INTEGRATED RURAL URBAN WATER MANAGEMENT FOR CLIMATE BASED ADAPTATIONS IN INDIAN CITIES (IAdapt)

Report on Urban Exposure Visit to Nagpur

22 - 24 October 2018, Nagpur

Proposal Code: Proposal # A-69683
Submitted to: International Development Research Centre (IDRC) Canada
Submitted by: ICLEI South Asia
Project Consortium: ICLEI South Asia (Lead Member)
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International Water Management Institute (IWMI)
Indian Institute of Technology, Madras (IIT M)
**Introduction**

Urban exposure visit to Nagpur was organised on 22nd to 24th October 2018 by ICLEI-South Asia under the IAdapt project. Main objectives of the visit were:

- To showcase the best practices in sustainable water management
- To interact with the officials of other local government involved in water management
- To know advancement in the field of water and waste water management by national institute

Solapur city faces water scarcity and water pollution issues because of increased population, vast area, insufficient pipe network, limited water resources and other problems like manpower, finances etc. Knowing the preferences of Solapur, ICLEI – South Asia shortlisted few cities for urban exposure visit based on the discussions with partners and in-house experience of working with various cities in India. Nagpur city was finalized as it resembles similar situation and problems in terms of water management and represents the same state to know more about schemes and policies.

For this exposure visit, Solapur Municipal Corporation (SMC) nominated three officials of Public Health and Engineering Department looking after water and waste water management in the city. These officials are mainly involved in day to day operation of water management as well as new projects proposed under Smart Cities Mission and AMRUT mission. Nagpur has already implemented few projects similar to the projects proposed by Solapur for sustainable water management. Hence the learning for this exposure visit would be used to implement projects in pipeline with better understanding and improved planning.

**About Nagpur**

Nagpur is the winter capital and third largest city of the Indian state of Maharashtra after Mumbai and Pune. With the population of about 24.48 lakhs, Nagpur is the 13th largest Indian city. Geographically, Nagpur is located at the centre of India and acquired importance in international aviation to become a hub for passenger and cargo movement. Nagpur is an important urban centre in the Vidarbha region with jurisdictional area of about 225.08 sq km. Nagpur Municipal Corporation (NMC) has implemented many exemplary projects in terms of water management like 24X7 water supply, reuse of treated sewage, SCADA system for water management, decentralized STPs through various schemes of state and central government.

**Details of exposure visit**

Based on the discussions with the officials of NMC; following sites were selected for site visit.

1) Ambazari lake recreational area
2) Water treatment plant – Gorewada (Capacity 136 MLD) and 24X7 water supply scheme
3) Sewage treatment plant – Bhandewadi (Capacity 200 MLD)
4) Tertiary treatment (sewage) plant for recycle at thermal power plant (Capacity 130 MLD)
5) Decentralized sewage treatment plant

A separate session was allocated for detailed discussion with NMC officials and Technology Development Centre of National Environmental Engineering Research Institute.

Mr. Nikhil Kulkarni of ICLEI – South Asia welcomed all the participants in Nagpur and provided a brief introduction about IAdapt project and its objectives. Participants were also informed about the work done so far under this project and plan for future activities. Mr. Shardula and Mr. Sharad of ICLEI –
South Asia, informed background of Nagpur city, its similarities with Solapur and objectives of the urban exposure visit.

**Ambazari lake recreational area**

First site visit was made to Ambazari lake recreational area. Ambazari Lake is one of the 11 lakes in the city. The Nag River of Nagpur originates from this lake. This lake was surrounded by mango trees, gaining the name Ambazari as ‘Amba’ means ‘Mango’ in local language. Earlier, the lake was used to supply water to Nagpur for over 30 years. Ambazari lake located in the heart of Nagpur city was the worst polluted due to disposal of wastewater by surrounding areas. However the lake has been desludged partially to remove the polluted sediments and beautified to improve its aesthetic value. Local authorities have developed a part of Ambazari lake area as a recreational centre with park, urban forest and boating for tourists. The gym, musical fountain and radio speakers were added in the park for citizens and to attract more tourists. Under the Smart City Mission, NMC has proposed to develop an urban forest at Ambazari in association with the Forest Department, Government of Maharashtra by 2020.

Solapur city has 2 major lakes within city – Sidhheshwar and Kambar lake. Solapur has also proposed to develop Sidhheshwar lake area as a tourist attraction under the Smart Cities Mission. City authorities have already prepared a proposal for Kambar lake under the National Lake Conservation Scheme to reduce its pollution load and development of recreational area.

**Water treatment plant – Gorewada**

On 23\(^{th}\) October, team visited Gorewada water treatment plant of 136 MLD capacity. The plant is maintained by OCW, appointed by NMC for the period of 25 years. Dr. Dilip Thakare of OCW provided detailed information about plant operations. The Gorewada tank source was developed in the year 1911. The WTP is placed at a distance of about 45 kms from the source and water is being supplied in a closed pipeline by NMC from the source. The plant is sub-divided into two technologies as conventional flow (113 MLD) and multi-flow system (23 MLD fitted with tube settlers) used for settling of the solids. Team visited each operation and received its information along with problems faced and its remedies.

Flow of operations:

| Aeration | Pre-chlorination | Coagulation by PAC | Clariflocculation | Chlorination | Filtration | Settling |

Mr. Savit Walde of OCW informed the process of quality control. In addition to the plant level quality testing, daily 10 samples are being collected from user ends and analyzed at third party laboratories. Due to the provision of standby equipments and its regular maintenance, this plant is performing well in terms of quality, he added.

Mr. Samir Choudhary of OCW provided information about instrumentation part of the WTP. He also provided overview of supervisory control and data acquisition (SCADA) system implemented for real time control that uses computers, networked data communications and graphical user interfaces for high-level supervisory management. Participants also visited Meter Testing Laboratory and got overview of calibration process of various meters and its tests.
**24X7 Water Supply System:**

NMC has appointed private contractor (OCW) to provide drinking water to entire Nagpur city and implement 24X7 water supply in phase wise manner. The contract is for 25 years under Public-Private-Partnership (PPP) model. Orange City Water Pvt. Ltd. (OCW) is a joint venture of two companies with supervisory control of NMC. The organization was established in 2011 for the execution of Nagpur Municipal Corporation’s Uninterrupted Water Supply Scheme, popularly known as 24×7 Water Supply Scheme and reduce its non-revenue water (NRW) losses, under Central Government’s JnNURM (Jawaharlal Nehru National Urban Renewal Mission).

NMC gets its water supply from three surface sources namely Pench canal, Kanhan river and Gorewada tank. The overall treatment capacity of all the 4 water treatment plants is about 740 MLD and currently operated for 650 MLD. Treated water is supplied to 68 elevated service reservoirs, 3 ground service reservoirs and 2 master balancing reservoirs spread all over the Nagpur city. SCADA system has been placed for water distribution and real time data of inflow, outflow, pressure, residual chlorine etc. are being recorded and displayed on public domain website.

OCW has divided Nagpur city in various water supply zones and deployed its staff to address local issues. Each zone has its zonal manager assisted by service manager and network manager. Service manager looks after billing section while network manager further assisted by network engineer (for tank wise management), supervisor and field staff to address local complaints. NMC’s zonal officer coordinates communication between NMC and OCW for water management. OCW and NMC have deployed social teams for awareness on 24X7 water supply project, water losses and billing. These teams interact with citizens regularly through various activities like street plays, ward level meetings etc.

Officials informed that NRW losses are reduced considerably because of this project and expansion of the 24X7 water supply project is in progress to cover maximum area of Nagpur city. Solapur has proposed same project on pilot scale for the area based development under Smart Cities Mission. Hence, separate discussion was conducted to know pre-requisites of 24X7 water supply and SCADA implementation.

**Sewage Treatment Plant – Bhandewadi (Capacity: 200MLD)**

Next site visited by the participants was Bhandewadi Sewage Treatment Plant (STP) where existing plant is being operated for 100 MLD capacity and new plant has been constructed with Sequential Batch Reactor (SBR) technology for 200 MLD capacity. Mr. Amol Malvatkar of Vishwaraj Environment Ltd. provided overview of the STP on a prototype developed for better understanding. Earlier, in absence of the dedicated sewage network in Nagpur; local nallahs (storm water streams) and rivers were used to discharge sewage. Hence the new STP is designed to treat polluted water from river lifted by with two pumping stations of 75 MLD each and 50 MLD sewage discharged by sewerage network in the city.

Officials of Vishwaraj Environment Ltd. interacted with the team and provided specifications, pros and cons of each operation in the plant. Team got insights of SCADA system for real time monitoring of various parameters of the sewage treatment and electrical operations. Process of SBR technology and its
benefits were also shared by the plant operators. Participants also got a chance to check the sample of treated sewage (odourless) and compare with inlet sample (90-95% BOD removal). The treated sewage is being discharged in a same river.

NMC has appointed private contractor to manage this STP under a Public-Private-Partnership contract for 30 years. Officials also told that the plant is being upgraded for tertiary treatment for its use at thermal power plant and showed its civil construction. NMC and private contractors are taking initiative to use renewable energy for the plant operations.

**Tertiary treatment (sewage) plant for recycle at thermal power plant (Capacity 130 MLD)**

Mr. Bhattacharya, plant manager provided background information, overview of the plant and importance of tertiary treatment for cities. There are many thermal power plants established near Nagpur. Continuous need of water for their operations in cooling towers and limited fresh water resources directed them to use sewage as a source of water. Maharashtra State Power Generation Company (MAHAGENCO), NMC and private contractor formed a tri-party agreement for 25 years to establish, operate and sell treated sewage of desired quality to be used at thermal power plants.

Mr Bhattacharya, explained the process of tertiary treatment and Deep Bed Media Filtration technology. Tertiary treatment starts after disinfection (chlorination) and discharges treated sewage with Biochemical oxygen demand (BOD) less than 5 mg/lit, total dissolved solids (TDS) less than 480 and phosphates less than 0.5 mg/lit.

Solapur Municipal Corporation has signed a MoU with National Thermal Power Corporation Ltd (NTPC) to supply treated sewage from its Degaon STP of 75 MLD capacity. Site visit and interaction with officials who are actually managing this facility helped Solapur officials to know more about agreement process, plant operations and quality control.

**Phytorid bed decentralized sewage treatment plant**

National Environmental Engineering Research Institute (CSIR-NEERI) has implemented phytorid bed sewage treatment plant in collaboration with Dr. Panjabrao Deshmukh Agriculture University at Nagpur. The plant has been constructed on a bank of one of the most polluted nallah (storm water drain) in Nagpur city. The system lifts polluted water from a nallah and reuse for agricultural purpose after passing through Phytorid bed. The system is based on the specific plants, such as Elephant grass (Pennisetumpurpureum), Cattails (Typha sp.), Reeds (Phragmitessp.), Cannas pp. and Yellow flag iris (Iris pseudocorus), normally found in natural wetlands with filtration and treatment capability. The beds are constructed in series forming a circle to use minimum land. The phytorid technology treatment is a subsurface flow type in which wastewater is applied to a chamber filled with porous media such as crushed bricks, gravel and stones. The hydraulics is maintained in such a manner that wastewater does not rise to the surface retaining a free board at the top of the filled media. The system is consist of the three zones (i) inlet zone comprising of crushed bricks and different sizes of stones, (ii) treatment zone consisting of the same media as in inlet zone with plant species, and (iii) outlet zone. The reduction in the treated effluent for the total suspended solids (TSS) varied from 60-70%, BOD from 70-80%, nitrogen from 60-70%, phosphorus from 40-50% and fecal coliform from 80-90%. The treated sewage is being used for cultivation of flowers by the students of agricultural college.
Solapur city is developing an urban forest for which water is a key resource. Being a water scare region, this kind of system will definitely help them to recycle waste water for developing green areas.

Discussion with NMC Officials

After the site visits, a meeting was organized at Nagpur Municipal Corporation to discuss other issues with NMC officials. Mr. Manoj Ganavir, Principal Executive Engineer (Water Supply) and Mr. Aniruddha Chorangkar, Executive Engineer (Sewerage) interacted with the participants. They shared their experience of implementing various schemes, different conditions of PPP contracts and supporting Government Resolutions (GR). NMC officials informed that a delegate has been appointed at each zone that represents Commissioner to coordinate and solve billing issues and complaints related to water management. Response of citizens, awareness activities, financial implications, recovery of bills and operational costs were also discussed in detail. Concepts of water friends (to interact with citizens), dummy bills (during initial month after installation of new water meters and 24X7 water supply), checking for leakage losses till user end (taps) were explained by project in-charge.

Visit to National Environmental Engineering Research Institute (NEERI)

Team visited NEERI campus on 24th October to know more about their work and advanced technologies in water/wastewater treatment. Dr. Sunil Kumar welcomed all the participants and explicated overview of NEERI’s objectives, its work and overall role in national environmental activities. He also informed various activities of Technology Development Centre of NEERI and its various activities of consultancy and research. Officials of SMC briefly explained water management of Solapur, problems and various ongoing and proposed projects under various schemes and missions.

Conclusion

Overall the visit was prolific in terms of learning from the best practices. Officials of Solapur Municipal Corporation could correlate their proposed projects with already implemented projects in Nagapur. The site visits and interaction with the officials of Nagpur Municipal Corporation and private contractors will help Solapur to avoid potential errors and direct them for successful implementation of water infrastructure for its efficient usage. Discussion on PPP contracts, technology used, people participation and supervisory procedures will facilitate Solapur to plan, implement and maintain inclusive, sustainable and integrated water management.
List of participants

A) Officials of Solapur Municipal Corporation
   1) Mr. Vyankatesh Choube
   2) Mr. Shrishail Babanagare
   3) Mr Shakil Shaikh

B) ICLEI – South Asia team
   1) Mr. Nikhil kulkarni
   2) Mr. Sharad Wagh
   3) Mr. Shardul Venegurkar
## Agenda – Urban Exposure Visit

### Exposure visit under the project on Integrated Rural Urban Water Management for Climate Based Adaptations in Indian Cities (Intact)

#### Agenda

<table>
<thead>
<tr>
<th>Date</th>
<th>Time</th>
<th>Activity</th>
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<tbody>
<tr>
<td>23/10/2019</td>
<td>03:00 PM – 04:00 PM</td>
<td>Presentation by (CLE – South Asia) about the project</td>
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<tr>
<td></td>
<td>04:00 PM – 05:30 PM</td>
<td>Visits Arbatan lake recreational area</td>
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<tr>
<td>23/10/2019</td>
<td>09:30 AM – 11:30 AM</td>
<td>Orientation by MMD and visits Orange City Water Private Limited (OCWPL), UWWTP and SCADA system</td>
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<td></td>
<td>11:30 AM – 01:00 PM</td>
<td>Visits decentralized treatment plant, Wastewater SRLC</td>
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<td></td>
<td>01:00 PM – 02:00 PM</td>
<td>Lunch Break</td>
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<td></td>
<td>02:00 PM – 04:00 PM</td>
<td>Visits Biodegradation STP and its tertiary treatment</td>
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<td></td>
<td>04:00 PM – 05:30 PM</td>
<td>Discussion and knowledge sharing</td>
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<tr>
<td>24/10/2019</td>
<td>10:00 AM – 12:30 PM</td>
<td>Visits MERRI and discussion on advanced technologies in water/wastewater management</td>
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Photos of urban exposure visit to Nagpur

Water treatment plant – Gorewada

Meter testing and 24X7 water supply scheme

Sewage treatment Plant - Bhandewadi
Tertiary treatment (sewage) to recycle at thermal power plant

Phytorid bed – decentralized sewage treatment and recycle for gardening

Meeting with NMC officials and CSIR – NEERI