

Wastewater Treatment and Reuse System – for Polluted Yamuna Waters and Beyond



International Workshop on Sustainability and Water Quality
January 17-20, 2011

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Wastewater Treatment and Reuse System – for Polluted Yamuna Waters and Beyond

Rivers of the World

Mission

The primary objective of the ROW Foundation is to make all efforts to cleanup highly polluted Rivers in US, India, SE Asia, S. America, Africa, Europe, and Other Parts of the World. This corporation is organized and shall be operated exclusively for charitable, educational, and scientific purposes . Some of the major objectives are as follows:

- Evaluate the eco-environmental status of the major rivers and tributaries of the world
- Identify a few Rivers initially which could be easily undertaken in the program
- Inform and involve the public in activities that foster the protection, enhancement, and sustainable development along the river banks and riparian areas.
- Identify, evaluate, and address threats to the biological, cultural, and economic components of conservation of the river and riparian areas.
- Acknowledge and promote the significance of the rivers, streams, and their adjacent riparian areas.
- Facilitate cooperation between private landowners, Local/Federal Govts. and other interested parties
- Encourage voluntary participation of all potential partners

Wastewater Treatment and Reuse System – for Polluted Yamuna Waters and Beyond

Primary Objectives Include:

Efforts to Cleanup/Protect highly polluted Rivers in

- ❖ US
- ❖ India
- ❖ China
- ❖ Nepal
- ❖ Bangladesh
- ❖ S. America
- ❖ Africa,
- ❖ Europe, and
- ❖ Other Parts of the World

Wastewater Treatment and Reuse System – for Polluted Yamuna Waters and Beyond

Yourthgroup Workshop (June 14, 2007) Arranged by –
Dr. K. Vijaya Lakshmi, Sr. Program Director
Development Alternatives

B32, TARA Crescent, Qutab Institutional Area, New Delhi 110016;
Tel: 26130899(O), Email: koneru.vl@gmail.com



Dr. Vijaya Lakshmi



Blue Yamuna Volunteers from Delhi and Agra

at the **Center for Science and Environment**, New Delhi

L to R : Girish Chaudhry, Sumit Dutta, D.K. Mital, Brij Khandelwaal, and Mr. Parasnath choudhury



Subijoy Dutta Meeting with Sunita Narain,
Center for Science and Environment

June 14, 2007



L to R:
Girish Chaudhry, S. Dutta, D.K. Mital,
Brij Khandelwaal, and Paras Nath Chaudhury



Yamuna Awareness Center - Panipath



Mr. Singh



Mr. Googlani



Girish Chaudhry



Meeting with Locales
On the Riverbank in Yamunanagar

June 15, 2007

Folks who volunteered to Help
in Yamuna Nagar



Gurpal Singh
Yamuna Nagar
below Yamuna Bridge



Mahichand Sharma
Potential Yamuna Riverkeeper
Yamuna Nagar (near Yamuna Bridge)



Vikram Singh
near Yamuna Bridge,
Yamuna Nagar

Wastewater Treatment and Reuse System – for Polluted Yamuna Waters and Beyond
Accomplishments

2. Yamuna Conference on January 11, 2008 in New Delhi, India



ed Solution to clean up Yamuna

NRI Offers Low Cost Technology To Clear 50% Pollutants From River

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Agra: A US-based Indian environmental scientist Subjoy Dutta, on Monday, offered a low cost, high-result water cleaning technology to cleanse the Yamuna in Agra.

Founder president of Yamuna Foundation for Blue Water in the US and author of "Environmental Treatment Technologies", Dutta spoke of his passion and commitment to restore the pristine purity and glory of river Yamuna, one of the most polluted rivers in the world.

He has set up three centres along Yamuna's bank at Yamunanagar, Karnal and Panipat in Haryana to collect samples and constantly monitor results of cleaning

efforts by various governmental agencies and voluntary organizations. The fourth is to be set up soon in the city of the Taj.

"Some of the tests - like for presence of carcinogenic hydrocarbons - can be done only with highly sophisticated technology available in the US," Dutta said while interacting with the media here on Sunday evening.

Dutta, who pays a visit and carries out tests every six months, said the Yamuna Action Plan, on which crores of rupees had been spent, has not made any difference and the river remains a stinking drain. "Obviously there is need for greater involvement of citizens' groups and volunteers



STILL PURE FOR THE FAITHFUL

for whom I have developed low-cost technologies which can remove 60% of the pollution load in the river, and thereby decrease our dependence on harmful water-treatment chemicals," he maintained.

Dutta said air diffusers and simple floating or stationary aerators, which can

be operated by generators and available motors and pumps, would make a significant difference. "A simple diffuser will not cost more than Rs.10,000 and we can have a row of them over a stretch of 20 km. The oxygen content will definitely improve and solid wastes will be segregated and settle down. The water will be regenerated with oxygen and become healthier," he said.

"Even sprinklers can be used to improve levels of biological oxygen demand. All these simple mechanisms and their operators are locally available. All you need is will power and determination. It's here that smaller citizens' groups can come forward and supervise the

running of these simple devices," Dutta said.

"In India, people think it is only government's responsibility to clean the river. If government agencies failed to deliver the promises made, as has happened in Yamuna's case, can we keep sitting with our hands folded tight?" Dutta asked.

At a conference on the Yamuna last week in New Delhi, Dutta outlined a 10-point strategy to revive Indian rivers, the chief being involvement of smaller groups armed with low cost technology and independent of the government pressures. "Let the government do what it likes to do, but citizens of India need to wake up," said Dutta. **IAS**

Dairy Federation Limited

017. Tel.: 2702501-006, Fax: 2712029
E-mail: rccfd@satyam.net

Dated: 19th January, 2008

NOTICE

from the bonafide manufacturers/processors of 23 Iacs Natural, 8.4 Iacs Yellow and HDPE Bags (Woven Sack) at our Bikaner & Jodhpur for packing

North Central Railway Allahabad

let Condoquendum
Condoquendum No. 30071519 Dated: 17.01.2008 On behalf of the President of India, Controller of Stores, North Central Railway, Allahabad is issues a correspondence in tender no. 30071519 due on 24.01.2008 published against Tender Notice No. 07062 dated 27.12.2007 as under: 884:1, Particulars:Description, from: Metal Bonded Rubber Pads

Agra shivers at 2.2° Celsius

Agra: The city of Taj Mahal shivered as mercury dipped to 2.2 degrees Celsius on Monday and touched freezing point 23 km away on the road to Fatehpur.

Powercuts to continue in Uttarakhand

Market Research Division, Ministry of Tourism, C-1 Hutments, Dalhousie Road, New Delhi-110011.

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Wastewater Treatment and Reuse System – for Polluted Yamuna Waters and Beyond
Accomplishments

3. Yamuna – Potomac Partnership – (Alice Ferguson Foundation)

- Yamuna Trash Cleanup Agra - 400 plus volunteers including the Agra municipal commissioner (http://www.rowfoundation.org/row/Yamuna_Photo.html)



Site Selected for Cleanup

Yamuna Cleanup, March 25, 2008
Agra, India



Site After Cleanup

Part of the Area After Cleanup by the Blue Yamuna Team, Agra



Wastewater Treatment and Reuse System – for Polluted Yamuna Waters and Beyond

3. Yamuna – Potomac Partnership – (Alice Ferguson Foundation)

➤ **New Delhi Yamuna Cleanup – March 30, 2008**



Blue Yamuna Team ...after collecting the Trash...

Lion D.K. Mital with Dark Glasses, leaning against Lion Jittender Kapoor, one of the Pillars of the Blue Yamuna Team in Delhi since its inception...

Wastewater Treatment and



Well, I see some Goocy Stuff...says Suresh S. Nair..
Blue Yamuna Team – Delhi in more action...

Wastewater Treatment and Reuse System – for Polluted Yamuna Waters and Beyond
SITE CLEANUP ACTIONS AND THE BLUE YAMUNA TEAM – NEW DELHI...



Let me pick that first....

Volunteers competing to pick up the Trash...



YAMUNA FOUNDATION FOR BLUE WATER STARTS RIVER CLEANUP CAMPAIGN

In Association with :

- RIVERS OF THE WORLD FOUNDATION, USA
- ALICE FERGUSON FOUNDATION, USA
- TECHKNOW ENGINEERING LLC (Environmental Services India), DELHI
- WATER COMMUNITY, DELHI

Date : 30th, March, 2008

Venue : Kotla Drain, Near Kotla Rly. Crossing

Time : 8.30 a.m. to 12.00 a.m.

Wastewater Treatment and Reuse System – for Polluted Yamuna Waters and Beyond

4. Two Seminars in Delhi University, Gargi College and Kamala Nehru College



Wastewater Treatment and Reuse System – for Polluted Yamuna Waters and Beyond
5. Water monitoring by Boy Scouts in Crofton



Wastewater Treatment and Reuse System – for Polluted Yamuna Waters and Beyond
5. Water monitoring by Boy Scouts in Crofton



09/20/2008

Wastewater Treatment and Reuse System – for Polluted Yamuna Waters and Beyond



Wastewater Treatment and Reuse Systems

- **Health & Sanitation Problems in India –**
Health Effects of Impure Water Supply
- **Policies for Assuring Quality Water Supply**
- **Deep Pond™ System, Hyderabad, India**
- **Advantages of Low-Cost, Deep Pond™ System**
- **Industrial Wastewater Treatment System, Pune, India**
- **Yamuna Watershed Analysis using Remote Sensing Technologies**
- **Conclusions/Recommendations**

Wastewater Treatment and Reuse System – for Polluted Yamuna Waters and Beyond

Status of Health & Sanitation

- ✧ Although slow progress is being made, rural India is way behind many other countries in providing adequate health and sanitation.
- ✧ A Comparative Status as of 2000 is Presented below:

Country	Under-5 Mortality Rank	% Population Using Improved Drinking Water Sources (Rural)	% Population Using Adequate Sanitation Facilities (Rural)
India	54	79	15
Indonesia	77	69	46
Italy	164	-	-
Mexico	102	69	34

Source: Unicef Report “The State of the World’s Children 2003”

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Health & Sanitation Needs

- ❖ Protection of Surface and Groundwater
- ❖ Proper Disposal of Solid & Hazardous Wastes
- ❖ Protecting watersheds – minimize flooding and other damages
- ❖ Prevention & Awareness
- ❖ Rural clinics and camps

Health Effects of Impure Water Supply

- ❖ Low productivity of population.
- ❖ Higher health care costs from Diarrhea, Diabetes, and other Diseases.
- ❖ Increased childhood mortality.
- ❖ Over 30 percent of children being underweight.

Wastewater Treatment and Reuse System – for Polluted Yamuna Waters and Beyond

Water Friendly Policies

Policies that can significantly improve availability of water in India should be geared towards:

- Balancing the cost of water treatment with the economic stature of the end-user,
- Watershed-based management to match the agricultural and industrial water needs to the availability, and
- Improvement of water conservation techniques such as drip irrigation, rain water harvesting, and implementation of effective controls for a leak-proof water supply infrastructure.

Wastewater Treatment and Reuse System – for Polluted Yamuna Waters and Beyond

What is being Done? Listing only a few International programs...

- World Bank – Water and Sanitation Program (WSP)
 - United Nations Development Program
 - Unicef -
 - Rural sanitary marts in India were conceived by UNICEF as “...retail outlets dealing with not only the materials required for construction of sanitary latrines and other facilities but also those items which are required as a part of the sanitation package.”
 - Inventory of the typical mart included low cost ceramic pans and traps, RCC pit covers, pipes and such other material required for construction of a leach pit latrine and other items relating to personal hygiene and home sanitation.
 - The rural sanitary mart is also expected to serve as counseling center for those interested in building a toilet on their own.
 - Rural sanitary marts in India have been supported by UNICEF for nearly a decade
- (Ref. <http://indiatogether.org>)

SUMMARY VOLUNTEER PROJECTS IN INDIA YAMUNA CLEANUP

✧ YAMUNA RIVER REMEDIATION USING LOW COST TREATMENT SYSTEMS - NEW DELHI

✧ Read an Article by Gus Speth (WRI) (1992) about Serious Pollution in the Yamuna River resulting in 700 death and over 600,000 people ill from drinking the Yamuna Water.

✧ Proposed Constructed Wetland Treatment Systems in 1993 to then DWSSD (now DJB) for \$110,000 – for Khyber Pass Drain near Aruna Nagar Pumping Station

✧ Pursued till 1998 – Spent over \$40,000 personal Funds

✧ Formed Yamuna Foundation for Blue Water in Maryland, USA with active volunteers in New Delhi and Agra.

✧ Wrote a Book in 2002 to Generate Funds from the Royalty to help the Yamuna River.

Website:

<http://www.rowfoundation.org>

NOV. 27 1999

Wastewater Treatment and Reuse System – for Polluted Yamuna Waters and Beyond

Environmental Treatment Technologies for Hazardous and Medical Wastes

Remedial Scope and Efficacy

ISBN No.0-07-043586-3, Tata McGraw Hill Publishing Co. Mar. 2002



<http://www.rowfoundation.org/1/booksummary>

Environmental Treatment Technologies for Hazardous and Medical Wastes provides a systematic framework for analyzing the full range of outcomes that may result from many of the components of urban development and for remedying their adverse effects. The book also provides details on various waste treatment technologies for hazardous and medical wastes.

Book Contents

- Containment Technology
- Bioremediation
- Soil Washing
- Incineration
- Thermal Treatment
- Vapor Extraction
- Other Physical/Chemical Treatments

The book also includes a description of the technology, flow diagram and other technology specific information. With this coverage the book would be useful for the environmental scientists and engineers, scientists at the Pollution Control Boards, NGO's , hospitals and medical organizations and students of environmental engineering and sciences.

Wastewater Treatment and Reuse System – for Polluted Yamuna Waters and Beyond

Deep Pond™ System (Hyderabad) Case Study

Project Objectives and Goals:

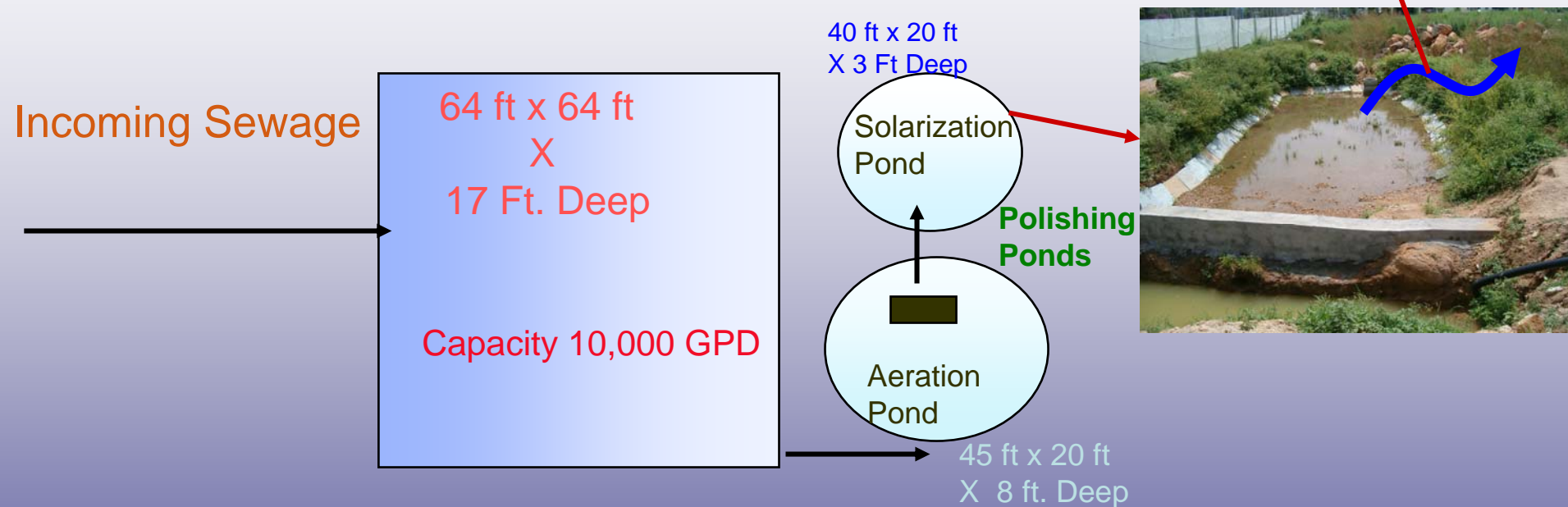
The project goals and objectives are furnished below:

- Constructing, Operating And Maintaining The Deep Pond™ System
- Monitoring Results For The Operation And Functioning Of The System;
- Developing The Economics And Business Aspects Of Deep Pond™ System; And
- Educating Local People And Other Professionals About The Benefits Of Anaerobic Digestion.

Wastewater Treatment and Reuse System – for Polluted Yamuna Waters and Beyond


Deep Pond™ System (Hyderabad) Case Study ..contd.

Final Effluent for Reuse
(irrigating orchard at JNTU and other non-potable uses)



Wastewater Treatment and Reuse System – for Polluted Yamuna Waters and Beyond Deep Pond™ System (Hyderabad) Case Study ..contd.

- ❖ Use of low-cost biological treatment systems have been studied by the authors for the past several years
- ❖ Amongst many different low-cost alternatives, the Deep Pond™ systems was selected for the following inherent advantages
- ❖ *Advantages and Benefits of Using a Deep pond™ System:*
 1. This system can be used in most places around the world with multiple benefits of clean water, energy production and other beneficial uses such as irrigation, fish culture and recreation.
 2. It is relatively simple to install, operate and maintain. It has a very low maintenance cost and requires lesser manpower to operate and maintain.
 3. The Deep pond™ system installed in Hyderabad is treating 10,000 Gallons per Day with only three (3) moving parts.
 4. No chemicals are used for treatment, so there is no hazard to human, plant or animal life. The treated water can be reused with very little post-treatment or polishing.
 5. This system does not produce any sludge, since anaerobic digestion causes the sludge to be transformed into methane, carbon dioxide, and water. Past experience with this system in US required no sludge removal for 20+ years.
 6. This system is flexible. Once it is installed, its treatment capacity can be increased by adding ponds in parallel trains.



Deep Pond™ System (Hyderabad) Case Study ..continued

**POND #1
(Deep Pond)
Dec 26, 2004**

Deep Pond™ System (Hyderabad) Case Study ..continued



**POND #2
(Aeration Pond)
Dec 26, 2004**

Deep Pond™ System (Hyderabad) Case Study ..continued

POND #3
(Solarization Pond)
Sep 21, 2004

Settling Tank (8 ft. Deep x 10 ft wide)



**Wastewater Treatment and Reuse System – for Polluted Yamuna Waters and Beyond
Preliminary Results from the Deep Pond™ System, Hyderabad, India.**

Number	Sampling Points	Electrical conductivity (µmho/cm)	PH (SU)	Total solids (mg/L)	Organic solids (mg/L)	BOD** (mg/L)	COD** (mg/L)	DO** (mg/L)
1	Inlet Of Deep Pond (Pond #1)	762	7.28	600	140	18	24	3.9
2	Outlet Of Deep Pond (Inlet Of Pond#2)	756	6.9	620	160	3.6	48	3.3
3	Outlet Of Pond #2	765	7.1	760	200	9.6	39	6.4 ++
4		724	7.06	680	220	3.0	16	4.9

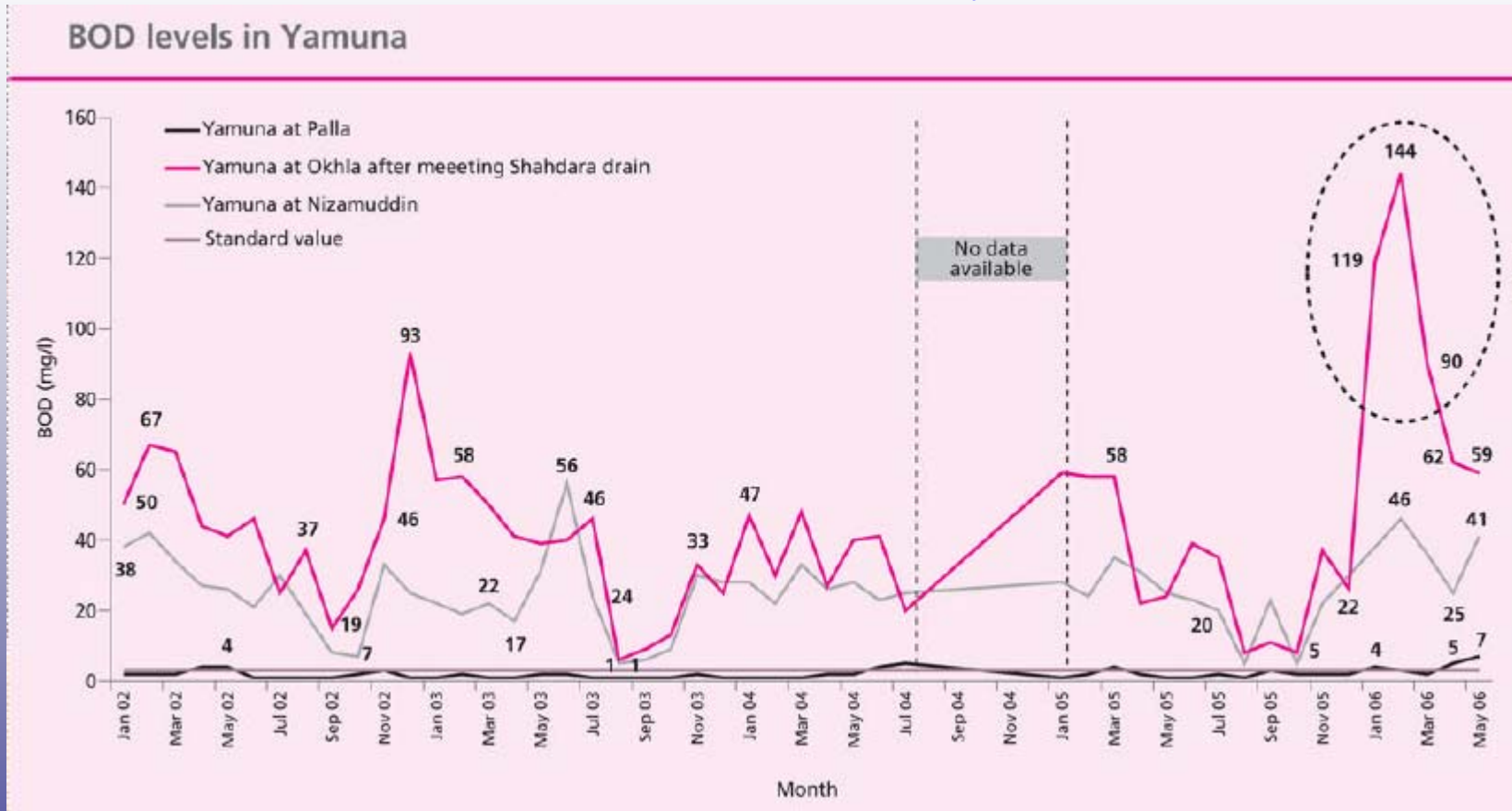
** BOD – Biochemical Oxygen Demand; COD – Chemical Oxygen Demand; DO – Dissolved Oxygen

++ - Note the effect of aeration – The Oxygen content is almost doubled at the effluent of Pond #2

Wastewater Treatment and Reuse System – for Polluted Yamuna Waters and Beyond

DATA ON YAMUNA WATER QUALITY

Source: CPCB (presented by CSE)



Wastewater Treatment and Reuse System – for Polluted Yamuna Waters and Beyond



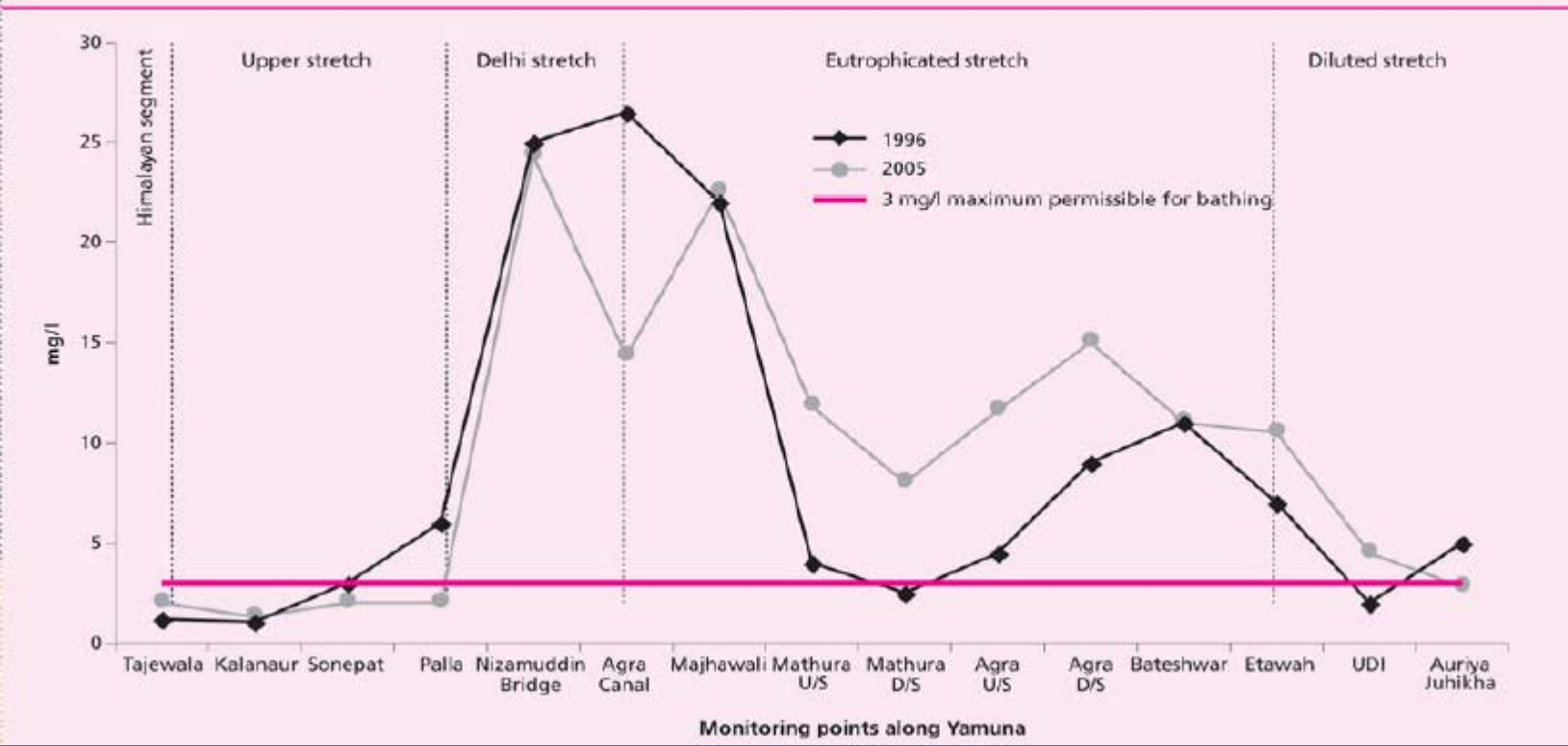
Wastewater Treatment and Reuse System – for Polluted Yamuna Waters and Beyond

Faecally transformed into a sewage canal



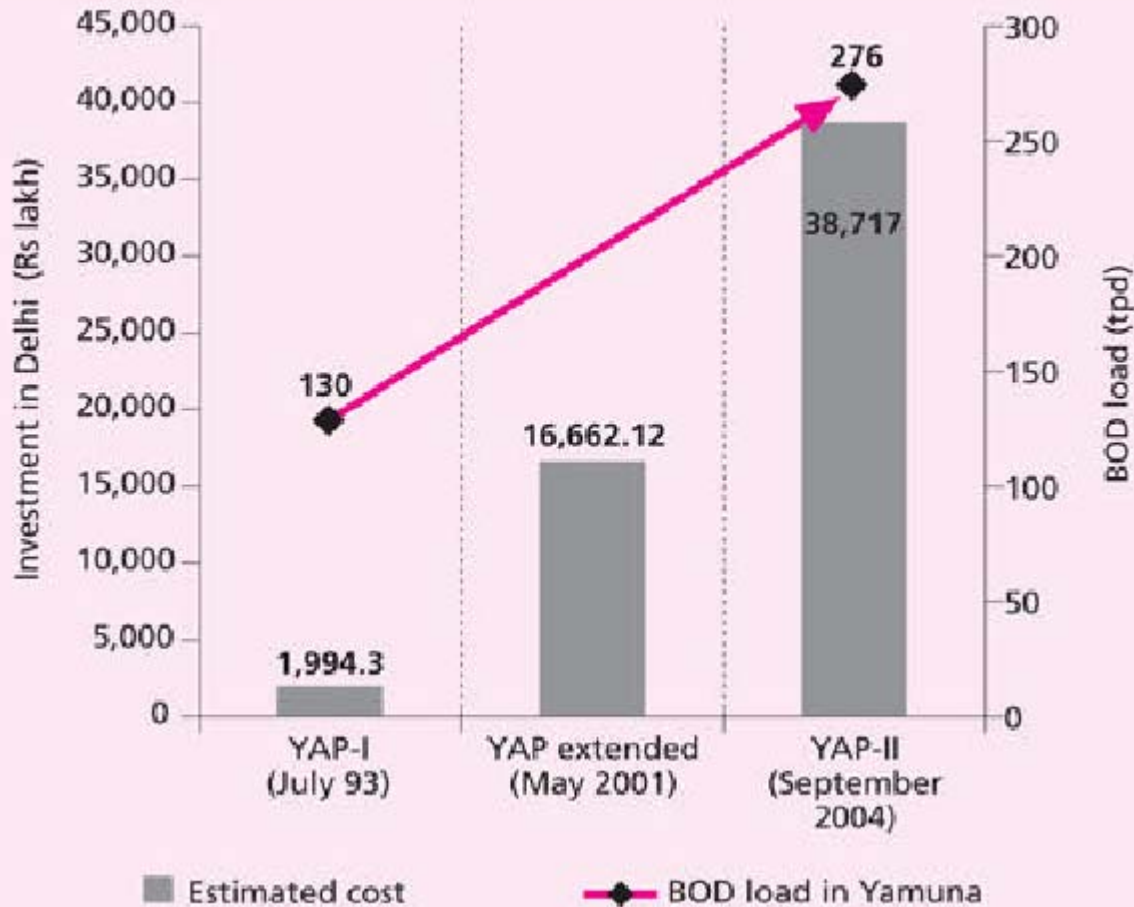
Wastewater Treatment and Reuse System – for Polluted Yamuna Waters and Beyond

BOD trends in Yamuna from 1996-2005



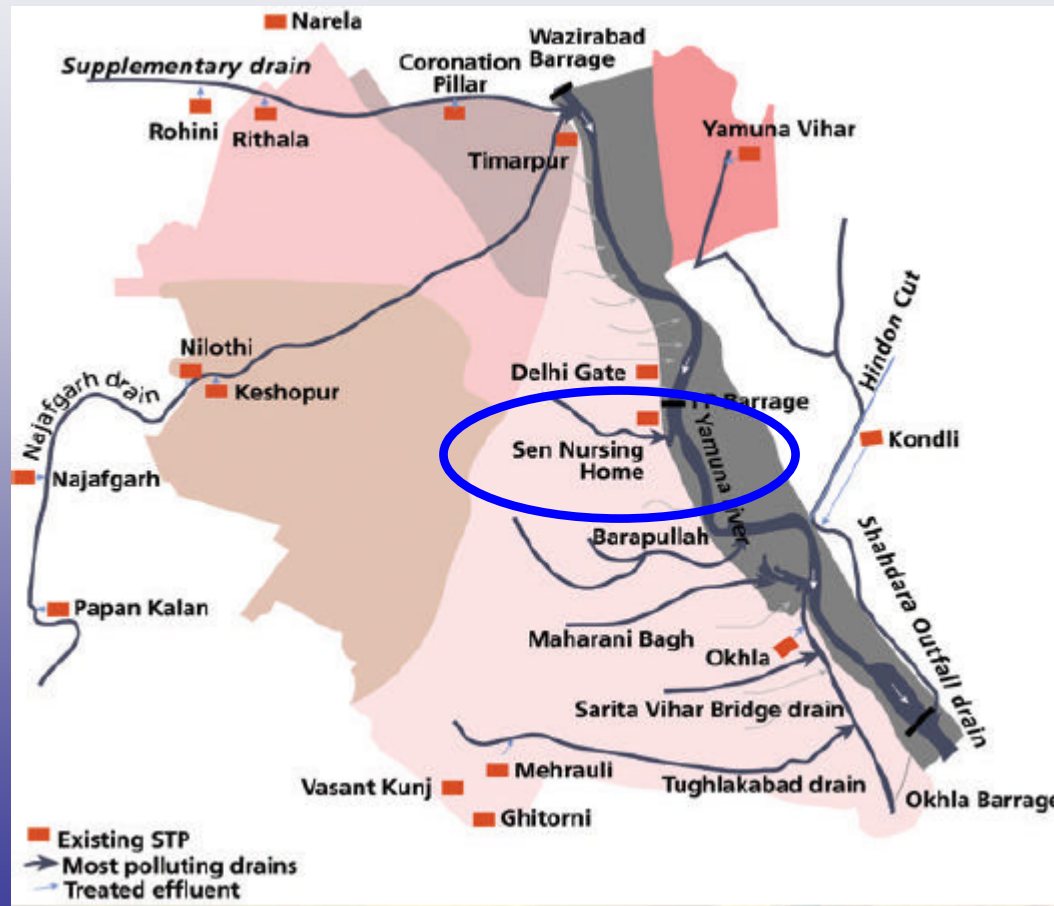
Wastewater Treatment and Reuse System – for Polluted Yamuna Waters and Beyond

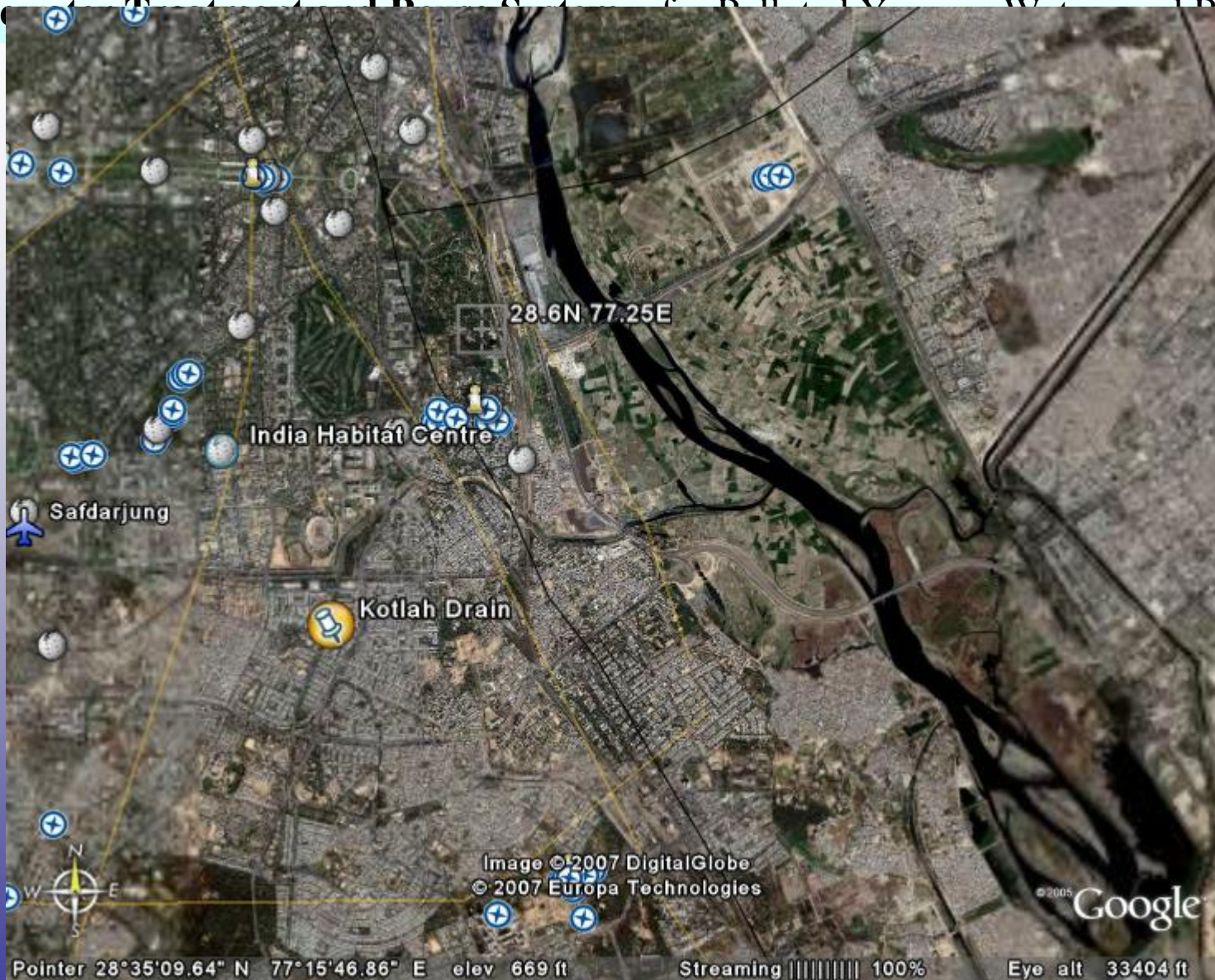
Pollution and investment both rise

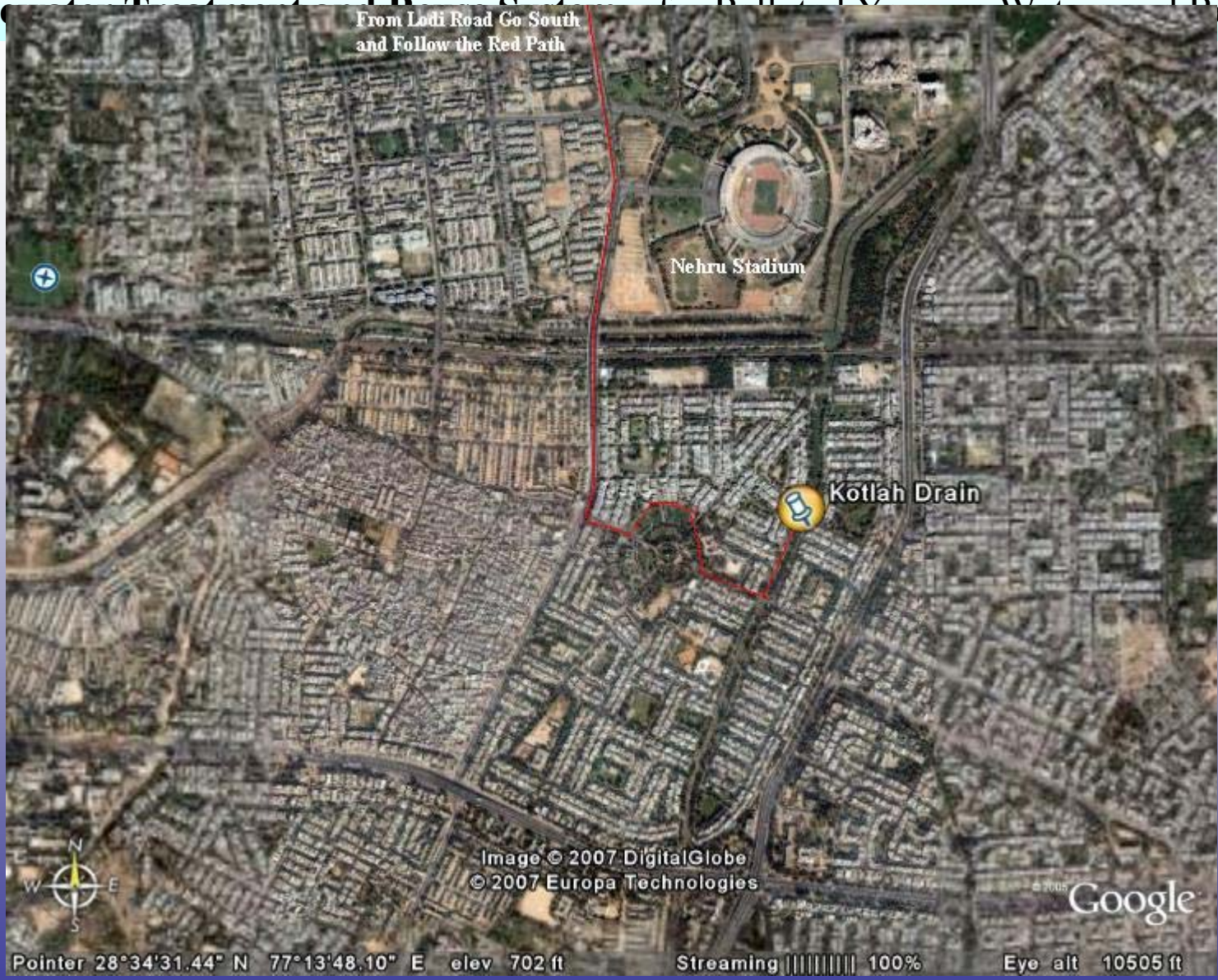


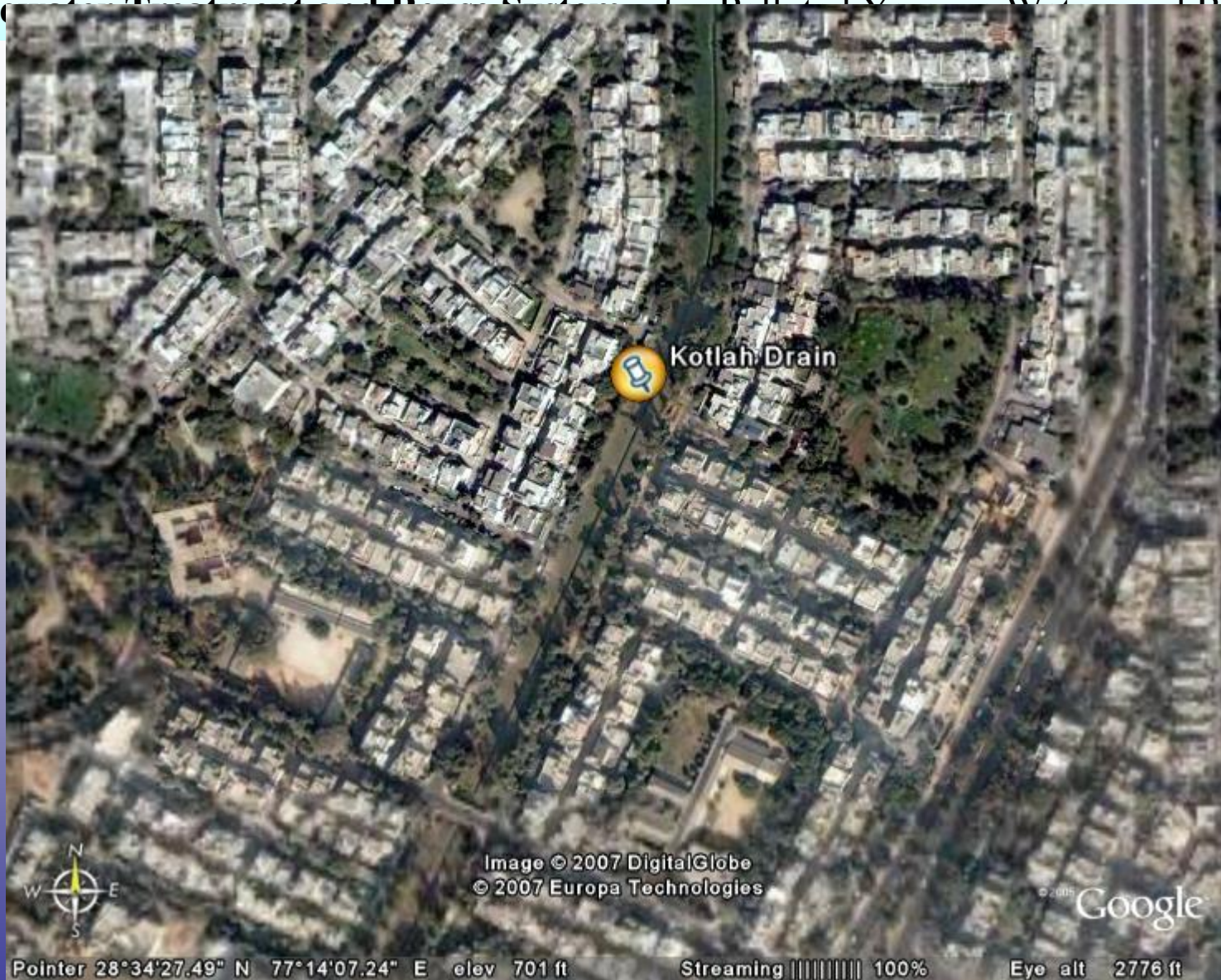
Wastewater Treatment and Reuse System – for Polluted Yamuna Waters and Beyond

Proposal Submitted to Delhi Jal Board in 2004
by S&M Engineering, India, (<http://snmengg.netfirms.com>)
– Updated/Revised in 2005-2006









Wastewater Treatment and Reuse System – for Polluted Yamuna Waters and Beyond

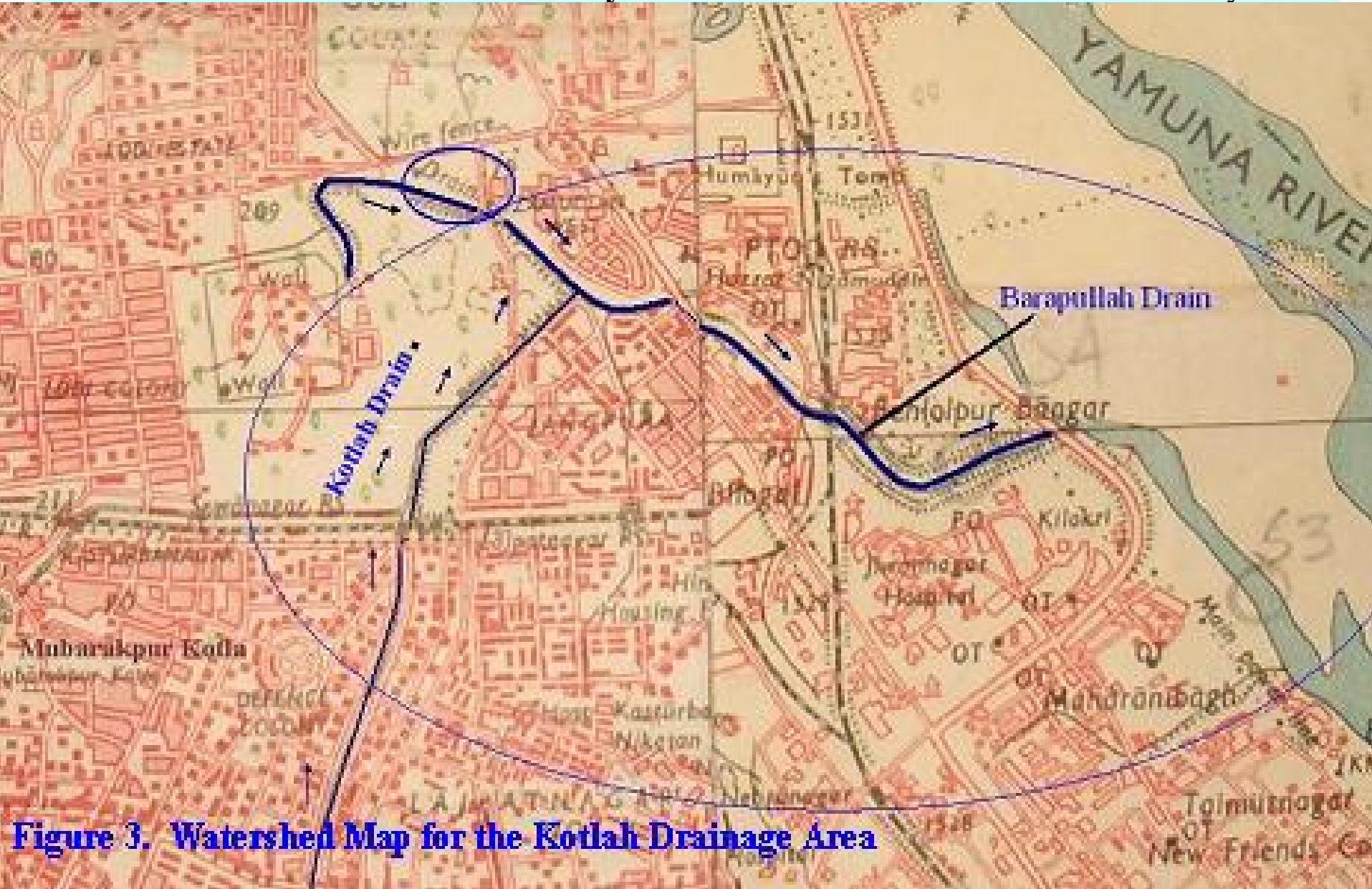


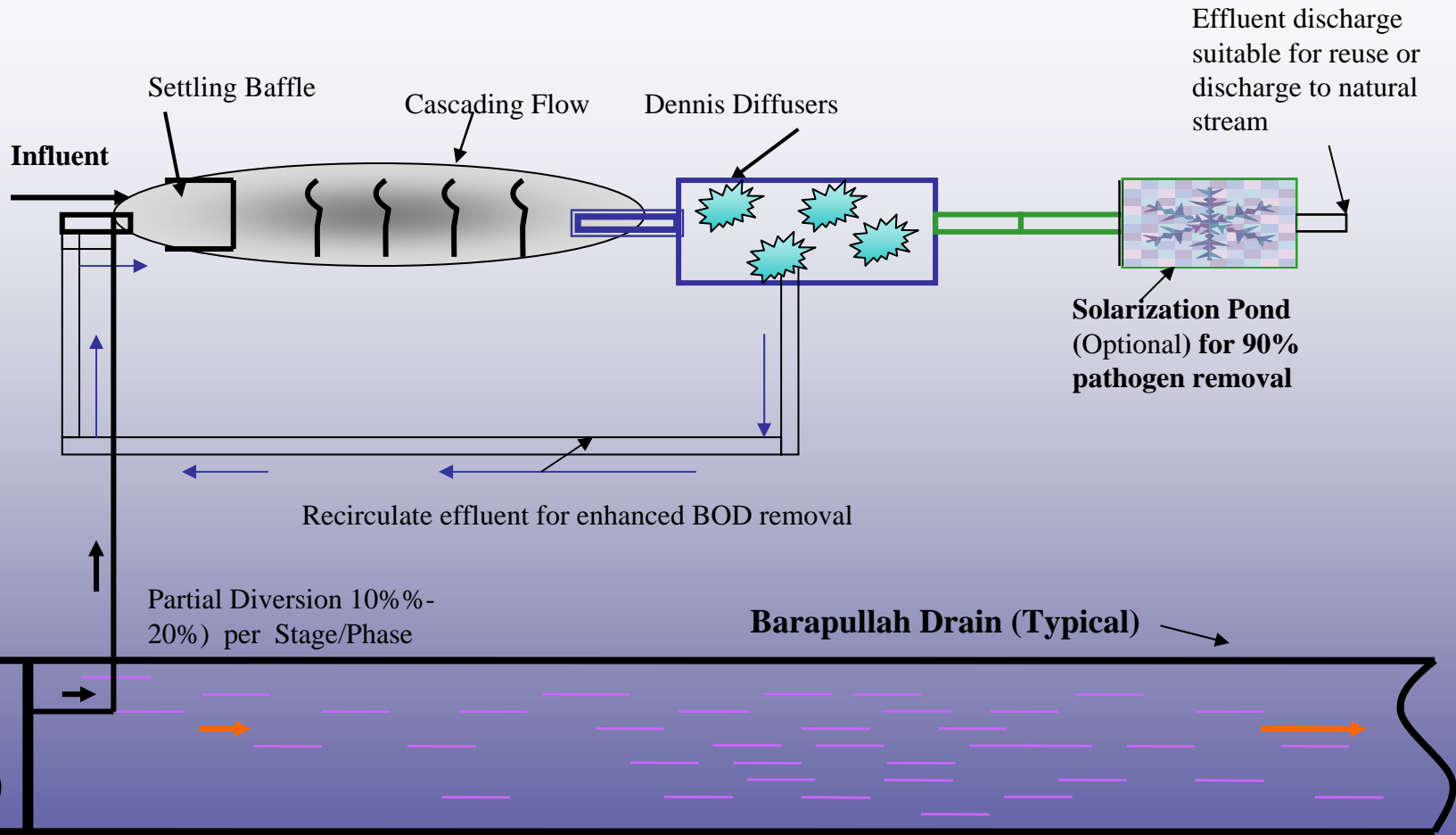
Figure 3. Watershed Map for the Kotlah Drainage Area



Kotlah Drain



Schematic of W/W Treatment For A Typical Nullah Draining To the Yamuna River



Wastewater Treatment and Reuse System – for Polluted Yamuna Waters and Beyond

The basic assumptions, design parameters and relevant constraints are listed below

1 Reclamation Capacity – 350,000 gallons/day; however some additional capacity may be kept for the design max. condition and for possible enhancement of the facility.

2 BOD inflow- 174.6 Kg/day or 132 mg/l (CPCB 2000)

3 Influent - Sewer and Stormwater runoff

4 Total Volume- 43.1 cu. meter/day or 350,000 gallons/day

5 BOD Effluent- <20 mg/l OR as per **CPCB/Delhi PCB** norms

6 H₂O Quality- Suspended Solids and Other effluent characteristics as per CPCB

7 Soil - Bearing Capacity – assumed min. 10T/square meter

8 Concrete - M-25 (250 Kg/cm²) grade (in touch with soil), Other–M-20 (200Kg/cm²)

9 Discharge - will be aesthetically pleasing and suitable for irrigation or other secondary uses.

1 Landscape - Special landscaping and cascading aeration systems should make the reclamation visually pleasant for the residential/business district in and around the area.

1 Clearance - All necessary clearance to start construction on the land specified in Figures 1 and 2 have to be acquired by the Delhi Government or other organizations. SNM will coordinate all such activities through our local representatives, Mr. D.K. Mital, Ram Koduri, P.E., and Mr. Dilip Biswas.

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1 Housing - Proposal will include a small bldg. for housing the maintenance staff.(200 sqft or so) for keeping the maintenance equipment and a 24-hr. electronic and manual surveillance system for the facility.

1 Cost breakup- Detail cost breakdown will be furnished upon preliminary acceptance of the proposal. It involves a significant effort by SNM and can only be undertaken upon cost-reimbursement by the Delhi Government.

1 Maintenance- The proposed construction will Include one year maintenance cost

1 Site Visit – Any special access to the proposed site or any other site would have to be provided by the Delhi Government

1 The proposed site is in a highly congested area with residential areas on the both sides of the drain. A suitable staging area has to be provided by the DJB for the construction work to be performed at the site.

1 Proposal Cost -The estimated cost of the project will remain valid until Dec 2, 2010.

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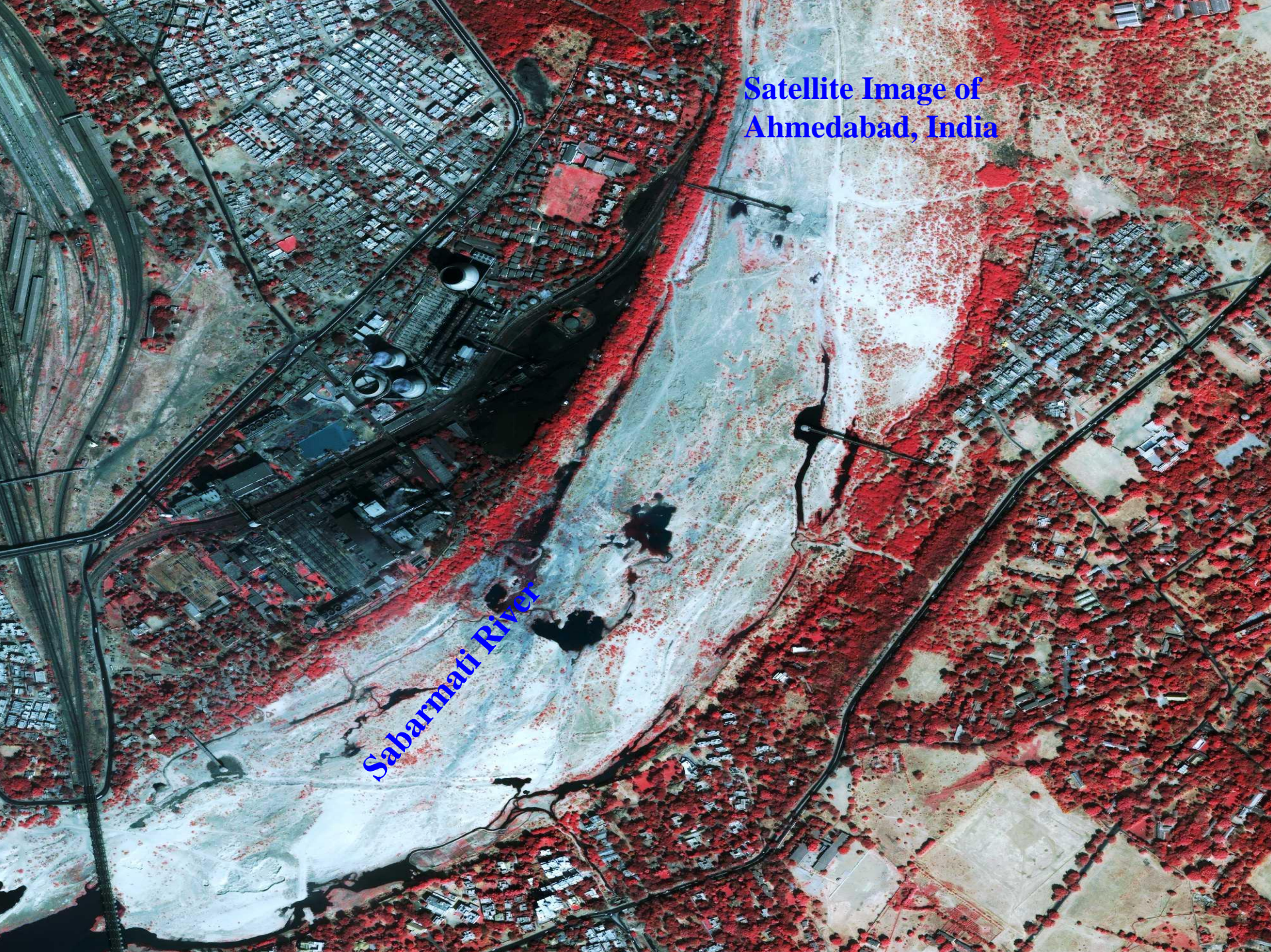
1 Site Visit – Any special access to the proposed site or any other site would have to be provided by the Delhi Government

1 The proposed site is in a highly congested area with residential areas on the both sides of the drain. A suitable staging area has to be provided by the DJB for the construction work to be performed at the site.

1 Proposal Cost -The estimated cost of the project will remain valid until Dec 2, 2010.

Satellite Image of
Ahmedabad, India

Sabarmati River



A Small Difference – Gau Ghat
Identified in Dec 2000 – Better in Nov 2007



Conclusions/Recommendations

1. Small steps at a time –

- **Initiate Small Demonstration Projects involving any of the following:**
 - **Compost Sanitation Systems (CSS) in a few villages**
 - **Locate suitable areas for Installation/Demonstration of**
 - **Innovative Diffuser/Aeration Systems**
 - **Deep Pond™ Systems**
 - **Constructed Wetland Systems**
 - **Other low-cost/Biological Systems**

QUESTIONS/Comments ?

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