

# Improving Yamuna River Water Quality and Agra Forest Lands



## Restoration of Yamuna River using Constructed Wetlands

by

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Expanded Maps of Area A, B, C, D and E are shown in the following images/slides



10/15/2021

## Facts

- Making persistent efforts to Improve Yamuna watershed near Agra
- The water quality (WQ) improvement effort had two major objectives:

### Objective 1:

- ✓ Restore the Yamuna river water quality in Kakhretta area, Agra
- ✓ Enhance the growth of existing forest on the Yamuna bank.

### Objective 2:

- ✓ Transform the drains into valuable resources yielding-
- ✓ Forest growth, eco diversity, and improved Yamuna water quality.

Compared to 2008 (before), the current (April 2021) observation reveals -

- Final flow through the wetland area flows into the Yamuna river after removal of >75% contaminants and > 300 tons of Carbon capture/year
- More forest growth in the floodplains of the Yamuna River
- Vibrant rebounding of a diverse ecosystem in the wetland and the Yamuna river spanning that area.

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## Area A

Cascading Aeration

First Retention area

Kakhretta Drain -2

Kakhretta Drain-1

Kakhretta Wetland

Image © 2021 Maxar Technologies  
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Kakhretta Wetland System  
Agra, India

Perimeter: 11,668 Ft. Area: 145 Acres

Satellite Imagery: courtesy Google Earth, NOAA



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Imagery Date: April 15, 2021 | Not to scale

# Area B

Pond Outfall

Oxidation  
Pond #3

Cascading Aeration #2

Oxidation Pond #2

Wetland Vegetation

Cascading Aeration #1

Kakhretta Wetland System  
Agra, India

Perimeter: 11,668 Ft. Area: 145 Acres

Satellite Imagery: courtesy Google Earth, NOAA



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Area C

Pond Outfall

Oxidation pond #5

Pond Outfall

Oxidation Pond #4

Kakhretta Wetland System  
Agra, India

Perimeter: 11,668 Ft. Area: 145 Acres

Satellite Imagery: courtesy Google Earth, NOAA



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# Area D

Clean Discharge from Area D  
flowing into Area E through vegetation



Outfall - Pond #5



Kakhretta Wetland System  
Agra, India

Perimeter: 11,668 Ft. Area: 145 Acres

Satellite Imagery: courtesy Google Earth, NOAA



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Imagery Date: April 15, 2021 | Not to scale

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# Area E

Yamuna river (kinara)

यमुना नदी

Yamuna River

Yamuna River

Final stage Area E -  
flow from the Wetland system flows to the Yamuna River  
dispersing through vegetation after removal of >75% contamination

Image © 2021 Maxar Technologies  
© 2021 Google

Kakhretta Wetland System  
Agra, India

Perimeter: 11,668 Ft. Area: 145 Acres

Satellite Imagery: courtesy Google Earth, NO



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Imagery Date: April 15, 2021 | Not to scale

# Improving Yamuna River Water Quality and Agra Forest Lands

## Before, During and After Installation of the Kakhretta Wetland System



Image – 6-28-2012, Courtesy: 2013 Digital Globe

Kakhretta Wetland System  
One Year after the initial Construction

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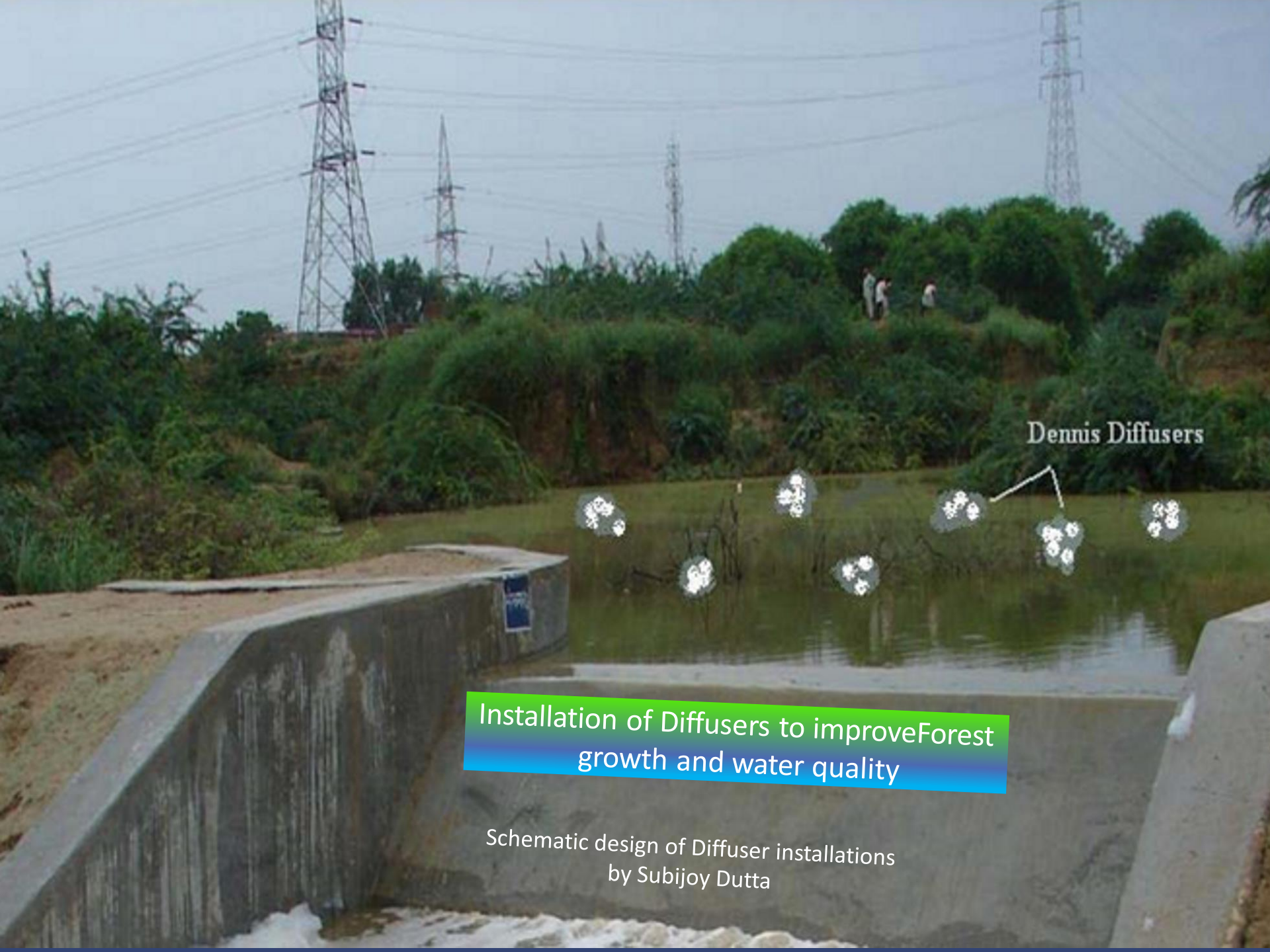
Clarity – 0 inches  
DO <1.0 mg/L  
No aquatic life



New Cascading Aeration System was installed in Area B for adding more oxygen and filter out suspended solids/contaminants

## Kakhretta Drain –Initiation of wetland construction

- Effluent from Pond 1 (Area A) generated high level of foam (July 30, 2011)
- New Cascading aeration system was designed and installed in Area B



Dennis Diffusers

Installation of Diffusers to improve Forest  
growth and water quality

Schematic design of Diffuser installations  
by Subijoy Dutta



High Nutrient-laden water supplied to the trees and plants promotes fast and healthy growth

# Improving Yamuna River Water Quality and Agra Forest Lands



During construction (Area B) - Reforestation initiatives to enhance regrowth of forest lands



Active construction of the wetland system

With periodic site visits by Geeta Devi , Ramanji and Late Shrvan Kumar (1950 – May 2, 2021)



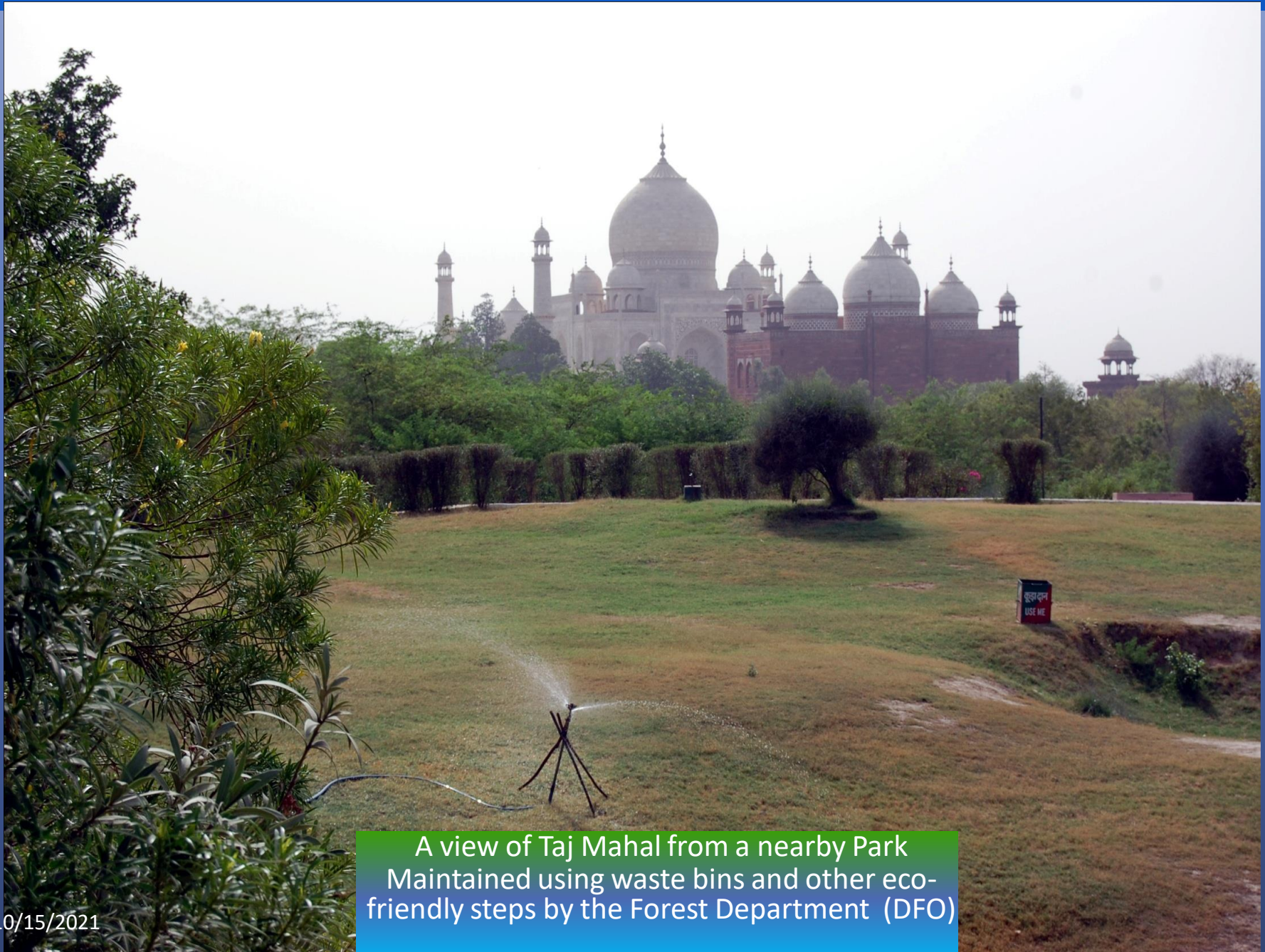
December 2011

Several meetings & discussions with District Forest Officers (DFOs) for 2-3 years.

L-R: Geeta Devi, Subijoy Dutta, DFO, Raman Balla, and Shrvan Kumar (1950 – May 2, 2021)



# Improving Yamuna River Water Quality and Agra Forest Lands



A view of Taj Mahal from a nearby Park  
Maintained using waste bins and other eco-  
friendly steps by the Forest Department (DFO)

## Conclusions and Recommendations

**Compared to 2008 (before), the current (April 2021) observation reveals -**

- Final flow through the wetland area goes into the Yamuna river after removal of >75% contaminants and > 300 tons of Carbon capture/year
- More forest growth in the floodplains of the Yamuna River
- Vibrant rebounding of a diverse ecosystem in the wetland and the Yamuna river spanning that area.

- Continue efforts to Improve Yamuna watershed in the Agra – Delhi Area.
- Continue with the following objectives :

### **Objective 1:**

- ✓ Restore the Yamuna river water quality by treating the discharges from drains
- ✓ Enhance the growth of existing forest / vegetation on the Yamuna bank.

### **Objective 2:**

- ✓ Transform the drains into valuable resources yielding-
- ✓ Forest growth, eco diversity, and improved Yamuna water quality.



## Questions & Comments

Please send comments or questions to Subijoy Dutta  
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