Spatial Planning, Land Use and Urban Water Management for Adaptive Delta Management

Bangladesh Delta Plan (BDP) 2100

General Economics Division
Bangladesh Planning Commission
Ministry of Planning
Government of the People's Republic of Bangladesh

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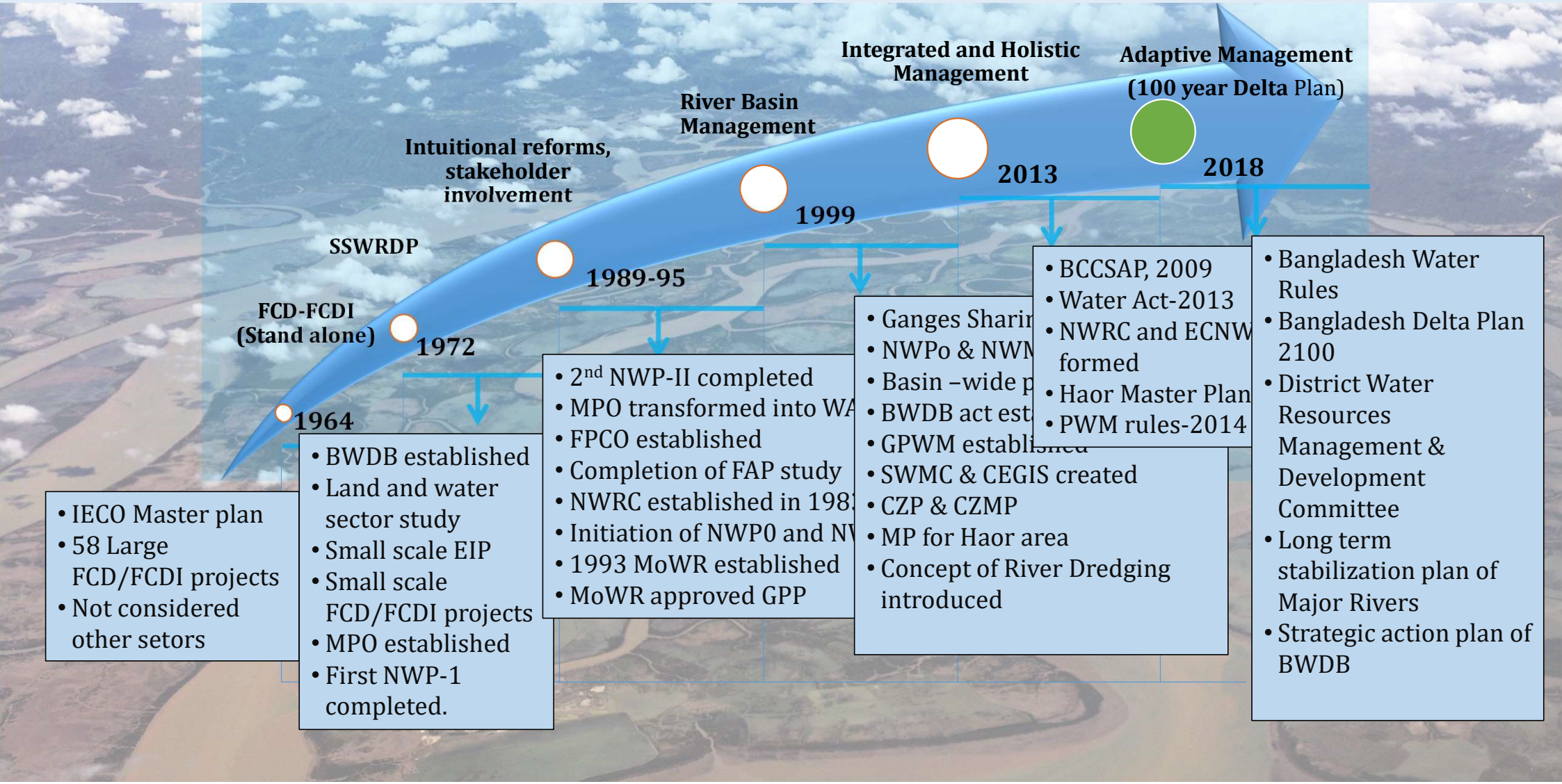
BDP2100: Adaptive Delta Management

- A paradigm change in national planning of Bangladesh;
- For long term solution, delta management for Bangladesh has been divided into two dimensions:
  - National (Long Term Strategic Plan)
  - Regional (Regional Plans and Programmes)
- At each level, there are different stakeholders with different objectives and actions, and
- At each region there diverse needs and demands competing with limited water, energy and land resources;
- An appropriate planning structure and governance come first to address the Delta management.

In Bangladesh, focus is "to ensure **socio-economic development** under uncertain changing conditions regarding **climate** and water resources, landuse development."

As per the Bangladesh's 2nd Perspective Plan 2040-2041, the extreme **poverty rate** in the country is expected to reduce to **2.5% in 2031** from 9.4% in 2020 (base year), to **0.68% in 2041**. The government set target to attain **9% GDP growth by 2031** and expect to grow at **9.9% in 2041**.

Paradigm Shift in the Development of WRM



Need for a Delta Plan

A number of **sectoral initiatives and plans** for water and agricultural development sectors have been adopted in Bangladesh since 1960. The sectoral plans tend to be short term oriented and independently pursued by the formulating ministries or departments.

National-level **strategic plans** such as the Five-Year Plans and Perspective Plan have been formulated by the Government.

More recently, the **SDG with 17 goals and 169 targets** are new global agenda and Bangladesh is highly committed to meeting these goals.

The challenge lies in **integrating these sectoral, national and global targets** and plans into long term coherent strategies taking climate change and future demands into account, as well as in effective implementation of the needed interventions in a well-coordinated manner.

BDP 2100 has adopted an **integrated and holistic delta management approach** to formulate the projects to translate its vision, goals and strategies for implementation over a period till 2100.

BDP 2100 Baseline Studies.. (contn.)

BDP conducted baseline studies in 26 major areas:

Vol 1 Water Resources Management

BL Study 1: Sixty Years of WRD in Bangladesh: Lessons Learnt
BL Study 2: River System Management
BL Study 3: Water Resources
BL Study 4: Groundwater
BL Study 5: Coast and Polder Issues
BL Study 6: Water Supply and Sanitation
BL Study 7: Part A- Sediment Management; Part B- Meghna Estuary Study

Vol 2 Disaster and Environmental Management

BL Study 8: Climate Change
BL Study 9: Disaster Management
BL Study 10: Environmental Pollution
BL Study 11: Ecological Setting

Vol 3 Land Use and Infrastructure Development

BL Study 12: Land Resources Management
BL Study 13: Urbanization and Settlement
BL Study 14: Sustainable Transportation and Infrastructure

Vol 4 Agriculture Food Security and Nutrition

BL Study 15: Agriculture and Food Security
BL Study 16: Fisheries
BL Study 17: Livestock
BL Study 18: Forest and Biodiversity

Vol 5 Socio-Economic Aspects of the Bangladesh Delta

BL Study 19: Population Growth and Management
BL Study 20: Socio-Economic and Demographic Condition
BL Study 21: Socio-Economic Characteristics of Chittagong Hill Tracts

Vol 6 Governance and Institutional Development

BL Study 22: Institutional Framework and Arrangements
BL Study 23 : Information and Knowledge Management
BL Study 24 : Regional Cooperation
BL Study 25 : Finance Mechanisms & Arrangements in the Water Sector
BL Study 26 : Private Sector Engagement in Deltas

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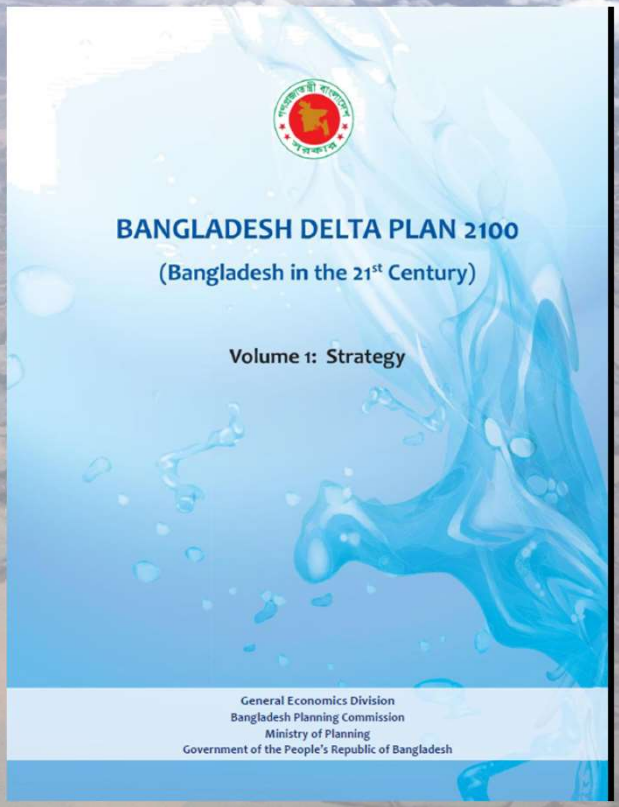
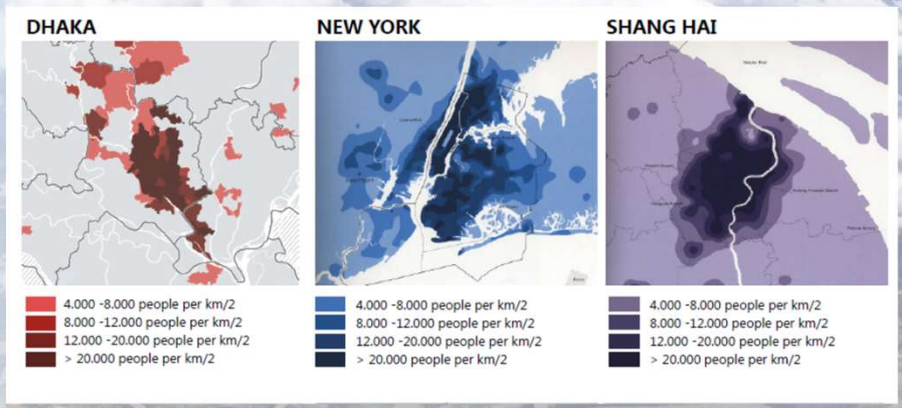
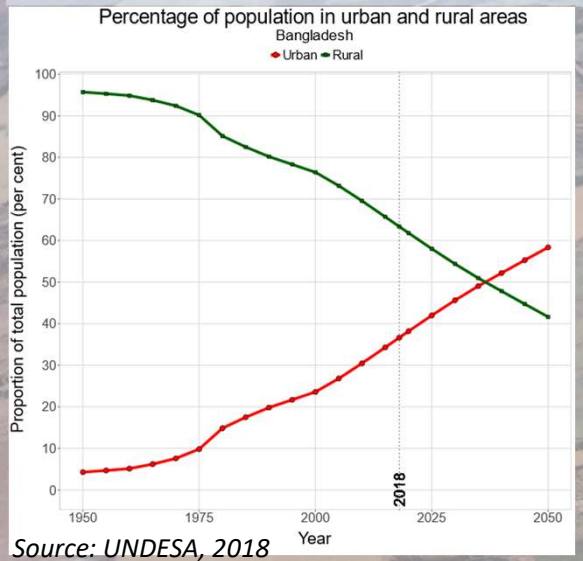


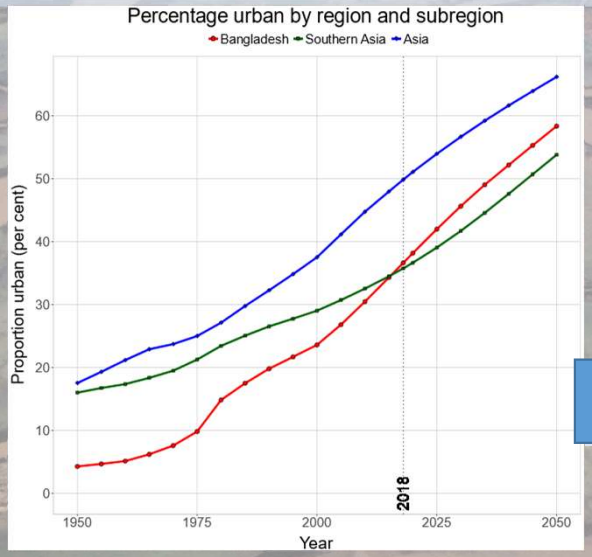
Changes in Demography

Rapid growth accompanied with unplanned development is causing:

- High density population in cities and other urban areas
- Congestion of traffic leading to air and noise pollution
- Inadequate and unsuitable accommodations including slums and squatters
- High price of land inaccessible for poor people
- Lack of basic facilities in the unplanned settlements e.g. schools, health care, sanitation, etc.
- Insufficient infrastructure (roads/water supply/sewer)
- Improper mix of functions causing long distance travelling between living and working place





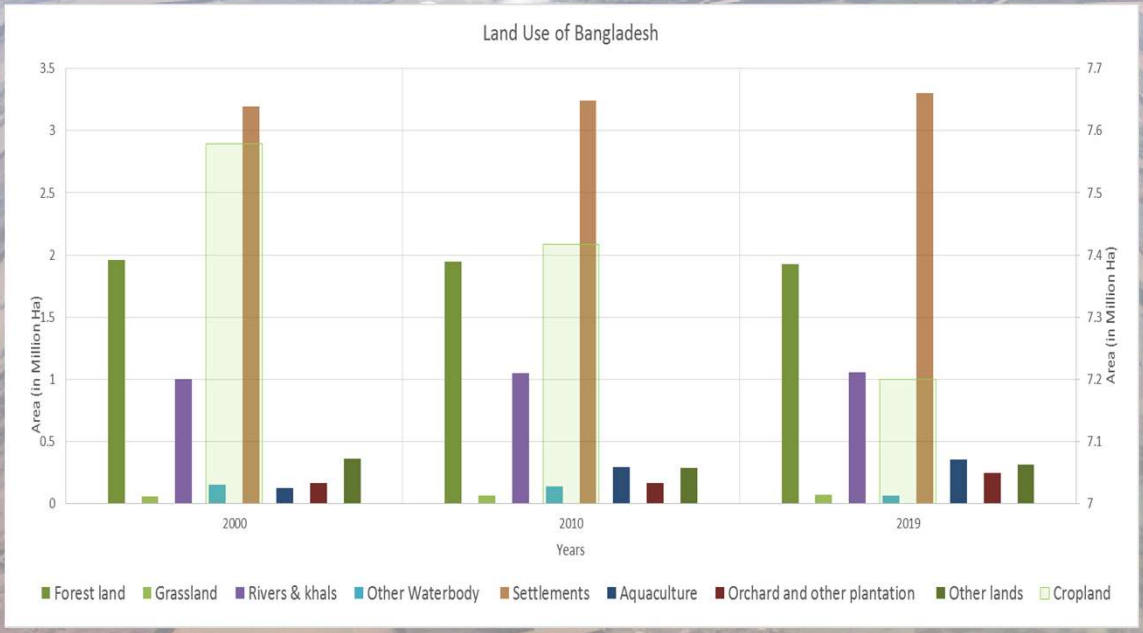


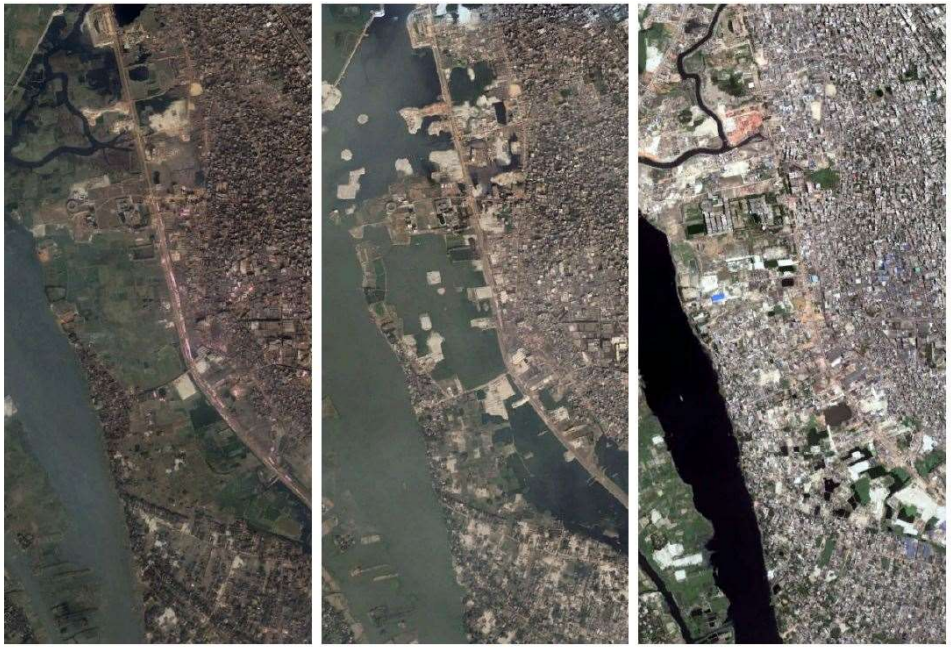
Source: UNDESA, 2018

Results into unsustainable growth

Land use changes over time

- Increase of urbanisation
- Growth of settlements
- Decrease of forest area
- Decrease of agricultural land

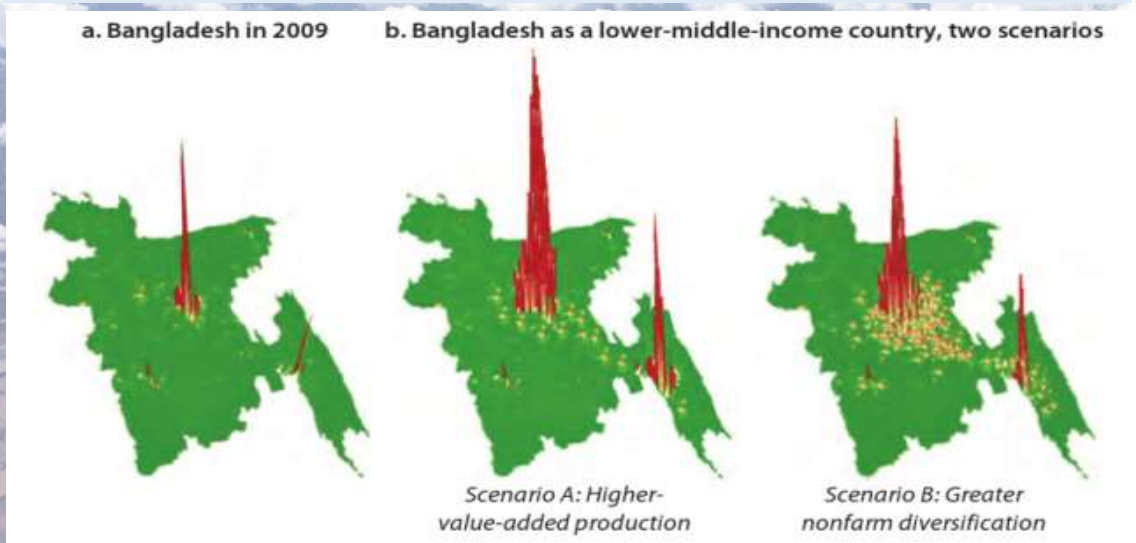




Flood zones are dissapearing
(lack of implementation of the land use plan)

Source: satalite images of Dhaka over time

Growth of Cities



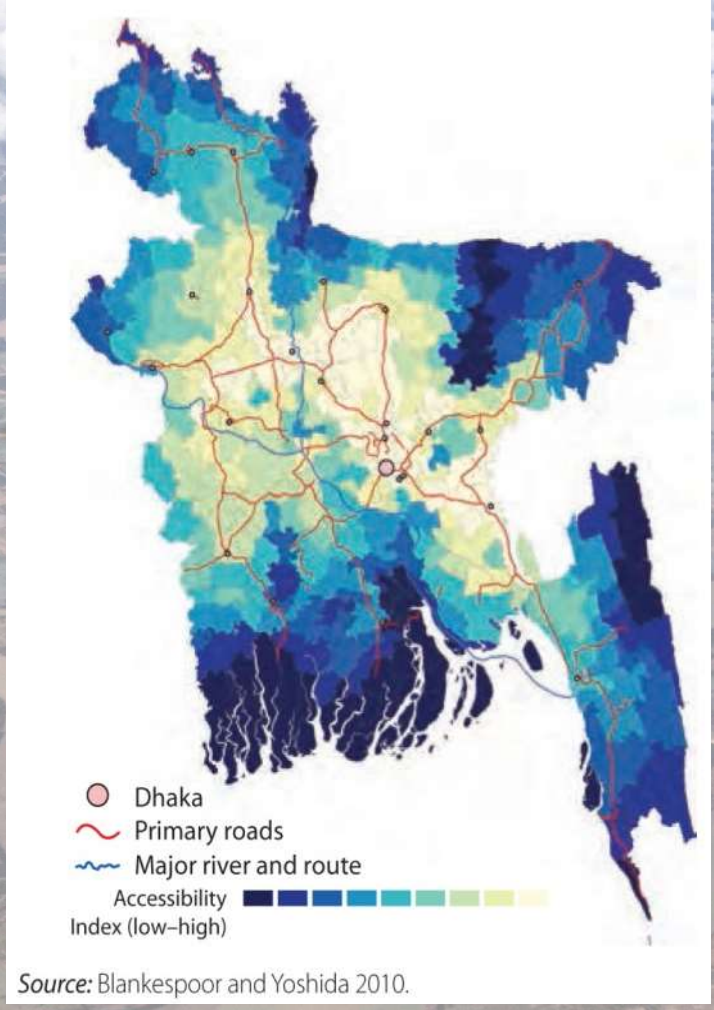
Source: Based on data from Bangladesh Bureau of Statistics 2009.

Economic Growth

- Rapid urbanisation has been occurring due to economic growth without overall socioeconomic improvement.

Accesibility / Connectivity

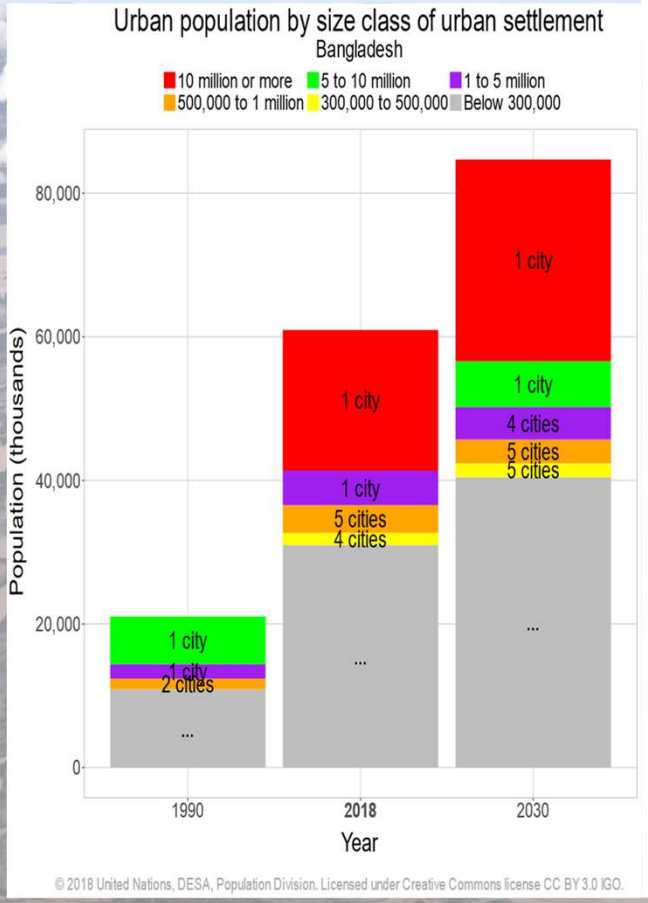
- Spatial development depends on accessibility or connectvity.
- Infrastructural development mainly road network leads to growth of cities and settlements.

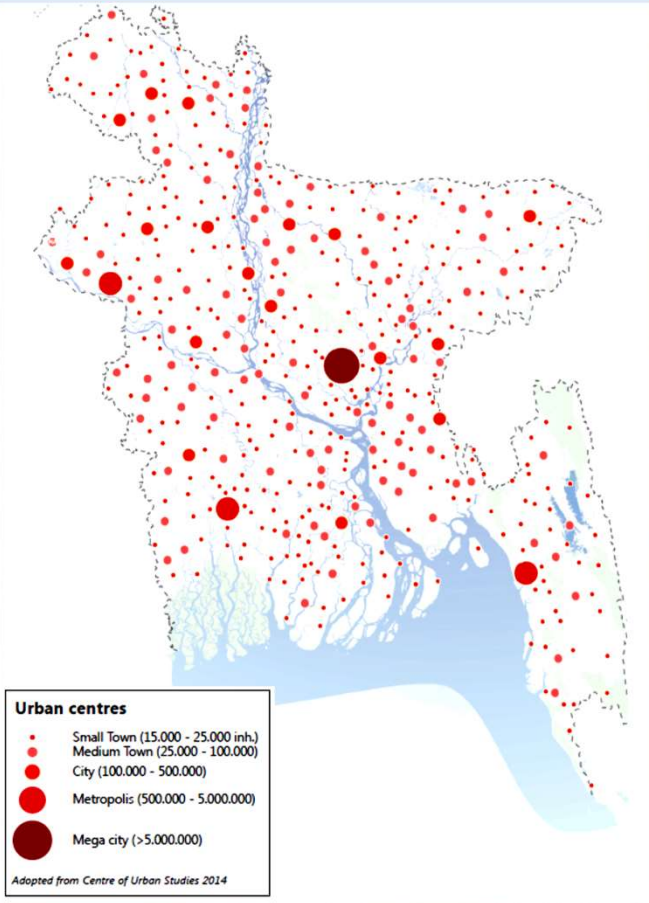


Source: Blankespoor and Yoshida 2010.

Growth of Cities

- Urban population is concentrated in only a few cities, where Dhaka is a meta city (21 million population).
- Chattogram is the second largest city due to the proximity to the country largest seaport followed by Khulna and Rajshahi.
- Rapid urbanisation has been occurring due to
  - employment opportunity
  - higher income
  - better facilities and services

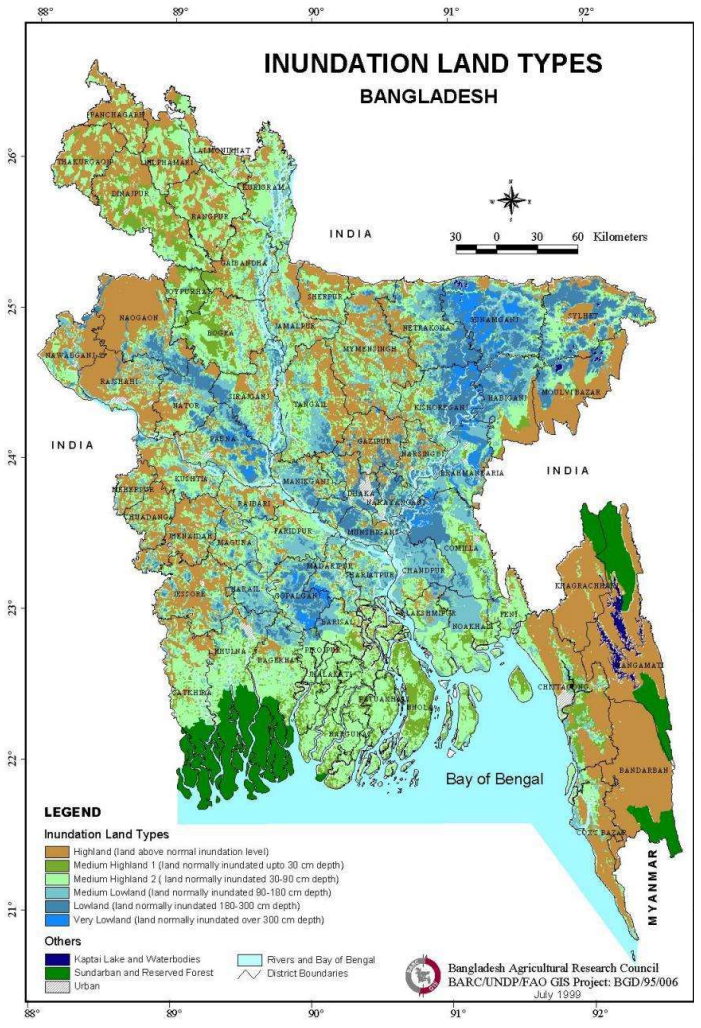


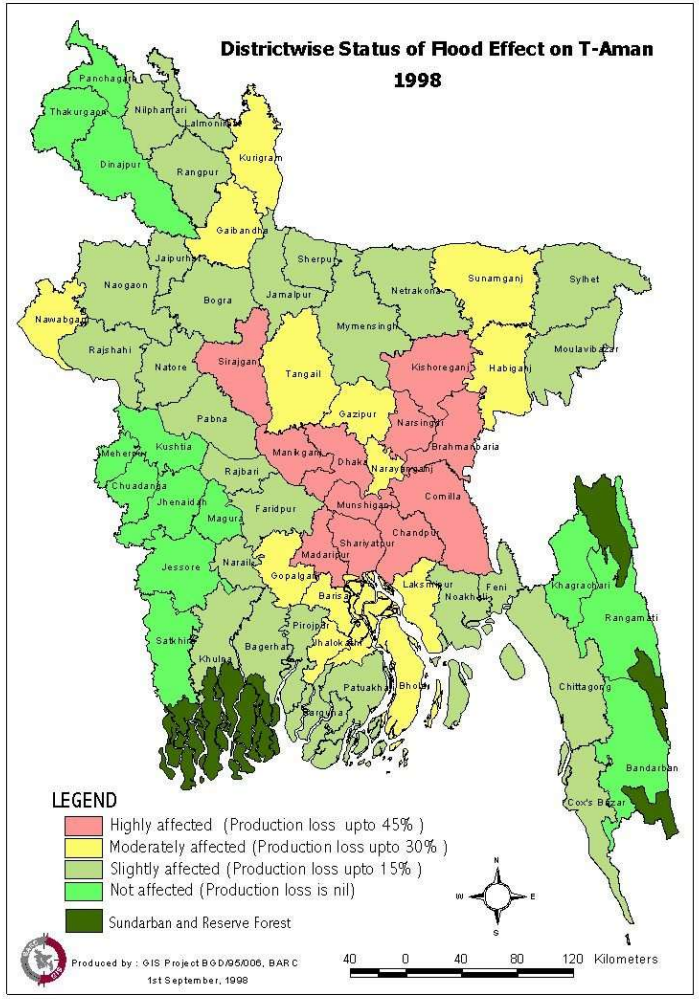


Moving towards Poly-centric Urbanization

Floods and Drainage Congestion

- Changes in climate will induce more frequent intensive flooding and also effect water supply, cause water pollution etc
- Floods are also a risk to the food security
- Too much rainfall results in urban drainage problem



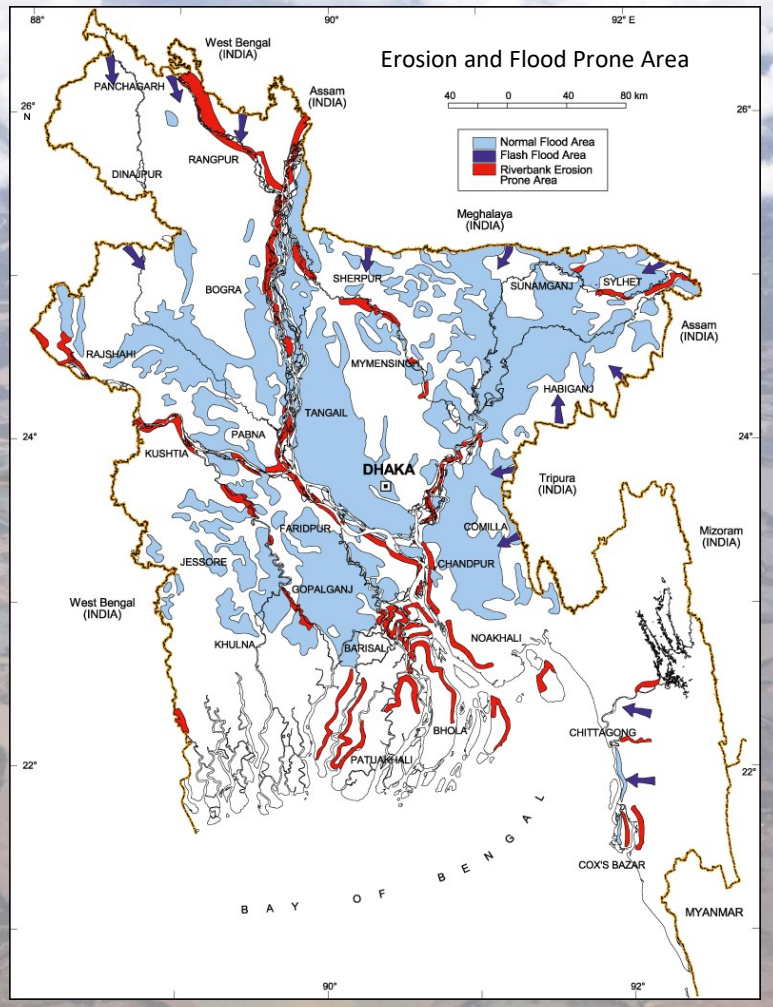


Erosion and Accretion

- There is development in area's that are at risk of flood (e.g. Floodplains, Coastal areas)
- Displacement occurs due to erosion (e.g. Sirajganj, Bhola etc)
- At the same time, there is also the accretion process going on (e.g. River and coastal chars)
- Delta Plan looked at the erosion as well as natural shifts and plans for land reclamation

In Bangladesh:

- the erosion rate in the major rivers are 30 sqkm/yr
- Total erosion in Bangladesh from yr 1973-2015 is 2400 sq.km area.



Source: CEGIS

Cyclone and Storm Surge

- Coastal inundation due to cyclone induced storm surge
- Land and environmental degradation
- Destruction of setllements in coastal belt
- Super Cyclone Amphan in May 2020 caused widespread damage in Eastern India (e.g. West Bengal) and Bangladesh.
- Since cyclone Sidr in 2007, it was the strongest tropical cyclone to strike the Ganga Delta and the first super cyclonic storm to have formed in the Bay of Bengal.

Amphan near peak intensity over the Bay of Bengal on May 18

NASA - https://worldview.earthdata.nasa.gov/

Land Resources Management

Goals of Land Resources Management

To achieve **sustainable** and **optimal land use**, supporting **better spatial planning** across the dynamic Delta while being supportive of the broader development goals of the country. These can be summarized as:

- Ensuring **food security** for the growing population;
- Ensuring **housing** and **shelter** for the growing population;
- Achieving 8% **GDP growth** by 2020 for **higher levels of job creation** and
- Accelerated **poverty reduction** through higher levels of growth in the manufacturing sector with its increased share in GDP;
- Ensuring **multi-modal transportation system** using land and water in an integrated approach;
- Ensuring **land use management** and risk sensitive land use/spatial planning.

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Urban Water Management

Challenges

- The **primary source** of piped water is **groundwater** that is extracted using deep tube-wells,
- Lowering of water tables making tube-wells vulnerable.
- **Treatment** of surface water is **difficult** due to **industrial** and **other pollution sources**. Hence, water quality is a major issue for both urban and rural water supply.
- **Financial viability** of existing water supply systems is **threatened by low tariff rates and huge losses** of water due to leakage illegal connections, etc.
- Apart from water supply, urban waste management, sanitation and drainage is chronic.

Around **30% of the urban population** get **piped water supply** while the rest depend on household-managed hand pumped tube-wells (BBS, 2012).

Table: Water Supply Coverage in Urban Areas, MICS Report, 2012-13

Location		Improved water source (%)	
		Piped water	Other improved source
Division	Barishal	0.7	94.6
	Chattogram	3.6	93.4
	Dhaka	16.5	83.4
	Khulna	2.3	92.1
	Rajshahi	4.2	95.1
	Rangpur	0.7	99.2
	Sylhet	3.5	90.3
Area	Urban	28.7	70.4
	Rural	1.3	96.3
Total		***7.0***	***90.9***

Urban Water Management

Targets of SDG6

- By 2030, achieve universal and equitable access to safe and affordable drinking water for all.
- By 2030, achieve access to adequate and equitable sanitation and hygiene for all and end open defecation, paying special attention to the needs of women and girls and those in vulnerable situations.
- By 2030, improve water quality by reducing pollution, eliminating dumping and minimizing release of hazardous chemicals and materials, halving the proportion of untreated wastewater and substantially increasing recycling and safe reuse globally.
- By 2030, substantially increase water-use efficiency across all sectors and ensure sustainable withdrawals and supply of freshwater to address water scarcity and substantially reduce the number of people suffering from water scarcity.
- By 2030, implement IWRM at all levels, including through transboundary cooperation as appropriate.
- By 2020, protect and restore water-related ecosystems, including mountains, forests, wetlands, rivers, aquifers and lakes.
- By 2030, expand international cooperation and capacity-building support to developing countries in water- and sanitation-related activities and programmes, including water harvesting, desalination, water efficiency, wastewater treatment, recycling and reuse technologies.
- Support and strengthen the participation of local communities in improving water and sanitation management.

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Urban Water Management:
Linkage between SDGs, Delta Plan and Water Act

BDP 2100

- Goal 1: Ensure safety from flood and climate change related disasters
- Goal 2: Enhance Water Security and Efficiency of water usages
- Goal 3: Ensure sustainable and integrated river systems and estuaries management
- Goal 4: Conserve and preserve wetlands and ecosystem and promote their wise use
- Goal 5: Develop effective institutions and equitable governance for internal and trans-boundary water resources management
- Goal 6: Achieve optimal and integrated use of land and water resources

SDGs

- Goal 2:End hunger, achieve food security and improved nutrition and promote sustainable agriculture
- Goal 6: Ensure availability and sustainable management of water and sanitation for all
- Goal 13: Take urgent action to combat climate change and its impacts
- Goal 14: Conserve and sustainably use the oceans, seas and marine resources for sustainable development

BWA 2013

Integrated development, management, abstraction, distribution, use, protection and conservation of water resources

Integrated Spatial Planning

Goals of Integrated Spatial Planning

- to identify the **appropriate locations for economic** and **urban development**.

  Economic zones and urban areas should be developed in coherence with BDP 2100 aspects such as flood risk management, fresh water availability, waterway and road infrastructure connections, sustainability and land reclamation.

- to coordinate efforts in **environmental protection and the improvement of liveability** of urban areas.

  Environmental degradation is a typical cross-sector issue, produced by contradictory interests converging in one area. Largest cities are facing soil, water and air pollution, and lack qualitative living environments. Urban strategies for green-blue structures and mobility are absent. Spatial planning and the implementation of such plans provides a means of addressing these problems.

- to provide **vision and strategic assessment** of not only what is desirable, but also of what is **possible in various scenarios**.

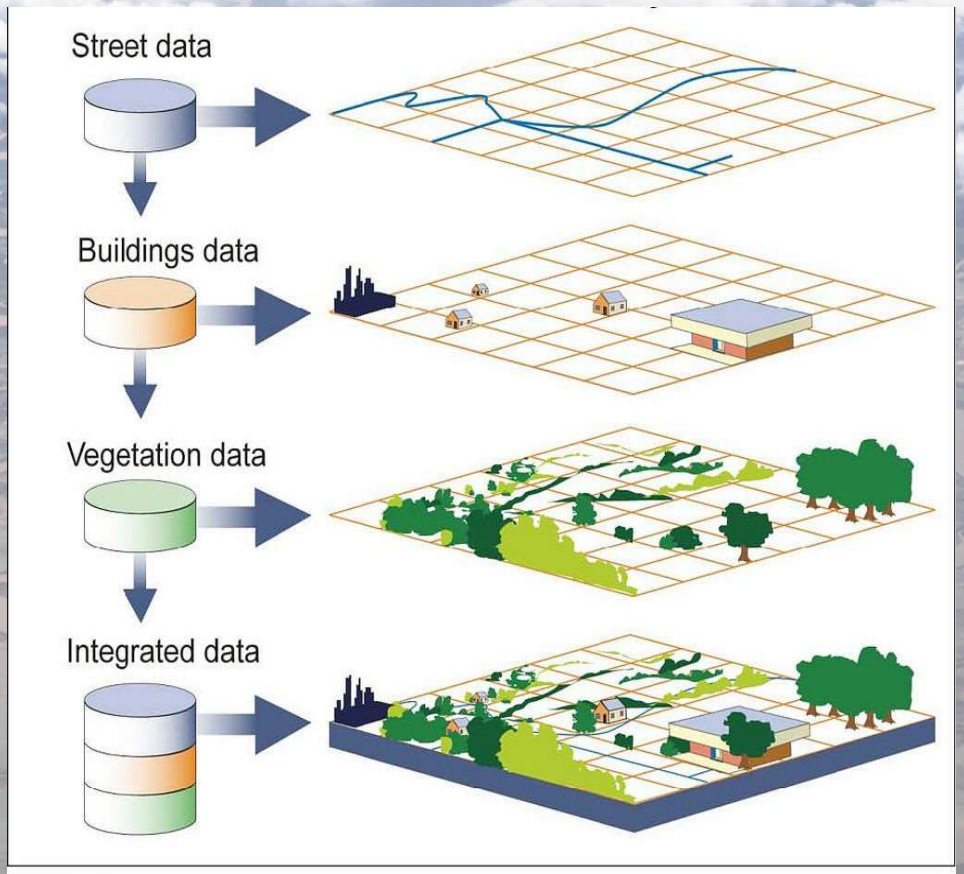
- to **formulate spatial strategies** at national, regional and local levels **to deliver priorities for investment and development**.

Integrated Spatial Planning

Based on the concept of 'triple layer framework', which is instrumental in understanding the natural delta system, and the relation between spatial interventions.

These three layers are:

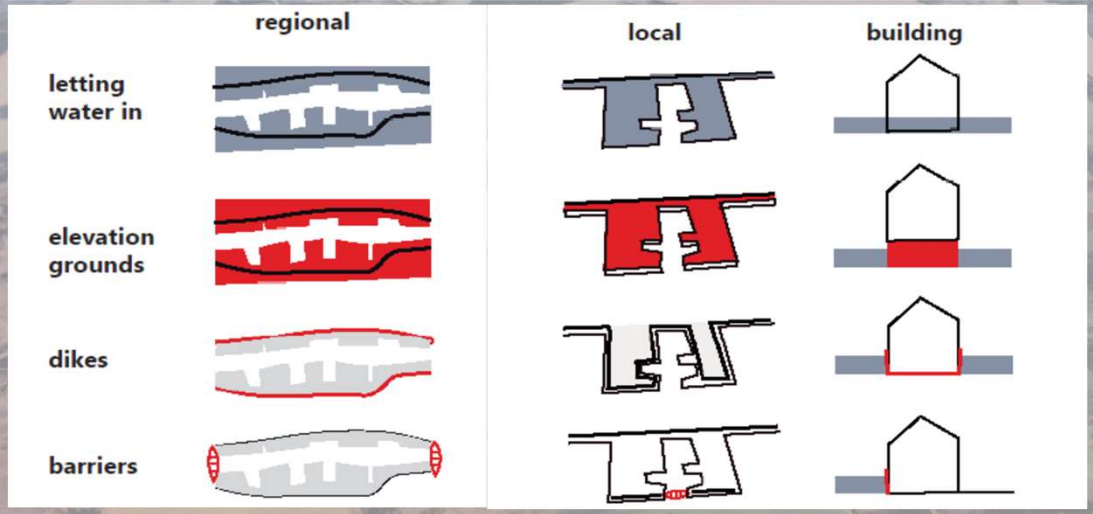
- The **Network** layer (the layer of the infrastructural networks, e.g. roads and embankments, characterised by a relatively development rate of 50-100 years);
- The **Occupation** layer (the layer of human settlements, e.g. rural and urban, within a relatively short development rate of 25-50 years);
- The **Substratum** layer (the natural layer of the subsoil in which physical changes take place over centuries).

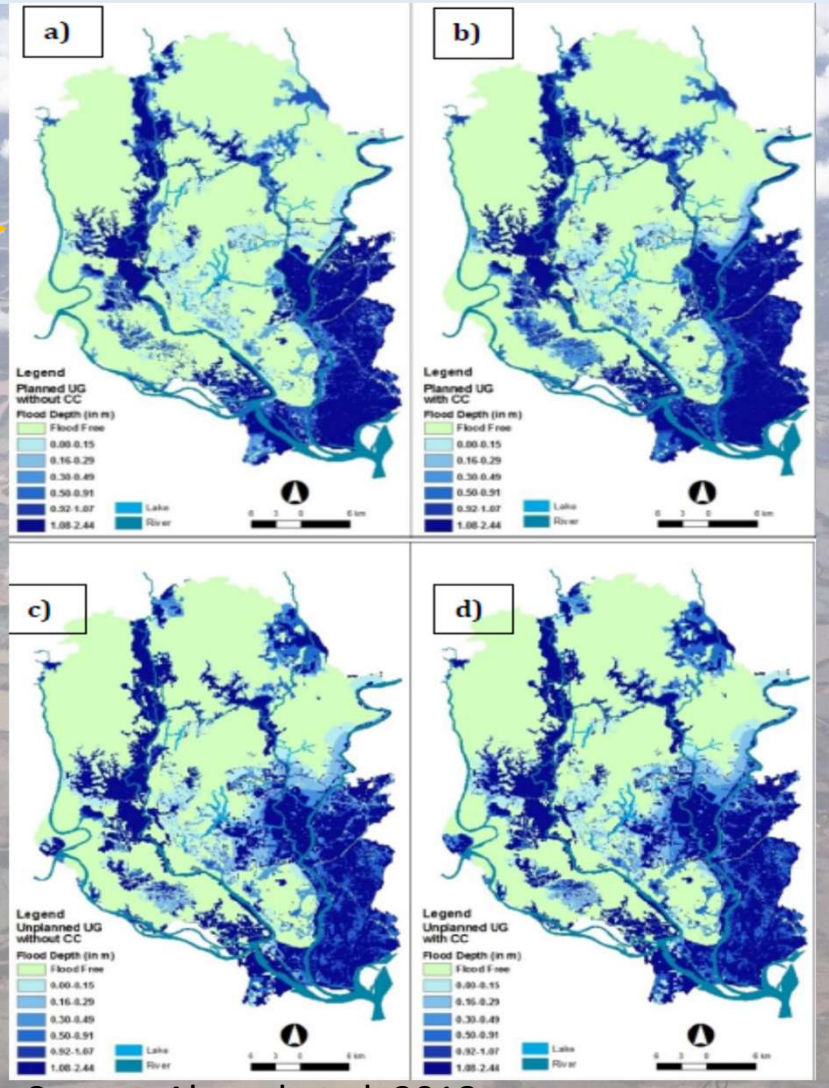


Source: GAO.

Integrated Spatial Planning-at All Scale

- Connecting different scale levels
- Multi layer flood risk protection
- Designing with for different scenario's
- Designing for different return periods
- Protecting vital functions
- Reservation of area's for future development
- Land zoning and Multi functional Use
- Institutional integration





Source: Ahmed et.al, 2018

Integrated Spatial Planning-at City Scale/Urban Areas

Current Condition (Canal/Khal)

- Narrow and blocked by buildings
- Flow inhibited by bridge
- Illegal Settlement
- Polluted water through litter and waste

Improved (Canal/Khal)

- Wider canals and better view
- Clear and improved drainage
- Resettlement of poor community
- Healthier environment through proper waster management

a) Dry season

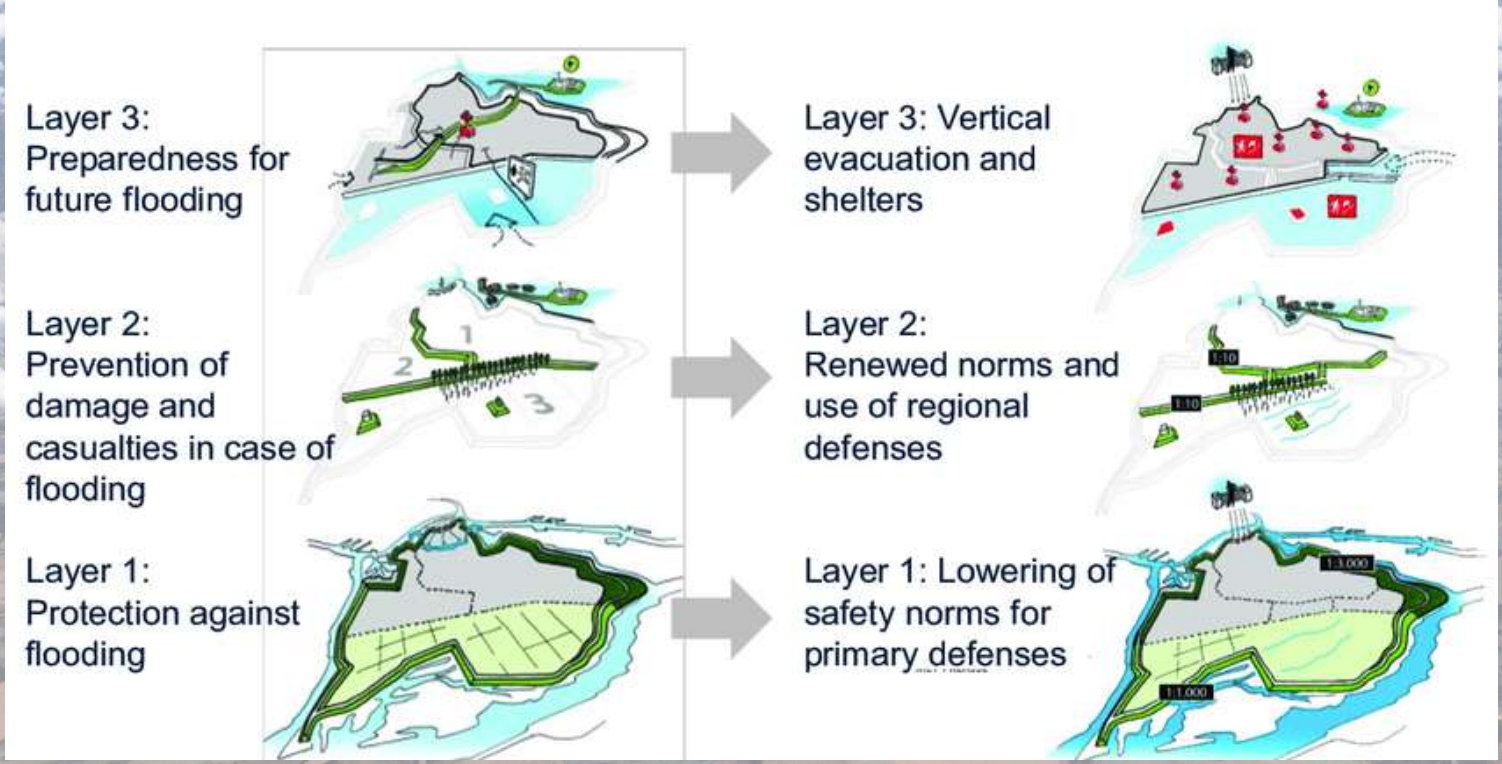
b) Wet Season

Multi-layered Safety Concept

Consequence reduction by policy measures

Consequence reduction by spatial measures

Probability reduction



(Source: Rijke, 2016)

Shifting from Protective to more Resilience based Adaptation Approach

Strategies on Sustainable Land Use and Spatial Planning

Goal 1: Ensure Safety from Floods and Climate Change related Disasters

Strategy 1: Preserve/conserve agricultural land from floods or erosion to sustain food grain production

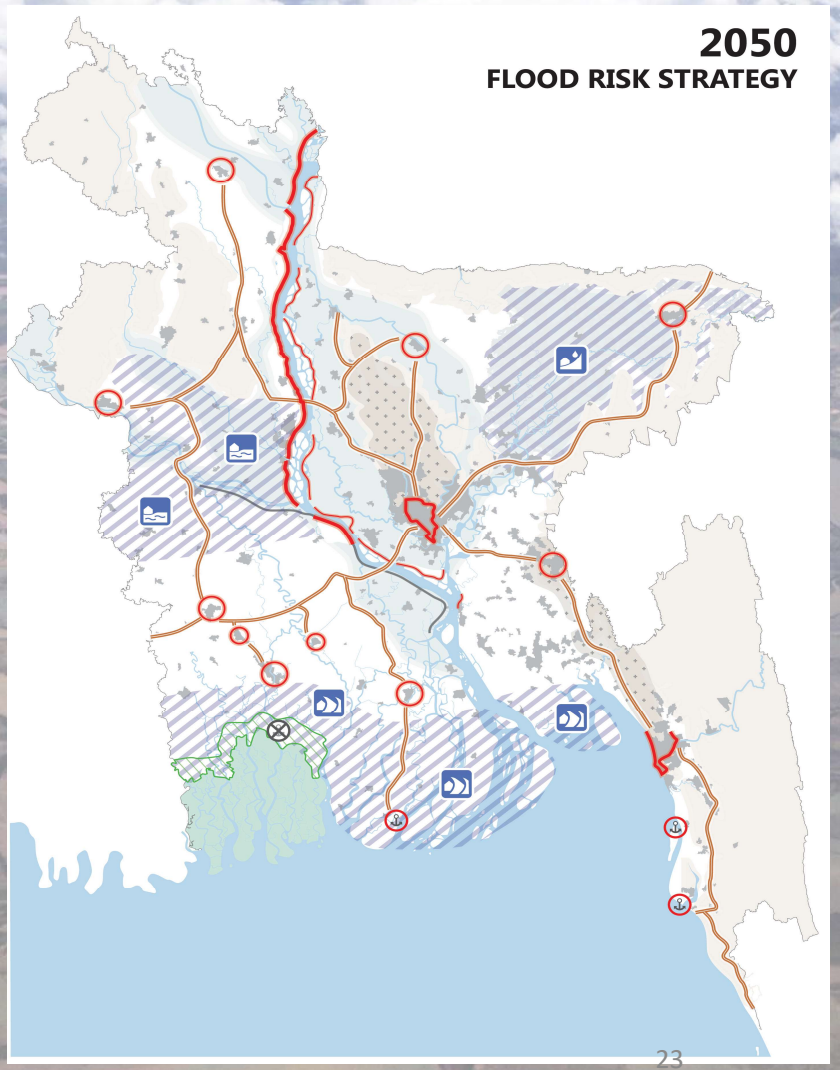
Strategy 2: Prevention of salinity intrusion and desertification

Goal 3: Ensure Sustainable and Integrated River Systems and Estuaries Management

Strategy 1: Management of newly accreted land in the Meghna Estuary

Goal 4: Conserve and Preserve Wetlands and Ecosystems and Promote their Wise Use

Strategy 1: Sustainable coastal land management for enhancing agriculture and non-agriculture land



Strategies on Sustainable Land Use and Spatial Planning

Goal 5: Develop Effective Institutions and Equitable Governance for In-Country and Transboundary Water Resources Management

Strategy 5.1: Development of ***Land Information System*** *(LIS) for Land Administration and Management*

Strategy 5.2: Development of ***Digital Land Resource Management System***

Strategy 5.3: Improvement/formulation of new ***National Land Use Policy***

Strategy 5.4: Reviewing and ***updating/enactment of Laws/Regulations*** *relating to Alluvion and Diluvion* ***to improve efficiency of land administration of accreting and reclaimed land***

Strategy 5.5: Formulation of necessary laws and acts to form ***Land Zoning*** *(e.g.* Economic zones, Forest, Shrimp, Agriculture, Tourism etc)

Strategy 5.6: Increase ***climate change adaptation capacity*** *for land management (e.g. climate adaptive crops, water management techniques*

Strategy 5.7: Ensure ***gender equitability*** *for land ownership*

Waterlogged tolerant rice variety

Strategies on Sustainable Land Use and Spatial Planning

Goal 6: Achieve Optimal and Integrated Use of Land and Water Resources

Strategy 6.1: ***Sustainable land utilization*** *for achieving food security*

Strategy 6.2: Spatial ***land use planning*** *for urbanization*

Strategy 6.3: ***Optimization*** *of Land Use*

Strategy 6.4: Formulation of ***Spatial Planning*** *and* ***Land Resource Management Act***

Strategy 6.5: Management and protection of ***Marine land***

Strategy 6.6: Enhance ***afforestation and plantation*** *in the coastal zone for stabilizing land*

Strategy 6.7: Restoration and ***protection of soil health***

Strategy 6.8: ***Reducing soil erosion*** *and land loss*

Strategy 6.9: ***Integrated management of coastal water*** *infrastructures to protect land*

Jhau Plantation Along Coast Area

Hedge row practices

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Strategies on Urban Water Management

Strategy 1: Ensure Improved Governance and Increased Financial Sustainability in Water Supply Sector

Strategy WSS 1.1: Provide effective water services

*Strategy WSS 1.2: Achieve **Sustainable Water Supply***

Strategy WSS 1.3: Include incentives for sustainable performance on sectoral funding

Strategy WSS 1.4: Adopt safety net tariff policy with suitable focus

Strategy 2: Maximize Sustainable Exploitation of Groundwater for Domestic Water Supply

Strategy WSS 2.1: Develop Hydrogeological knowledge base

*Strategy WSS 2.2: Ensure **sustainable allocation of groundwater** amongst sectors*

Strategy WSS 2.3: Develop technology to remove Arsenic contamination

Strategy 3: Shifting towards alternative Water Sources

Strategy WSS 3.1: Develop surface water based supply systems for major cities

*Strategy WSS 3.2: Promote **desalinizaation** and **wastewater re-use***

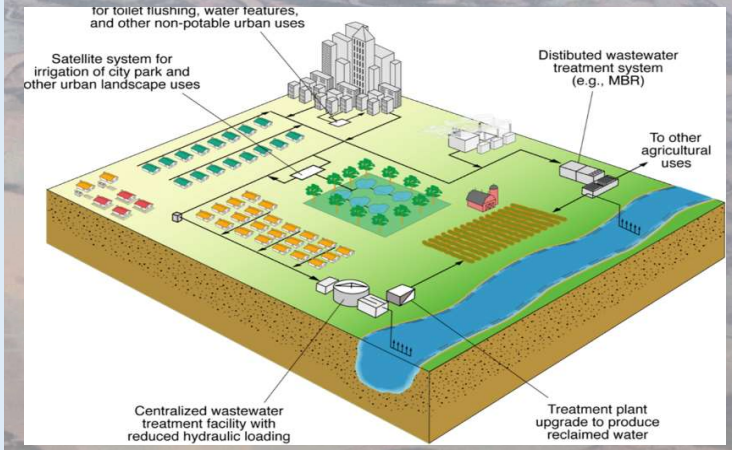
Strategy WSS 4: Stepping up the Service Ladder.

*Strategy WSS 4.1: Expand **piped system coverage***

Strategy WSS 4.2: Accelerate application of meter system in water supply

Strategy WSS 4.3: Reduction of Non-revenue Water

Desalinizaation Plant



Wastewater reuse

Source: Angelakis and Gikas, 2014

Strategies on Urban Water Management

Strategy 5: Strengthening of Institutional Capacity for Sustainable Water Supply

Strategy WSS 5.1: Ensure planned maintenance and proper management of assets

Strategy WSS 5.2: Build awareness through education

Strategy WSS 5.3: Involvement of Stakeholders

Strategy 6: Storm-Water and Urban Drainage Management

Strategy WSS 6.1: Develop ***Green Infrastructure***

Strategy WSS 6.2: ***Rain Water*** *Harvesting*

Strategy WSS 6.3: Handling Drainage Congestion in City

Strategy 7: Strengthening Governance Framework

Strategy WSS 7.1: ***Polluter pay*** *principles*

Strategy WSS 7.2: ***NGO*** *engagement*

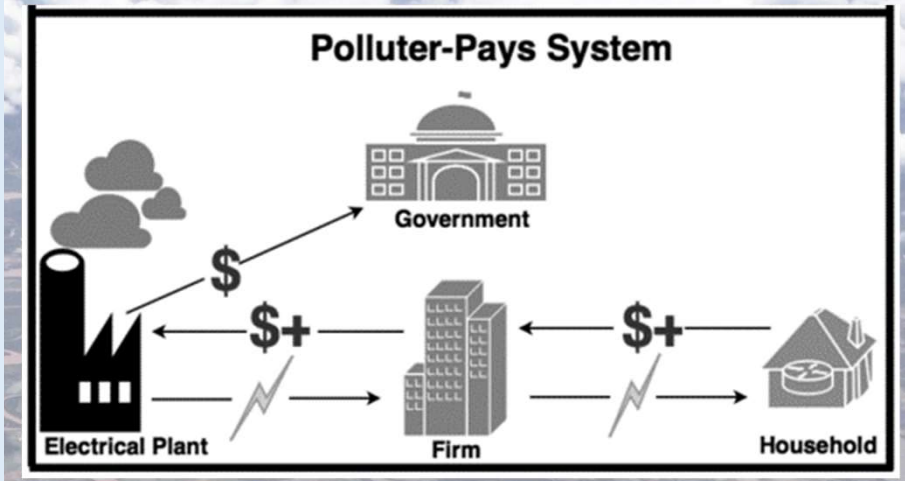
Strategy WSS 7.3: ***PPP*** *encouragement*

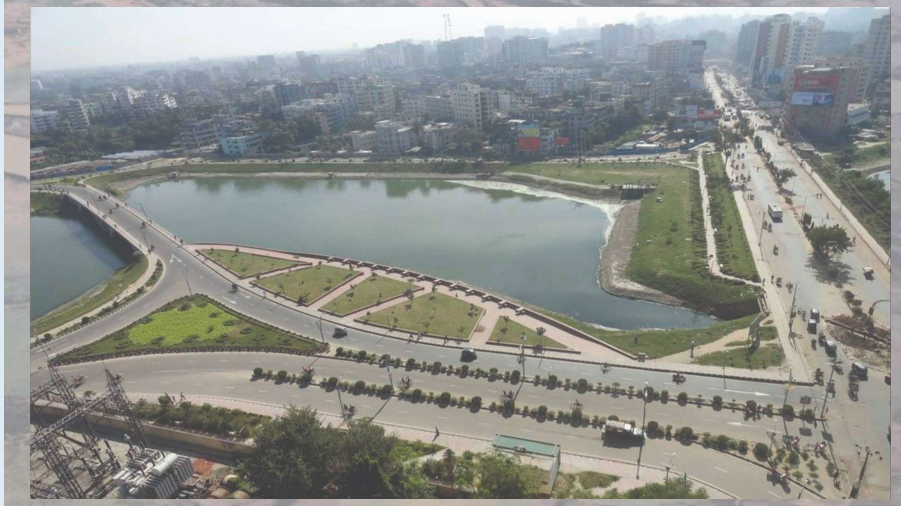
Strategy 8: Institutionalize Cost Recovery Principles

Strategy WSS 8.1: Municipal tax development

Strategy WSS 8.2: Flywheel fund considerations

Strategy WSS 8.3: Efforts for energy recovery

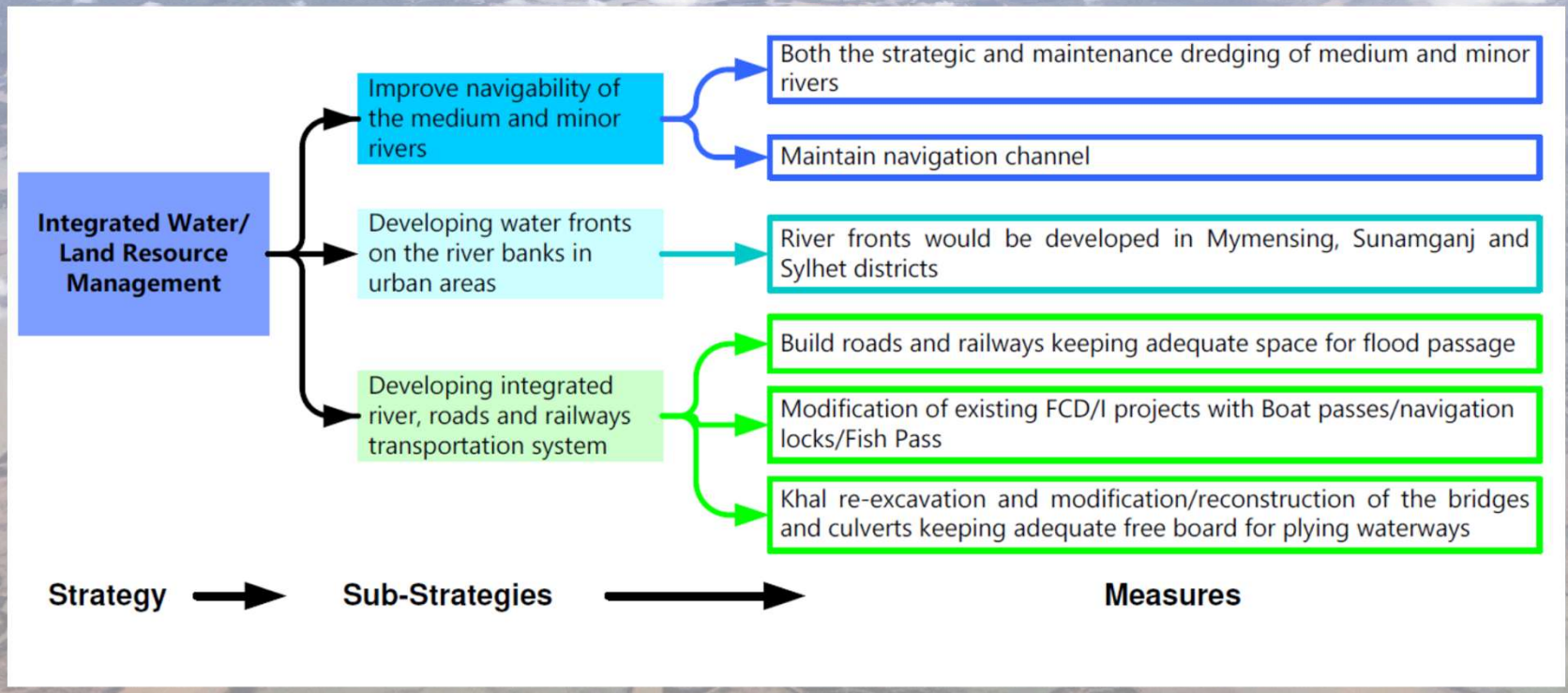




Strategies on Urban Area Hotspot

- ***Strategy UA 1: Increase drainage capacity and reduce flood risk in urban areas***
  - *Strategy UA 1.1: Integrated urban drainage improvement.*
  - *Strategy UA 1.2: Integrated flood risk management*
- ***Strategy UA 2: Enhance urban water security and water use efficiency***
  - *Strategy UA 2.1: Water availably and accessibility.*
  - *Strategy UA 2.2: Improved water quality.*
- ***Strategy UA 3: Managing river systems and estuaries in newly developed areas***
  - *Strategy UA 3.1: Land reclamation.*
  - *Strategy UA 3.2: Integration of River stabilization/erosion control and land reclamation*
- ***Strategy UA 4: Conserve and preserve urban wetlands and ecosystems and promote their wise-use***
  - *Strategy UA 4.1: Urban wetland preservation.*
  - *Strategy UA 4.2: Promote urban green and blue spaces.*
- ***Strategy UA 5: Develop effective urban institutions and governance***
  - *Strategy UA 5.1: Improved urban planning.*
  - *Strategy UA 5.2: Improved implementation of urban plans*
- ***Strategy UA 6: Integrated and sustainable use of urban land and water resources***
  - *Strategy UA 6.1: Integrated spatial planning in spatial policy making on national/regional scale.*
  - *Strategy UA 6.2: Advancements in local urban planning and land use regulations.*

Strategies and Measures of Integrated Water/Land Resources Management



Strategies and Measures for Haor and Flash Flood Areas

Sources:

BDP2100 Strategy Report Volume 1

BDP 2100 BL Study Volume 3 Part A Land Use and Infrastructure Development

BDP 2100 BL Study Volume 3 Part B Land Use and Infrastructure Development

Perspective Plan for Bangladesh, 2041-2041

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Thank You