Improving Water Security in Water Stressed Bagmati River Basin, Nepal

- **Rabindra Ray & Ram Kumar Shrestha**
Civil Engineer
Government of Nepal
Ministry of Urban Development
High Powered Committee for Integrated Development of Bagmati Civilization (HPCIDBC)

Abstract

The Bagmati River Basin is the most water stressed basin in Nepal as evident from increasing shortages in available water resources (surface and ground water) to meet the basin water demand at key locations (sub-basins) and time (mainly dry season), degradation of river environment, watershed and wetlands, floods and landslides in middle basin, and flood risks in lower basin (Terai). The Government of Nepal (GON) is working with ADB on the Bagmati River Basin Improvement Project (BRBIP) and Kathmandu Valley Urban Environment Improvement Project (KVUEIP) that intends to overhaul and modernize water management in the Bagmati River Basin and the Project aims to improve water security and resilience to potential climate change impact in the basin.

In the Upper Bagmati, stakeholders have agreed on a common vision of restoring the Holy Bagmati to how it was 30 or 40 years ago. In other words, as a first stage of river environment improvement, the Government hopes to achieve bathing water standards at Pashupati Nath temple.

This Vision will depend on three things, like a table standing on the three legs:

(i) Leg 1 - Treat all domestic waste water before discharging into the rivers
(ii) Leg 2 - Assure adequate flows throughout the year to dilute any pollution discharged in the rivers
(iii) Leg 3 - End all forms of untreated discharges and solid waste dumping into the rivers

Kathmandu Valley Urban Environment Improvement Project (KVUEIP)- will collect and treat domestic waste water to modern standards. BRBIP plans to increase dry season flows by storing monsoon flows in a reservoir to be constructed in the Nagmati River in the Shivpuri Nagarjun National Park (SNP) and releasing it during the dry season months. In addition, river channel improvements and construction of small aeration weirs to improve the water quality in the river. Last but not the least, there is a need for a concerted effort from all stakeholders including government, local bodies/municipalities, civil society, private sector and the general public to put an end to all untreated discharges and solid waste dumping in the rivers.

The Bagmati Action Plan (2009 – 2014) covering the Bagmati River System in the Kathmandu Valley (KV) approved by the Government has set a vision of a clean, green and healthy river system that is full of life and valued by all. The Bagmati River System within Kathmandu Valley (KV) has been categorized into five different zones in the river system of the KV. These zones are: Zone 1: Natural Conservation Zone, Zone 2: Rural

Zone, Zone 3: Peri-urban zone, Zone 4: Urban zone and Zone 5: Downstream zone. The action plan provides an overall vision for restoration and conservation of the Bagmati river system with defined goals, objectives and activities for each zone. The plan has envisaged High Powered Committee for Integrated Development of the Bagmati Civilization (HPCIDBC) as a key coordination and leading agency to implement and monitor the Action Plan.

High Powered Committee for Integrated Development of Bagmati Civilization (HPCIDBC) has hence started different initiatives to improve the river environment in the Upper Bagmati. It is also proposed that HPCIDBC will evolve as the River Basin Organization (RBO) for Bagmati with more legal authority to manage the river basin. This paper addresses the issues, interventions including the institutional strengthening of HPCIDBC under taken by HPCIDBC to improve water security in Bagmati River Basin.

Keywords

Water security, Bagmati River Basin, Bagmati Action Plan, River Basin Organization, HPCIDBC

Introduction

The Bagmati is the principal river of the Bagmati basin in Nepal. The river originates in the Kathmandu Valley, which comprises about 15% of the area of the Bagmati basin in Nepal. The total area of the Basin within Nepalese territory is about 3638km^2.The Bagmati basin is characterized as medium or dry basin fed by springs and monsoon rainfall (WECS, 2008). Based on the morphology and land use, the Bagmati basin can be divided into various sub-basins, viz. Upper Bagmati, Upper Middle Bagmati, Lower Middle (Tarai) Bagmati and the Lower Bagmati (Tarai) sub-basins.

The Bagmati river originates at Baghdwar, about 15 km northeast of Kathmandu in Shivapuri hill and its tributaries originate from different parts of the Valley. This portion of the Bagmati River is part of the Upper Bagmati basin and is a very important part of the basin system. It flows by several important parts of Kathmandu, including the Pashupatinath temple. The river is rain fed type with noted variations in seasonal flows. The average annual rainfall is 1900mm, of which about 80% occurs during monsoon (June-September). Rivers in the Valley also possess rich cultural and heritage values. As Bagmati attaches spiritual and emotional significance to the Nepali people, most of the important temples, shrines, ghats, etc. such as Sundarimai at Sundarijal, Uttar Bahini and Gokarneswor at Gokarna, Guheshwari and Pashupatinath temples at Pashupati, Sankhamul, heritage sites along Thapathali—Teku stretch, and Chobhar Ganesh at Chobhar are situated along the river. Similarly, important ghats (cremation sites) Aryaghat, Chintamanighat, Sankhamulghat, Kalmochanghat, Gokarneswar, Uttar Bahini and Sundarighats are also located along the river bank. Therefore, conservation of rivers is very important for the protection of both natural resources and rich cultural heritage of the Valley.

People see Bagmati as a source of civilization rather than just a river. The main tributary of the Bagmati River system is destroyed by the pollution, the water is black and poisonous, crawling with flies and contaminated with sewage. In absence of proper plans the river environment is under intense degradation for last couple of decades. The degradation thus depicts the degradation of the civilization within the river valley.

The Bagmati River currently faces a number of serious environmental and ecological challenges. Urbanization and industrialization of the river's headwaters at Kathmandu has deteriorated water quality with consequences on the aquatic ecosystem and on the health of the urban dwellers. The pollution in Bagmati River is caused by several factors like throwing of garbage directly, encroachment of river banks, withdrawal of sand and the disposal of untreated wastewater.

The most visible impact of pollution in Bagmati has been on the aesthetic part. River everywhere is considered as jewels of cities that lie on its banks. But the degradation of Bagmati has severely defaced the beauty of Kathmandu. Then, there are socio-cultural and religious aspects that are at risk. All of our activities related to river have been hampered by the pollution; our civilization is linked with Bagmati. The practice of taking holy ablution in the Bagmati River has vanished around the city as people fear the water of Bagmati instead of respecting them. They do not touch water even when performing rituals.

Thirty or Forty years ago people used to swim in the river but now it has turned into a sewer, which is a truth that is hard to accept. Today, people don't even wish to be cremated at the riverside, which used to be so holy. It's a tragedy that surmounts the entire life of Kathmanduites because it's a holy river.

The ongoing new constructions within the watershed have tremendously reduced the recharge rate and caused reduced river discharge during lean flow period. Today, in the dry season all the watercourses look like earthen sewers causing foul nuisance, bad aesthetic view and adverse impact on health of the people and the Environment. Excessive use of the river water from upstream and disposal of increasing amounts of waste have affected to the whole ecosystem of the valley. There is really a lot needed to do before one can take a bath or drink the river water as happened to be the case some 30 or 40 years back.

The following activities have directly or indirectly influenced in polluting the river:

1. Most of the water in the Bagmati is tapped for drinking water supply to meet the demand of an ever increasing population of Kathmandu directly affecting the cleanliness of the river
2. Haphazard establishment of carpet factories along the bank of the Bagmati river
3. Development of new residential zones without sanitation provision.
4. Discharge of the untreated sewage directly into the river
5. Lack of proper rules and regulations for the control of river pollution and non-implementation of existing regulation

6. Lack of coordination between the Municipality, KUKL,HPCIDBC and other related agencies.

Besides these, population growth in the recent past, excessive extraction of sand from the river bed for building work, industrialization as well as lapses on government policies and plans has all contributed to the degradation of the river's ecology.

This shows that the quality of river is not at all different than that of sewage. At present, the river has been used as dumping sites for all types of wastes. It has therefore; become urgent to transform the sewage drains back to rivers recover to their original status. Steps have been taken to control the river pollution and restore the river environment but they are inadequate. As Nepal is one of the poorest countries in the world, the government alone cannot afford to tackle key environmental problems on its own. It will need community involvement and awareness as well as worldwide help to ensure Bagmati to remain sacred. To combat the present situation, many organizations are working in Bagmati with number of good programmes such as clean up campaigns, plantation and awareness programmes etc. However, these initiatives did not produce significant impacts except generating public awareness to some extent.

High Powered Committee for Integrated Development of Bagmati Civilization (HPCIDBC) has started different initiatives to improve the river environment in the Upper Bagmati. Government of Nepal has approved the Bagmati Action Plan (2009 – 2014) covering the Bagmati River System in the Kathmandu Valley (KV) has set a vision of a clean, green and healthy river system that is full of life and valued by all. The Bagmati River System within Kathmandu Valley (KV) has been categorized into five different zones in the river system of the KV. These zones are: Zone 1: Natural Conservation Zone, Zone 2: Rural Zone, Zone 3: Peri-urban zone, Zone 4: Urban zone and Zone 5: Downstream zone. The action plan provides an overall vision for restoration and conservation of the Bagmati river system with defined goals, objectives and activities for each zone. The plan has envisaged HPCIDBC as a key coordination and leading agency to implement and monitor the Action Plan.

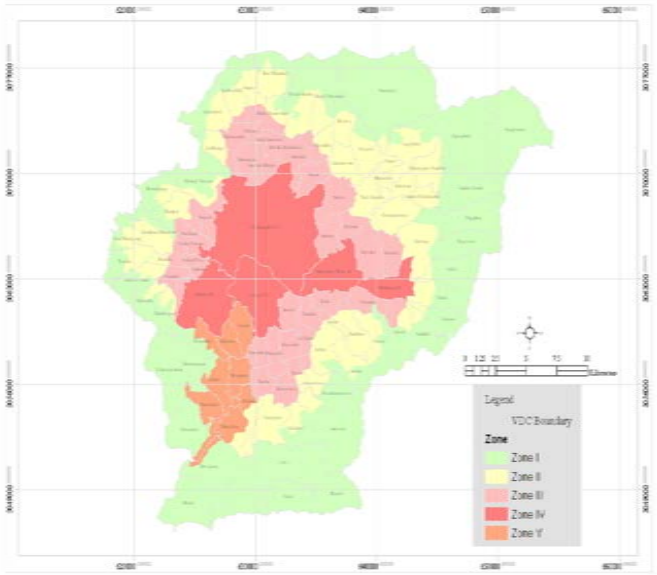

Figure 1 : Zoning Based on Bagmati Action Plan (2009 - 2014)

Bagmati River Basin Improvement Project (BRBIP) funded by ADB aims to focus on three main areas: (i) Improved management of water in the Bagmati river basin following IWRM principles; (ii) Improved flood resilience and irrigation development in

part of the middle basin, and (iii) Significant environmental improvements in one or more headwaters of the Bagmati river in the Kathmandu Valley, including development of new water sources to assure dilution flow during the dry season.

Role of HPCIDBC

HPCIDBC's predecessor, the Bagmati Civilization for Integrated Development Committee (BCIDC), was established in 1995 by the government under the Bagmati Area Sewerage Construction and Rehabilitation Project (BASCRP) with the mandate of cleaning of Bagmati River around Pashupatinath temple, one of the World Heritage sites. The main objective of HPCIDBC is to keep Bagmati River and its tributaries clean by preventing the direct discharge of solid and liquid wastes to the river and to conserve the river system within the Kathmandu Valley. Its current jurisdiction is within the Kathmandu Valley and its mandate is: (i) policy formulation and planning for restoration of the river system in Kathmandu Valley, (ii) construction of infrastructure (sewer system, service road, green belt, etc.) to protect and restore the Bagmati River System and its environment, (iii) defining the river alignment and width of flow regime, and (iv) monitor and regulate the activities along the river sides.

HPCIDBC has constructed wastewater interceptors along both sides of the Bagmati River upstream of Guheshwori WWTP to divert waste water and treat it at Guheshwori WWTP developed and operated by HPCIDBC. To date, HPCIDBC has constructed interceptors from Gokarna to Guheshwori and is now extending the interceptors downstream of Pashnupatinath from Tilganga to Shankhamul. HPCIDBC is also undertaking protection of recharge area,river training, greenbelt, service road and check dam construction works.Some pictures of work progress are as follows:

Conservation of Dhap Area, Origin of Bagmati River (Zone 1)



River Bank Protection @ Sundarijal-Gokarna *(Zone 2)*


Construction of Infrastructure @ Gokarna – Guheswori (Zone 3)



Waste Water Treatment Plant at Guheshwari


Bagmati River Basin Management and Future Role of HPCIDBC

BRBIP has envisages the following interventions to ensure a participatory and integrated Bagmati river basin management to address the issues facing the basin.

(i) legal and institutional strengthening for IWRM;

(ii) support for formation of an River Basin Organization (RBO);
(iii) capacity building and technical training for raising the RBO's competence;
(iv) legal support for allocating water from the Shivapuri reservoirs;
(v) preparation of an Integrated River Basin Development and Management Plan (IRBDMP);
(vi) establishment of a Central Water Resources Information and Modelling Decision Support System (DSS) including an operational water quality monitoring network, flood forecasting and early warning system;
(vii) preparation of design guidelines for land development (land-pooling) that introduces sustainable international best practices for stormwater, wastewater and solid waste management to supplement individual water supplies and protect both the groundwater reservoir and downstream river environment, including legal and institutional strengthening and capacity development to support implementation of the guidelines.

Under the structure envisaged, HPCIDBC will play a leading role as the Secretariat for the RBO. This is wholly compatible with HPCIDBC's current role as implementation agency for the Bagmati Action Plan and the many other works identified as required to achieve an improvement in the river environment in the Kathmandu valley. The only new issue to be addressed is that HPCIDBC must broaden its perspective – to encompass the whole Bagmati river basin in the role of Secretariat, and consequently reserve a proportion of its resources and expertise to deal with the other sub-basins of the Bagmati river.

Proposed Interventions in Upper Bagmati

In the Upper Bagmati, stakeholders have agreed on a common vision of restoring the Holy Bagmati to how it was 30 or 40 years ago. In other words, as a first stage of river environment improvement, the Government hopes to achieve bathing water standards at Pashupati Nath temple.
This Vision will depend on three things, like a table standing on the three legs:

(iv) Leg 1 - Treat all domestic waste water before discharging into the rivers
(v) Leg 2 - Assure adequate flows throughout the year to dilute any pollution discharged in the rivers
(vi) Leg 3 - End all forms of untreated discharges and solid waste dumping into the rivers

Kathmandu Valley Urban Environment Improvement Project (KVUEIP)- will collect and treat domestic waste water to modern standards. BRBIP plans to increase dry season flows by storing monsoon flows in a reservoir to be constructed in the Nagmati River in the Shivpuri Nagarjun National Park (SNP) and releasing it during the dry season months. In addition, river channel improvements and construction of small aeration weirs to improve the water quality in the river. Last but not the least, there is a need for a concerted effort from all stakeholders including government, local bodies/municipalities, civil society, private sector and the general public to put an end to all untreated discharges and solid waste dumping in the rivers.

The proposed interventions in Upper Bagmati to achieve suitable water quality standard and sufficient water depth for bathing at key temple sites, and an enhanced river environment to improve its amenity and encourage people's interaction and enjoyment of the river and its riparian areas. It includes two sub-projects:

(1) New Reservoir(s) in Shivapuri National Park

This sub-project combines three previously-identified sub-projects into a single component comprising:

(i) Storage dam and reservoir at Nagmati Dhap that would consist of increasing the water retention capacity of the existing Dhap by constructing a small to medium sized dam a short distance downstream;
(ii) Development of a further storage reservoir of larger capacity within the Shivapuri Nagarjun National Park, to assure a base flow in the upper Bagmati River during the dry season1;
(iii) Watershed enhancement activities upstream of the dam site(s) to maximise rainfall-runoff rates and maintain high water quality standards.

(2) Improving the Upper Bagmati River Environment

This sub-project will cover environmental improvements in the Upper Bagmati in the Sundrijal-Gokarna reach (8.2 Km), and in the Gokarna-Sinamangal reach (9.7 Km). Improvements will include:

(i) Establish weirs for river bed stabilization and re-aeration between Gokarna and Sinamangal Bridge;
(ii) Rehabilitation of two former irrigation regulator structures at Gokarna and Pashnupatinath to enable water depth regulation at the temple ghats and improve amenity;
(iii) Establish parks and green zones upstream Guheswori;
(iv) Provide river environment improvement and in-stream low flow regulation and phytoremediation from Tilganga Bridge to Sinamangal Bridge;
(v) Removal and safe disposal of contaminated and accumulated riverbed material at key sites;
(vi) Riverbank stabilisation at Sundarijal where existing structures are under threat of river bank erosion;
(vii) Enhancement and management of the riparian banks which are under government ownership;
(viii) Implementation of a communication strategy for engaging the local community, NGOs, CSOs and private sector to support improving and maintaining the river environment.

[1] Feasibility studies of a small to medium sized dam at Nagmati Dhap and a dam with larger storage capacity downstream at Nagmati River is under preparation by the BRBIP consultants and will be completed by April/May 2013 after the completion of the drilling and other field investigations currently being undertaken.

The sub-project will also include rainwater harvesting and groundwater recharge at household level, promoted in the form of best practice pilots.

Key Issues and Challenges

The critical issues of the Bagmati river and its tributaries are primarily related to water discharge, water quality, aquatic and terrestrial biodiversity, river side land use and preservation of culture and heritage.

River ecosystem and waste water

i. Decrease in water discharge;
ii. Degradation of river water quality due to direct disposal of domestic and industrial waste;
iii. Degradation of catchment quality;
iv. Narrowing and deepening of water way due to heavy extraction of sand; and
v. Depletion of aquatic biodiversity

River side land use and socio-economic conditions

i. Changes in riverside land use; and
ii. Eroding aesthetic values
iii. Encroachment of the land (because of various reasons such as agricultural plot, squatter settlement, solid waste dumping)

Culture and heritage

i. Deteriorating culture and heritage; and
ii. Eroding cultural values and norms

The key water management issues in the Bagmati River Basin are:

1. Rapid expansion of Kathmandu Valley resulting shortage of limited water resources and deterioration of river environment
2. Lack of sound water resources management and mitigation of water-induced disasters in the middle and lower basin
3. Lack of governance in all matters concerning water both at the government and civil society in the whole basin

Opportunities –

1. Integrated Water Resource Management
2. Waste water Treatment Plant construction
3. Construction of Intercepting Sewer, Green Belt, River training works
4. Bagmati Environment Improvement Plan
5. River Basin Organization

Recommendations/Findings/Options/Questions –

1. First of all there must be set standards and checks and controls on the disposal of raw sewage directly into the river.
2. All the domestic waste water has to be treated up to acceptable quality before discharging into the rivers. For this intercepting sewer has to be laid along both bank of river and its tributaries and waste water plant of adequate capacity and appropriate technology has to be constructed.
3. Adequate flows have to be assured in the river throughout the year to dilute any pollution discharged in the rivers. For this dam has to be constructed at upper Dhap, Sundarijal, Nagmati and Mahadev Khola .
4. There is a need for a concerted effort from all stakeholders including government, local bodies/municipalities, civil society, private sector and the general public to put an end to all untreated discharges and solid waste dumping in the rivers.
5. Government has to solve the problem of the squatters who are living along the bank of the rivers of the valley
6. Strict implementation of “Polluters Pay” principle.
7. HPCIDBC will be evolve as the River Basin Organization (RBO) for Bagmati with more legal authority to manage the river basin.
8. 0nce the sewage from the rivers of Kathmandu valley is separated, a major battle in the war to clean up the river will have been won.

Conclusions

The proposed institutional strengthening of HPCIDBC and establishment of a River Basin Organization (RBO) for Bagmati River Basin will be a paradigm shift on water resources management in Nepal in line with the Water Resources Strategy (2002) and National Water Plan (2005). HPCIDBC will also be implementing the proposed interventions in Upper Bagmati which will restore the Holy Bagmati River to meet its cultural and environmental needs of the Valley. The lessons and experience from these interventions can be useful to improve water security in other river basins of Nepal.

References

1. *'Bagmati Action Plan* 2009-2014' Kathmandu, Nepal
2. NAST. 2008.
3. *'DHI et al. 2012. Bagmati River Basin Improvement Project (BRBIP) Interim Report'* Kathmandu.
4. *'JWA. 2012. Study Reports of Supporting Investment in Water Security in River Basins' ADB* TA 7547 Reg.
5. *'WECS. 2002. Water Resources Strategy for Nepal'* Water and Energy Commission Secretariat. Katmandu.
6. *'WECS. 2005. National Water Plan for Nepal'* Water and Energy Commission Secretariat. Katmandu.