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Urban geology of BarishalDistrict: Environmental and geological constraints

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Abstract:*Urban geology is the application of the earth sciences to problems arising at the nexus of the geosphere, hydrosphere and biosphere within urban and urbanizing areas. In this way, it goes beyond the application of geology in civil engineering (commonly called "Engineering Geology"). The aim of this study is to provide a good view of urban geology of Barishaldistrict that lies on the banks of the Kirtankhola River in south-central Bangladesh.The topics of discussions about Barishal urban geology are included geologic (geomorphology, geology, climatology and hydrogeology), engineering geological (earthquake, river erosion and geotechnical hazards investigations) and environmental characteristics (air, soil and water hazards assessment).*
Keywords:*Barishal; engineering geology,urban geology*

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I. INTRODUCTION

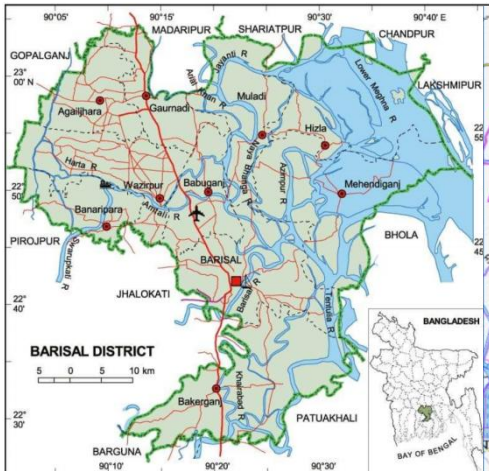
Urban geology is the application of geologic knowledge to the planning and management of metropolitan areas. Most aspects of engineering geology are applied in the urban setting, soil and groundwater for the purposes of planning and design of engineering structures.Several years of professional experiences and studies in the urban geology has been published by the Association of Engineering Geologists (AEG 1982-2004). Standard elements of urban geological considerations for cities by AEG recommendation is classified in 13 parts (SAIEG 1997). This procedure is generally classified into 4 major categories:

-The urbanism and historical backgrounds.
-The geological setting.
-Engineering geological constraints.
-Environmental constraints.

There categories are used in the present study for urban geology investigation of Barishal district. The urban area of Barishal is about 58 sq.km (22 sq. mi). The study area of Barishal City is bounded by the longitude of 22°48′0″ North and latitude of 90°30′0″ East. The study area is given in Fig-1.

II. GEOLOGIC SETTING

2.1 Geomorphology: Barishal is a district in south-central Bangladesh, formerly called Bakerganj district lies on the banks of the Kirtankhola River at coordinate of 22°48′0″N 90°30′0″E. In ancient times, it was called Chandrodip. Though the climate of Barishal is mainly sub-tropical monsoon, i.e. warm and humid; Bangla calendar year is traditionally divided into six seasons: Summer, Rainy,Autumn, Late autumn, Winter and Spring. Each season comprises two months, but some seasons flow into other seasons, while others are short. Actually, it has three distinct seasons: the pre-monsoon hot season from March through May, rainy monsoon season which lasts from June through October, and a cool dry winter season from November through February. However, March may also be considered as the spring season, and the period from mid-October through mid-November may be called the autumn.Barishal topographic map shown in Fig-2.



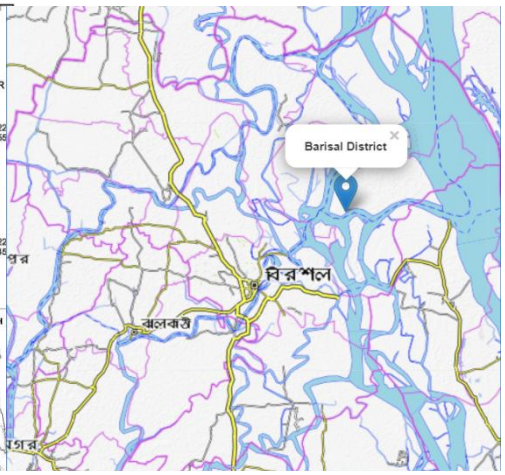


Fig-1: Study areaFig-2:Barishal topographic map

2.2 GEOLOGY

Barishaldistrict has been built on the plane surface area of stream deposits, delta plain deposits and flood plain deposits. The district is covered with alluvial sediments. The northern part of the city is limited to Dhaka Division and its southern part is limited to the Bay of Bengal.

2.3 CLIMATOLOGY

Barishal lies on 10m above sea level Barishal has a tropical climate. In winter, there is much less rainfall in Barishal than in summer. In Barishal, the average annual temperature is 25.9 °C | 78.7 °F. The annual rainfall is 2184 mm | 86.0 inch. The driest month is January, with 10 mm | 0.4 inch of rainfall. With an average of 444 mm | 17.5 inch, the most precipitation falls in July. The warmest month of the year is May, with an average temperature of 30.3 °C | 86.5 °F. January has the lowest average temperature of the year. It is 19.2 °C | 66.6 °F. The difference in precipitation between the driest month and the wettest month is 434 mm | 17 inch. During the year, the average temperatures vary by 11.1 °C | 52.0 °F.The average temperature and rainfall chart are given in Fig-3 and Fig-4.[3]

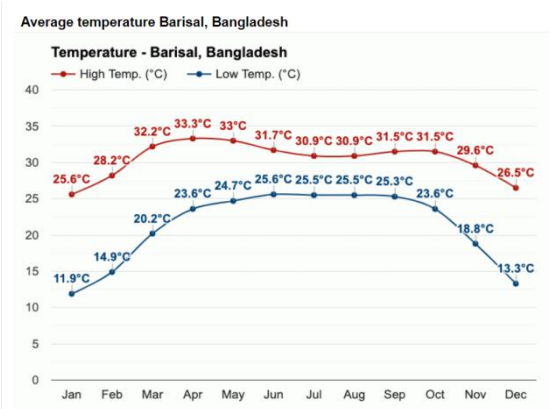


Fig-3: Average temperature

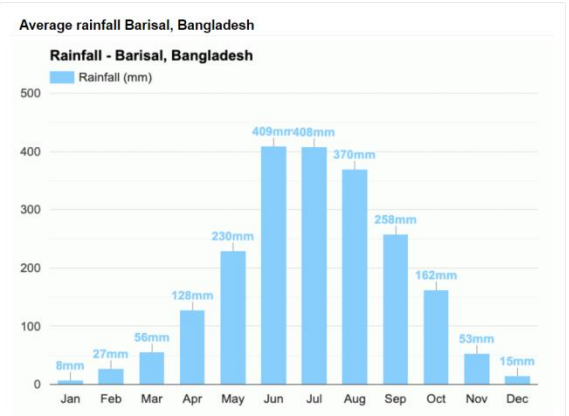


Fig-4: Average Rainfall

2.4 HYDROGEOLOGY

The groundwater quality of the study area is controlled by various physio-chemical parameters and sea water intrusion. Groundwater quality is mainly controlled by mixing of the surface water which is basically saline and ion exchange reactions. The Mg^{2+} and Ca^{2+} are derived mainly from dissolution of carbonate precipitates along with ion exchange process in the groundwater. Dominant water type in wet season was Na-ClHCO^{3-} , Na-Cl and Mg-Cl while distinguished type of water was identified in different depth. Copiousness of the major ions has followed this order: Na^{+}>Mg^{2+}> Ca^{2+}>K^{+}>Cl^{-}> HCO_3^{2-}> SO_4^{2-}> NO^{3-}>PO_4^{2-} . Vertical distribution of Arsenic (As) shows significant trend in which shallower wells have higher content than the deeper one. A thick layer of silty clay has segregated the upper aquifer from lower aquifer. Chemistry of the brackish water collected from shallower piezometers suggests that it's vulnerable to neither drink nor irrigation. Meanwhile, extraction from the greater depth would be a good option for daily use as its proven slightly injurious by means

of Cl^- / (CO_3^{2-} + HCO_3^-) ratio.Hydro chemical water types is presented a trilinear diagram called piper diagram shown in Fig-5.[2]

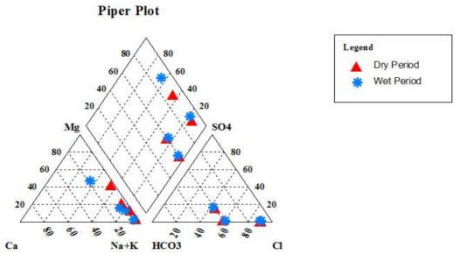


Fig-5: Piper diagram

III. ENGINEERING GEOLOGICAL CONSTRAINTS

3.1 EARTHQUAKE HAZARDS

Bangladesh is facing a high risk of moderate to strong earthquakes. It is positioned at the juncture of several active tectonic plate boundaries.Now we are discussing about the earthquakes those generated in study area Barishal between 22 48'0"N to 90 30'0"E. If a massive earthquake with 7 or greater magnitude occurred in this country will led a major human tragedy due to the faulty structures of many buildings and proper awareness. But our study area Barishal is situated in Zone-3, compromising the southwestern part of Bangladesh is seismically quiet, with an estimated basic seismic co-efficient of 0.04 (Banglapedia,2015).Barishal is located a very low risk area seismic zoning of Bangladesh. And the possible magnitude of zone-3(Bangladesh map) is 6 of Richter scale where Barishaldistrict magnitude was shown 5.1 in 1989.[11]

3.2RIVER EROSION

River erosion at Kawyar Char, Lamchari and Charbariya point of the Kirtankholariver is threatening Barishaldistrict area day by day. The erosion situation has turned for worse in at least 26 points on the banks of the rivers Kirtankhola, Meghna, Arial Kha, Sandhya, Sugandha, Tentulia, and Karkana under Barishal district.Newly- constructed AbdurRabSerniabat bridge on the Kirtankholariver at zero point of the city is also under threat of the river erosion.Different establishments like roads, croplands, residential houses, educational and religious institutions, shops and markets and ferry stations are eroding away every day.Rapidly advancing Kirtankhola River erosion endangered surface water treatment plant, ferry ghat, ice factory, shipyard at Beltala, Singherkathi, Taltali-Lamchhari road under Charbaria union, and ferry ghat area under Charkawa union on the outskirt of the city. Erosion by the Sugandha River created cracks on the approach road of the Barishal-Dhaka highway near Birshrestha Captain Mohiuddin Jahangir Bridge to Mohishadi area and washed away vast areas of Manikkathi,Rakudia and others parts under Babuganjupazila. The flood erosion of kirthankholariver shown in Fig-6.[10]

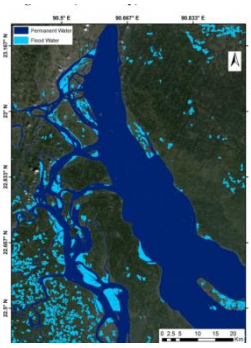


Fig-6: Kirthankhola erosionFig-7: Flood mapof Barishal

3.3FLOOD

Flood is usually a result of natural causes. It may also be caused by man-made factors. It causes huge damage to life and property. There are many different causes leading to flooding in Barishal. The main reason is Massive Rainfall. The wettest month (with the highest rainfall) is June (409mm). The driest month (with the lowest rainfall) is January (8mm).Barishal is situated beside the kirtankholariver. As a result with this high average rainfall Barishal is easily flooded.The number of deaths due to flood related causes however was very high according to health emergency control room. Flood Inundation from Cyclone Roanu in Barishal (2016 May) map given in Fig-7 and rain flood in Fig-8 and Fig-9


Fig-8: Flood in BarishalFig-9: Rain floods in Barishal

IV. ENVIRONMENTAL CONSTRAINTS

4.1 SOIL POLLUTION

Rapid urbanization and population growth is the main reasons for increasing the soil pollution inBarishaldistrict.Some aspects of soil pollution in regards to the waste are as follows; (a)Landfill and illegal dumping (b) Buried waste (c)Agricultural practices, such as application of pesticides,herbicides and fertilizers (d)Drainage of contaminated surface water into the soil (e)Dumping of polythene on earth leads to the soil degradation(f)Blocked the cities drainage and sewerage system.It causes bladder, lung, blood cancer or leukemia who are working in dumping and landfilling and it is also harmfulfor children. Gases are produced in the landfills through aerobic and anaerobic decomposition of organic components which are threat to the environment.


Fig-10: Soil pollutionFig-11: Water pollution

4.2WATER CONTAMINATION

(a)Surface Water Contamination: The dust and the air pollutants from industry contribute to water pollution.Surface water available to us in the forms of rivers, lakes and ponds etc. These waters become polluted when rainwater runoff carries pollutants into the water. One of the biggest risks to humans from surface water pollution are pathogens that cause types of waterborne diseases. Increasing water diseases of people living nearby to the Kirtankhola River because of the use of water for civil purposes.

(b)Ground Water Contamination: Ground water that is available the deeper layers of earth and safe to use as well as drink. Groundwater maybe near the Earth's surface or deep as 30,000 feet,according to the U.S.Geological Survey (USGS). Groundwater sources can become contaminated with germs such as arsenic,mineral substances,bacteria,chemicals etc. These water can make people sick.However, water can be polluted in many ways- (a) Agricultural pollution ,(b) Sewage or waste water, (c) Oil pollution, d) Radioactive substances,(e) River dumping,(f) Marine dumping. The water pollution is given in Fig-11.

4.3 AIR POLLUTION

Air pollution is the major environmental problem occurring due to waste dumping in an open place. The study some vital points in aspect of air pollution caused by unsatisfactory solid waste dumping in the study area as follows : (a) air pollution creates due to burning of waste in an open space is a common scenario for this city and produces smoke releases toxic components and ashes into the air which is threat to the environment and for human health, (b)industrial activity emit several pollution in the air that effect the air quality more then we can even imagine particulate matter 2.5 and 10 nitrogen dioxide ,sulfur dioxide ,and carbon monoxide (c)responsible for climate change including greenhouse gas (GHG), methane(CH_4). One organization named

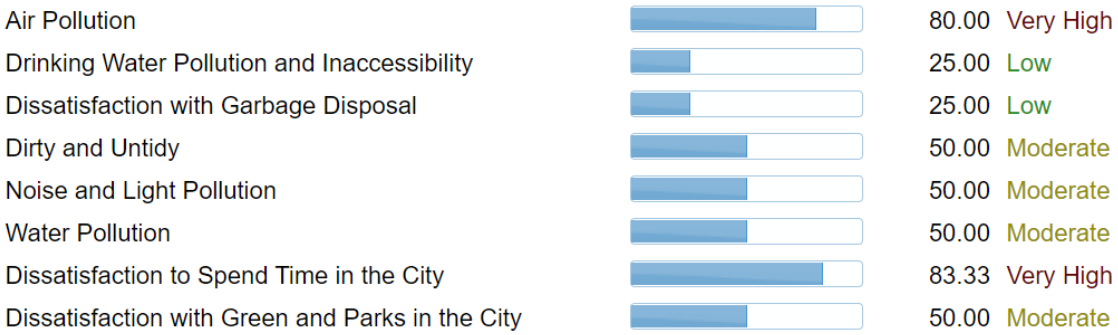
"Prodipon" are working for solid waste collection. The greenhouse gas emission potential of solid waste in Barishalcity is depicted in the bellow Table-1.

Table 1: GHG emission potential of solid waste(Source: Enayetullah I,2006)

City	TWG*(ton/day)	GHG emission potential, Million ton CO_2 e/year
Barishal	134.38	0.02

TWG*-Total waste generation

4.4 IN A NUTSHELL THE TOTAL POLLUTION: The total of Barishal District is given below



V. CONCLUSIONS

Based on the obtained results, Barishal district in terms of environmental status is wholesome, though the main city is being polluted day by day. The contamination of air,soil and water is medium.But it is higher than the average health recommendation by international standards.Geologically Barishal district has a high potential of flood,river erosion and natural calamities.

REFERENCES

[1]. Mohammad Azarafza, Akbar Ghazifard(2016). Urban geology of Tabriz city:Environmental and geological constraints.Advances in Environmental Research, Vol. 5, No. 2 (2016) 95-108.DOI: http://dx.doi.org/10.12989/aer.2016.5.2.095.
[2]. SukhenGoswami , A. K. M. Moshiur Rahman, M. I. M. Fuad, DhimanKumer Roy and Abdur Rahim(2017).Groundwater Quality Assessment of Barisal City Corporation in Bangladesh.Barisal University Journal Part 1, 4(2):339-350 (2017).ISSN 2411-247X.
[3]. Weather Atlas.Monthly weather forecast and climate Barisal Bangladesh.site:https://www.weather-atlas.com/en/bangladesh/barisal-climate.
[4]. Md. Shafiqul Islam, Tania Yeasmin , Md. Hamidul Islam and Md. Mir Al-Amin(2015).Assessing the Environmental Effects of Solid Waste in Barisal City of Bangladesh.ISBN: 978-984-33-8695-3, PI.63 (1-10).
[5]. MAPNALL. Topographic Map of Barisal. site:http://www.mapnall.com/en/map/OpenTopoMap/Map-Barisal-District_1106562.html
[6]. Reliefweb. Flood Inundation from Cyclone Roanu in Barisal, Bangladesh (May 2016).site:https://reliefweb.int/map/bangladesh/flood-inundation-cyclone-roanu-barisal-bangladesh-may-2016
[7]. NUMBEO.Pollution in Barisal, Bangladesh. site:https://www.numbeo.com/pollution/in/Barisal
[8]. S. K. Garg (2003). Physical and Engineering Geology. Khanna Publishers, India.
[9]. "Little rain submerges the city road" (Published: 08:07 PM, 27 May 2020), Daily Bangladesh. site:https://www.daily-bangladesh.com/english/Little-rain-submerges-the-city-road/43534
[10]. "River erosion turns severe in Barisal city" (Published:4 July, 2015 00:00 00 AM), The Independent. site: http://www.theindependentbd.com/printversion/details/6344
[11]. Ahmed Hossain, FarhanaKabir and Keya Roy(2016).Correlation between Temperature Change and Earthquake in Bangladesh.3rd International Conference on Advances in Civil Engineering 2016 (ICACE 2016). Paper ID: 123

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