Standard procedures in Central Inland Fisheries Research Institute Bulletin No. 10	Seasonal

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Fauna	Aquatic macro-invertebrates	Medium	Taxonomic studies, Standard procedures in Central Inland Fisheries Research Institute Bulletin No. 10	Seasonal
	Aquatic Insects	Medium	Taxonomic studies, Standard procedures in Central Inland Fisheries Research Institute Bulletin No. 10	Seasonal
	Fish diversity	High	Taxonomic studies	Once in 5 years
	Amphibians	High	Taxonomic studies	Once in 5 years
	Reptiles	High	Taxonomic studies	Once in 5 years
	Fish catch and effort (number of harvest cycles, catch)	High	Standard procedures in Central Inland Fisheries Research Institute Bulletin No. 10	Monthly
	Water Bird population and diversity	High	Census and Taxonomic studies	Annual
	Avian disease	Medium	Surveillance	Annual