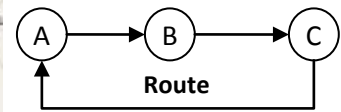


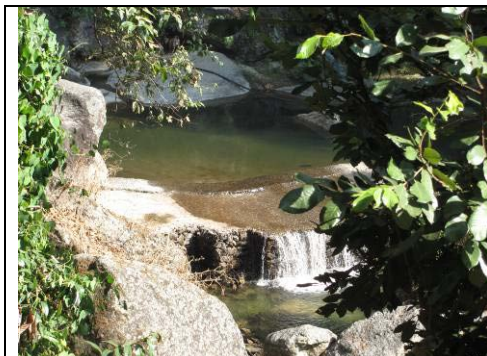
WEPA Nepal Dialogue Site Visit Report

13 and 15 December, 2010, Kathmandu, Nepal

I. Summary of the Site Visit on 13th December



The purpose of site visit was to gain knowledge of the Japanese participants of the Dialogue about water resource utilisation, state of water environment and future action plan of the Bagmati River, which is the major river system of Kathmandu Valley. The tour started from the upstream of the Bagmati River where a dual purpose dam and a drinking water treatment plant were observed. Then we descended downstream of the Bagmati River where increasing human settlement and gradual deterioration of river water quality were apparent. Finally the tour concluded at the office of High Powered Committee for Integrated Development of the Bagmati Civilization (HPC-IDBC), Nepal Government, Guheshwori, where the officials introduced us to the Bagmati Action Plan (2009-2014) and a wastewater treatment plant being operated by the office.



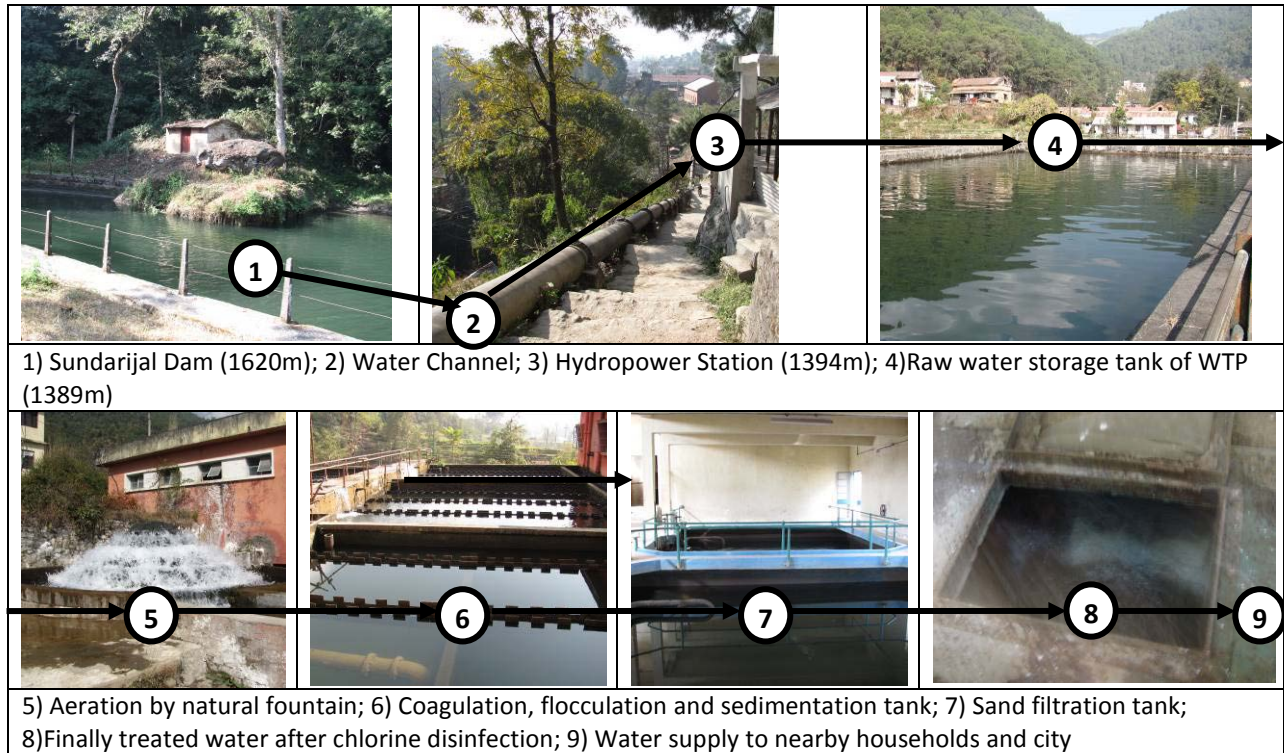
Bagmati River in the upstream at Sundarijal



Bagmati River in the downstream city area

1) Sundarijal

Sundarijal Sub-catchment (15 Km²) is located in Shivapuri National Park at the north of Kathmandu Valley. The Bagmati River originates at an elevation of 2732m in Shivapuri National Park and then flows along Sundarijal Sub-catchment before entering into the plain valley area of the city. The river flowing along the sub-catchment has been used for hydroelectricity generation, drinking water supply to people living in Kathmandu City and irrigation in nearby fields. We visited two main interest points, namely, dual-purpose Sundarijal Dam and Sundarijal Water Treatment Plant.



1.1) Sundarijal Dam

Sundarijal Dam (elevation: 1620m) was constructed in 1934 for the production of hydroelectricity by Sundarijal Hydropower Station (elevation: 1394m) which has an installed capacity of 0.64 Megawatts (MW) of electricity. In 2006, the average water discharge of the dam was 165 l/sec. The station management and distribution of electricity is carried out by Nepal Electricity Authority (NEA). After electricity generation, the water coming through the dam is treated for use as a drinking water supply in Kathmandu City.

1.2) Sundarijal Water Treatment Plant (WTP)

Sundarijal WTP was constructed in 1966 under Indian Government assistance. It is located just below Sundarijal Hydropower Station (elevation: 1389m) and it uses raw water coming out after the production of electricity. The WTP is currently managed by Kathmandu Upatyaka [valley] Khanepani [drinking water] Limited (KUKL). Initially, there were only two storage structures having capacity to supply about 30 MLD, which is mainly used by WTP. Recently a new storage structure of a capacity to supply 30 MLD has been constructed with Japanese Government assistance which is used to supply raw water to another water treatment plant located at Mahankal in the city area. During 1980s time the

WTP used to be the main source water supply to Kathmandu City, however now it can hardly fulfil one fifth of the current water demand of Kathmandu City which exceeds 225 MLD.

The WTP has adopted conventional purification processes and it is operated on a gravitational flow system. The treatment processes are raw water storage, aeration, coagulation-flocculation-sedimentation, sand filtration, and disinfection by chlorine. The majority of the treated water is then diverted to a distribution point at Mahankal in the city, where the treated water is periodically monitored for water quality with reference to WHO drinking water quality guidelines. Drinking water for households in areas located in between the WTP and Mahankal distribution point is directly supplied through the main line. Old infrastructure and lack of regular maintenance are the main problems for maintaining efficient treatment while insufficient quantity of available water in the dry season and leakage along transmission line are other problems for maintaining regular supply.



In front of HPC-IDBC office



Presentation about Bagmati Action Plan (BAP)

2) High Powered Committee for Integrated Development of the Bagmati Civilization (HPC-IDBC), Nepal Government, Guheshwori, Kathmandu, Nepal





Mr. Ram Chandra Devkota introduced the Bagmati Action Plan (BAP) being implemented by HPC-IDBC for the conservation of Bagmati River System. Mr. Devkota highlighted the cultural and religious importance of the Bagmati River environment. Increasing pollution, illegal river side encroachment and reduced discharges are identified as key issues of the Bagmati River. BAP has adopted a comprehensive framework of planning with a vision of clean, green and healthy river system that is full of life and valued by all. BAP has identified five priority zones in order to achieve its vision.

Zone 1	Natural conservation zone	To maintain and enhance the upstream river ecosystem	
Zone 2	Rural zone	To restore the river ecosystem through sustainable development approach	
Zone 3	Peri-urban zone	To restore the river ecosystem through effective management of urban growth	
Zone 4	Urban zone	To improve water quality and regenerate heritage linked with rivers	
Zone 5	Downstream zone	To enhance self-purifying capacity	

Source: Bagmati Action Plan (2009-2014)

Currently BAP is implementing various activities such as improvement of the river course through community participation, procurement of land for the creation of green belt on both sides of river, construction of sewer line, operation of WWTP, and conservation of cultural heritage sites. The budget provided by the government for the implementation of BAP is insufficient and funding opportunities are being discussed with donor agencies.

After an introductory presentation of BAP, Mr. Devkota showed WWTP, located just behind the HPC-IDBC office. The WWTP was designed in 1996 and it came into operation in 2001. The WWTP design is based on extended aeration type consisting of deep oxidation ditch of carrousel type. The major units and operational components of WWTP can be seen in the following table:

Units	Operation	
1) Primary unit	Mechanical bar screening, Sump well, Mechanical grit chamber	
2) Biological unit [2 units oxidation ditch (80m×20m)]	Capacity: 10400 m ³ ; Total oxidation demand: 355kg/hr; MLSS: 3500mg/l; Total power required: 375 KWh	
3) Secondary Clarifier [2 units of 27 m diameter]	Capacity: 1650 m ³ each	
4) Sludge treatment	2 drying beds of 27m×74m; drying period: 2-3 weeks	

1) Secondary clarifier; 2) Sludge treatment

5) Final effluent and effluent bypass



Final effluent



Effluent bypass canal

The WWTP has a design service area of 537 hectares, population of 198,000 and design wastewater flow of $0.190 \text{ m}^3/\text{s}$. The design parameters of water quality for influent and effluent are 270 mg/l and 25 mg/l for BOD_5 , 1150 mg/l and 250 mg/l for COD; and 216 mg/l and 100 mg/l for SS, respectively. The WWTP also has a water quality laboratory for monitoring performance of different treatment processes. To avoid excess flow of untreated water during the monsoon into the Bagmati River, just in front of holy Pashupatinath Temple, the WWTP effluents are diverted to outside of the temple boundary through a bypass tunnel. The major issues of WWTP management are: WWTP is already running over its design capacity; WWTP usually receives high load of suspended solids which often results into ineffective treatment of wastewater; frequent power cuts stops WWTP operation; and high operation cost. There is a plan to upgrade the capacity of WWTP by constructing an additional operation unit parallel to the current one and also the construction of sewer lines in the upstream areas to divert all wastewater into the WWTP.

II. Summary of the Site Visit on 15th December



The purpose of second day site visit was to gather information about practices of community level water supply and wastewater management practices. First, the team visited the ancient city of Patan to observe traditional water management practices such as a dug well, water sprouts, and water conservation ponds. People in this area used to depend on dug wells and water sprouts to meet their daily water supply needs for hundreds of years. On the other hand the water conservation ponds distributed across this area used to serve as storage of excess rainwater flow, increase aesthetic environment, and also supply water for non-drinking purposes during dry periods. Lack of proper management has resulted into their degradation and loss of their beneficial services to the community. Recently, the conservation ponds have been identified as potential sites for the recharge of depleted groundwater table in the area.

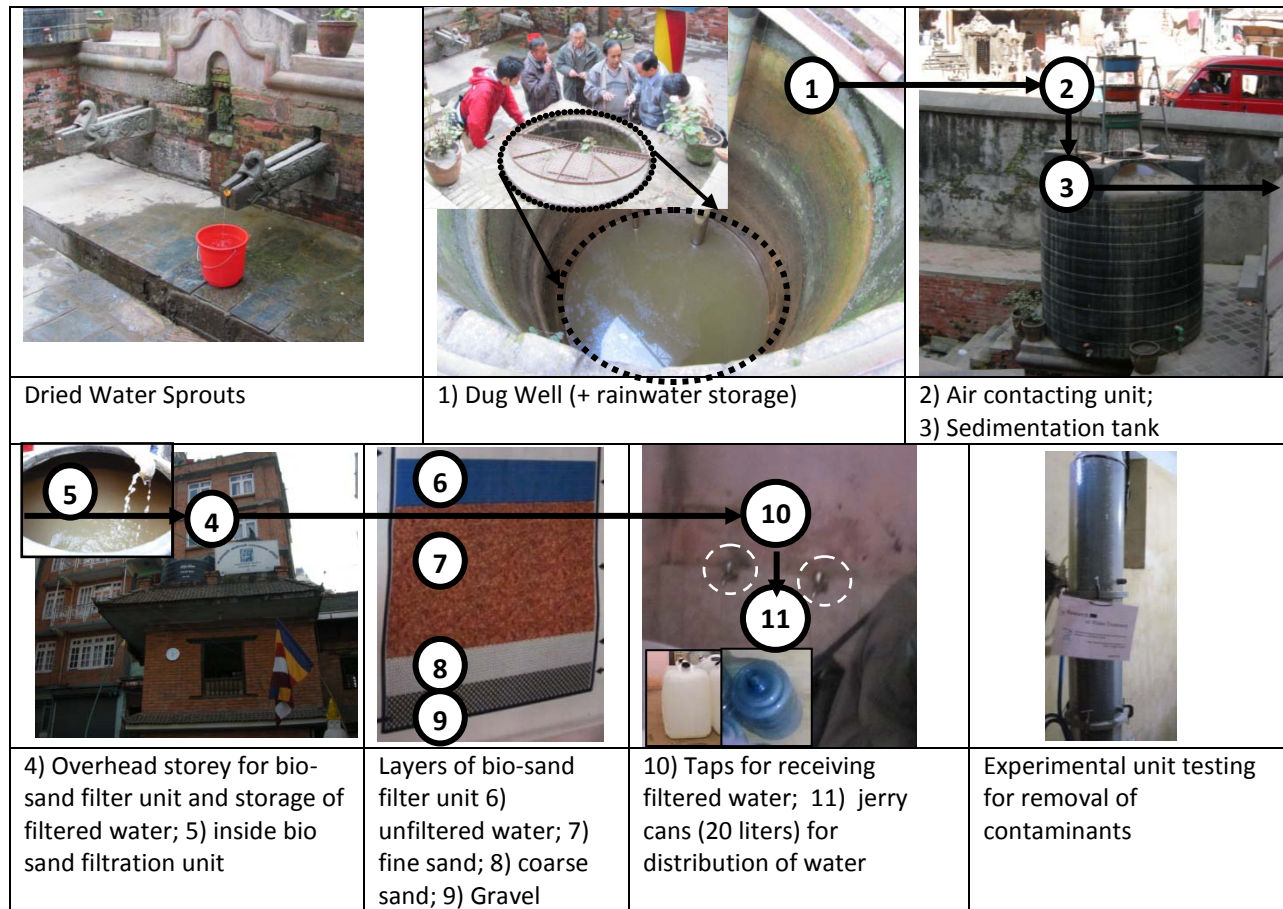


After visiting the Patan area we headed east towards Bhaktapur City, where we observed local scale domestic wastewater treatment plant based on constructed wetland. We concluded our tour at a partially functioning wastewater treatment plant operated by the government.

1) Community Water Supply (Gaj Laxmi Drinking Water Management Committee, Chyasal, Patan)

The surrounding area of this community used to depend on water sprouts for its daily water supply needs for many years. About 7 years ago the water sprout dried up during the dry season of the year and concurrently, the city run water supply was also not sufficient and very irregular. As a result the community faced severe water shortages during the dry season. The Urban Environment Management Society (UEMS), UNHABITAT (an INGO) and ENPHO (a local NGO) approached the community to assess the possibility of constructing a dug well to supplement water supply during the dry season. Later local government provided funds to construct the dug well. After completion of the dug well construction, there was sufficient water but water quality was not good enough for domestic uses, especially as there was high iron content and an odour problem. So the community again approached UEMS, UNHABITAT and ENPHO for the construction of a bio sand filtration system. As a result

UNHABITAT provided the main financial and technical support and other organisations provided technical support. Locals mainly volunteered for necessary labour service and the construction was completed in April 2007, three months prior to the estimated completion time.

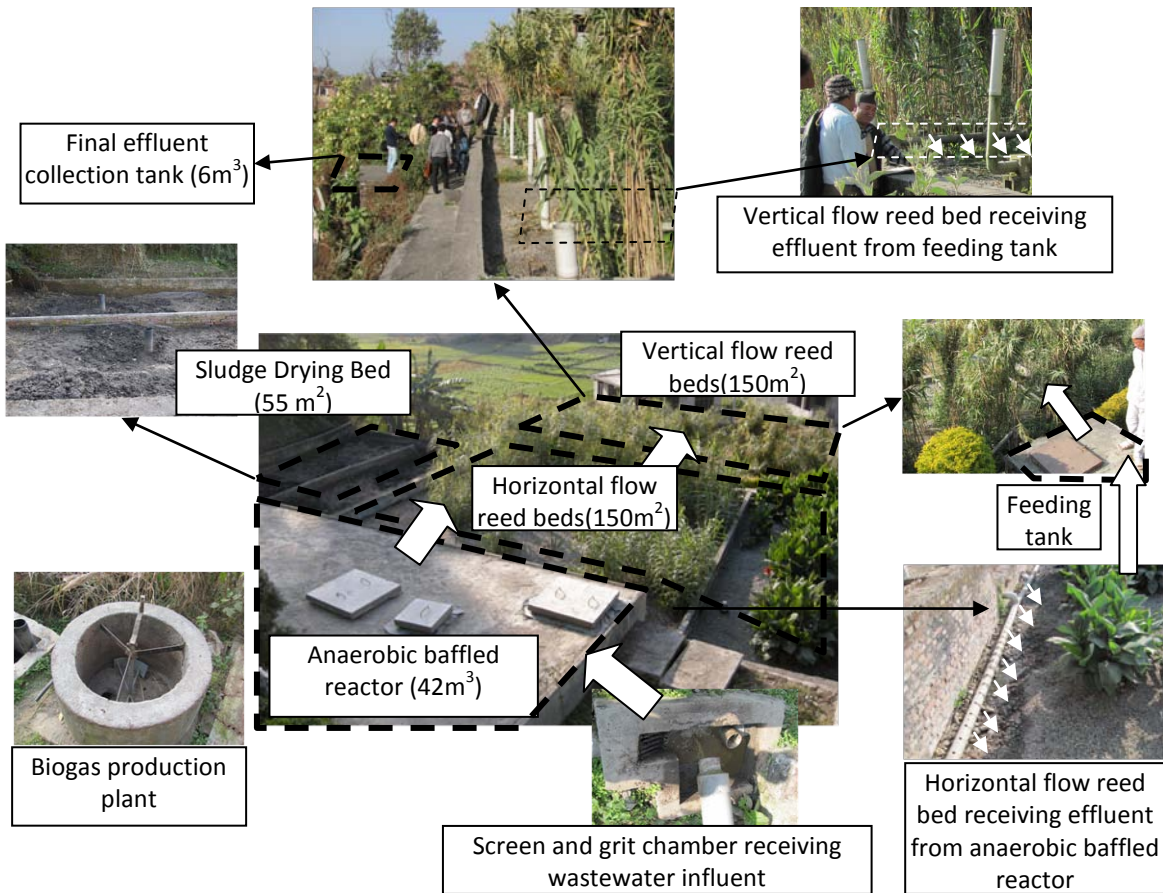


The filtration system consisted of a dug well, which also stores rainwater harvested from roof tops, as a main source of raw water. The raw water is pumped to a sedimentation tank (5000 liters capacity), but before entering the tank, the water has contact with air to remove the odour. Iron particles in the water are then allowed to settle overnight, and after that the water is pumped into the bio-sand filtration unit (3 units with 1000 liters capacity each) which has the capacity to filter 300 liters per hour. Each bio sand filtration unit consists of fine sand, coarse sand and gravel in layers. The filtered water is then stored in a 3000 liters tank, which is distributed through taps by filling 20 liter jerry cans. Before distribution, chlorine is added to the water for disinfection because the water is mainly used for drinking and cooking purposes.

Every jerry can containing 20 liters of filtered water is sold for NRS 3 per can to the local community and NRS 5 per can to people outside of the local community. The system can produce 6000 liters of water per day and serves about 300 households. The demand for water usually goes up during the dry season when other alternative water sources are not sufficient. Income from selling water is used for regular maintenance and providing salaries for the staff. Regular management tasks include cleaning of the sand filter (especially removal of the iron layer on the top once every 3 to 7 days), cleaning of jerry cans, testing of filtered water quality once in a month using test kits, and bookkeeping of daily transactions. The main problems are high iron content that reduces filtration rate to 100 liter/hour and low demand during wet season when alternative water sources are available. During the high demand period, cleaning of the filter is often conducted every day to enhance the filtration rate.

2) Sunga Wastewater Treatment Plant (WWTP), Madhyapur Thimi, Bhaktapur

Sunga WWTP is the first community based WWTP in Nepal that uses constructed wetland for the treatment of wastewater. It was introduced by an organisation called the Environment and Public Health Organization (ENPHO) in October 2005. The constructed wetland is a biological wastewater treatment technology designed to mimic processes found in natural ecosystems where wetland plants and their associated micro-organisms remove pollutants from wastewater. There are about 13 constructed wetland treatment systems at the community level (or individual household level) that have been constructed by ENPHO with the help of other organisations.



The WWTP was designed to provide service to 200 households but currently only 84 households are connected to the WWTP. It can treat 50 m³ of wastewater per day with influent quality of 900 mg/l. It has an anaerobic baffled reactor (ABR) of 42 m³ which is also connected to a biogas production plant. The effluent coming out of ABR is sent to horizontal flow reed bed (HRB) (150 m²) followed by vertical flow reed bed (VRB) (150 m²) for secondary treatment. The final effluent coming out of VRB is sent into a collection tank after which the effluent is sent to the natural environment. The WWTP can remove about 80% of BOD₅ and COD, 90% of TSS, 60% of TP, 75% of ammonia and 99% of faecal coliform. Excess sludge is collected in sludge drying bed (55 m²).

Operation, maintenance and management of the WWTP is completely done by 17 members of the management committee representing local leaders, community based organisations, the community, municipality and local schools. Madhyapur Thimi Municipality initially provided the required land for construction along with financial assistance (NRS 50,000 annually for operation and maintenance of WWTP including remuneration (NRS 3000/month)) and equipment for the caretaker. So far community members are using the services free of charge. ENPHO is mainly providing technical support to the community whenever requested.

3) Sallaghari WWTP, Sallaghari, Bhaktapur

This treatment plant used to receive wastewater from Bhaktapur Urban area. It was constructed in 1983 with GTZ support. Its treatment capacity was 2.0 MLD and it was originally designed as an aerated lagoon system using diffused aeration equipment. The treatment plant is based on simple lagoon systems, where wastewater is treated through natural processes such as sedimentation and biological degradation in a series of large lagoons. The WWTP stopped its full scale operation in 1991 after a problem occurred in its pumping and aeration equipment. Since then the WWTP is partially operating without any aeration. Currently, aquatic plants growing inside the lagoon ponds are harvested by locals to feed their livestock.



Non-functioning
Pump



Lagoon pond for wastewater
treatment



Locals harvesting fodder
from lagoon pond for
livestock feeding