BANGLADESH UNIVERSITY OF ENGINEERING AND TECHNOLOGY, DHAKA
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Application for the approval of M. Sc. (Water Resources Development) Thesis proposal

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6. Date of First Enrolment in the Programme: November 17, 2007

7. Tentative Title: **DEVELOPING WATER MANAGEMENT SCENARIOS FOR KHULNA DISTRICT DUE TO CLIMATE CHANGE**

8. Background and present state of the problem:

Bangladesh has been identified as one amongst 27 countries that are the most vulnerable to the impacts of global warming induced accelerated sea level rise (Islam, 2004). According to IPCC in their recently published Fourth Assessment report, significant changes have been observed in climate trends, variability and extreme events. The annual mean rainfall exhibits increasing trends in Bangladesh and decadal rain anomalies are above long term averages since 1960s. Water shortages has been attributed to rapid urbanization and industrialization, population growth and inefficient water use, which are aggravated by changing climate and its adverse impacts on demand, supply and water quality. Moreover, Salt water from the Bay of Bengal is reported to have penetrated 100 km or more inland along tributary channels during the dry season (DOE, 2007). Climate change induced sea level rise may aggravate the potential risks to coastal zones. IWM (2007) reported that about 13% more area i.e. 469,000 ha will be inundated in monsoon due to 62 cm sea level rise for high emission scenario A2 in addition to the inundated area in base condition. Due to increased rainfall in addition to 62 cm sea level rise, the inundated area will be increased and about 16% i.e. 551,500 ha more area will be inundated in the year 2080. On the contrary, in the dry season due to 62cm sea level rise about 364,200 ha (10%) more area will be inundated for A2 scenario in the year 2080 (IWM, 2007). Over the next 25 years, however, with the increase in the absolute size of the population the per capita water availability in Bangladesh will progressively be reduced (Ahmad et al., 2001). Under general climate variability, the annual per capita water availability in 2025 will become 7,670 cubic meters as against 12,162 cubic meters in 1991 (Ahmed, 2006). Keeping in view the poor water availability in the dry season, the per capita available supply will be much less, while demand for irrigation, industrial process water, domestic and municipal water supply will continue to rise.

Khulna district is one of the most vulnerable areas among 19 coastal districts (ICZMP, 2003). The characteristics of this district like, high population growth, high potential to be inundated due to sea-level rise, increasing water demand for agriculture etc. pretend itself as a suitable site for assessing the ability

of the GBM basin's water supply to satisfy potential fresh water demands in competition with salinity. It is crucial to plan for the future and making wise decisions. Therefore it is essential to know how the water should be evaluated and planned for future considering IWRM (Integrated Water Resources Management) approach with the continuously changing water use and demand pattern. This study wish to develop water management scenarios due to climate change induced sea level rise in Khulna district.

9. Objectives with specific aims and possible outcome:

The objectives of this research are-

i. To develop some future climate scenarios for the years 2020, 2030 and 2050 considering the inflows, outflows, demographic change etc. for future water use on the water resources of Khulna district.
ii. To determine the total water demand and surplus or shortage of water of the study area and developing water management decision support system.

This study will help to understand the effect of climate change on the water availability of the coastal districts of Bangladesh. Moreover, it will help for the planners and policy makers to develop efficient strategies of water management for the coast districts of Bangladesh.

10. Outline of Methodology/Experimental Design:

Water management scenarios will be assessed using a water evaluation and planning (WEAP) software. WEAP is widely used to integrate physical hydrologic processes with the management of demands and installed infrastructure in a seamless and coherent manner. WEAP allows for multiple scenario analysis, including alternative climate scenarios and changing anthropogenic stressors, such as land use variations, changes in municipal and industrial demands, alternative operating rules, points of diversion changes, etc (Sieber et al., 2004). Rahman (2009) has successfully used WEAP model for the simulation of water resources management scenarios in Dinajpur Sadar Upazilla in the northwest region of Bangladesh where irrigation is a critical issue. WEAP framework can be applied under future climate change scenarios to investigate how the hydrology could impact associated ecosystem services (Purkey et al., 2007). Future scenarios can be generated comprising the future changes on the basis of demographic projection, technological developments, salt water intrusion and sea level rise due to climate change.

Future water demand considering agriculture, urban and industrial requirements will be estimated based of population projections. Water supply considering total future precipitation over GBM basin can be calculated by using data from PRECIS regional climate change model. Since over nine-tenths of the surface flow is received from outside Bangladesh, the rise and fall of the water level in rivers is governed predominantly by the amount of rainfall beyond (upstream) the country's political boundaries (Ahmad et al., 1994). So a basin-wide predicted precipitation is essential. The net basin inflow of water, river water availability, groundwater storage and agricultural return flow along with precipitation over Bangladesh will be calculated as water supply. Salinity and sea water level will be projected based on the data of global and regional climate change model for year 2020, 2030 and 2050.

Groundwater level, river water level and river flow data of the rivers surrounding Khulna district will be collected from the Bangladesh Water Development Board (BWDB) for last ten years (1995-2008). Population data will be collected from the annual reports of Bangladesh Bureau of Statistics. Agriculture and landuse data will be collected from Bangladesh Agriculture Research Council and Bangladesh Survey of Bangladesh respectively. Season wise cropped area will be gathered from Department of Agricultural Extension office. The existing salinity level data will be collected from available maps and reports developed by Institute of Water Model (IWM). Field survey will be conducted to determine water demand per day per person of the study area.

11. References

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