Rethinking Flood Management

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- Of the Philippines' total land area of 300,000 square kilometers, 266,000 sq.km. are coastal, which are prone to sea level rise, storm surge and flooding.
- Of the Philippines' 1,642 municipalities and cities, close to 60% (or 985) are coastal.
- We have 20 major river basins, 424 principal river basins, and 72 lakes – most of which overflow during heavy rains.
- We average 20 typhoons a year, about 11 of which hit land, bringing 2,400mm of rainfall every year, with most causing floods.

Yet, we don't have a national integrated flood management policy / master plan.

What we have is a hodge-podge of water-related policies and plans, and offices:

- Integrated Water Resource Management Plan (IWRMP)
- Philippine Water Supply and Sanitation Master Plan (PWSMP)
- Water Resources Management Office (WRMO) under DENR
- Flood Control Management Cluster of DPWH
- River Basic Control Office (RBCO) under DENR

The existing situation is described as being:

- Fragmented
- Inadequate in infrastructure and other mitigating measures
- Lacking in inter-jurisdictional collaboration

- The traditional approach to flooding problems is to construct hard or “grey” infrastructure, such as . . .

reservoirs, levees, floodwalls, floodgates, seawalls, channel modifications, enlarging culverts or bridge openings, diversions, and storm sewers.

SHORTCOMINGS OF HARD INFRASTRUCTURE:

- Very expensive (but “profitable”)
- Disturbs the land and disrupts natural water flows, often destroying natural habitats
- Requires regular maintenance, which if neglected can have disastrous consequences
- Often built to a flood protection level that larger floods can exceed, thus causes extensive damage
- Creates a false sense of security, as people protected by it often believe that no flood will ever reach them.

- Despite the enormous expenditure on these structures, economic losses due to floods continue to increase.

We need to rethink the existing approach to flood management and to shift from the traditional flood control mindset to a water-sensitive urban planning and land management approach.

As the impacts of climate change
become increasingly evident, there is a need to
better understand floodplains and stormwater management
systems, which are on the front line of
mitigating flood hazards.

THE HYDROLOGIC CYCLE

- Floods are part of the Earth's natural hydrological cycle, which maintains an overall balance between water in the air, on the surface, and in the ground.
- Sometimes the hydrological cycle gets out of balance, sending more water to an area than it can normally handle. The result is a flood.

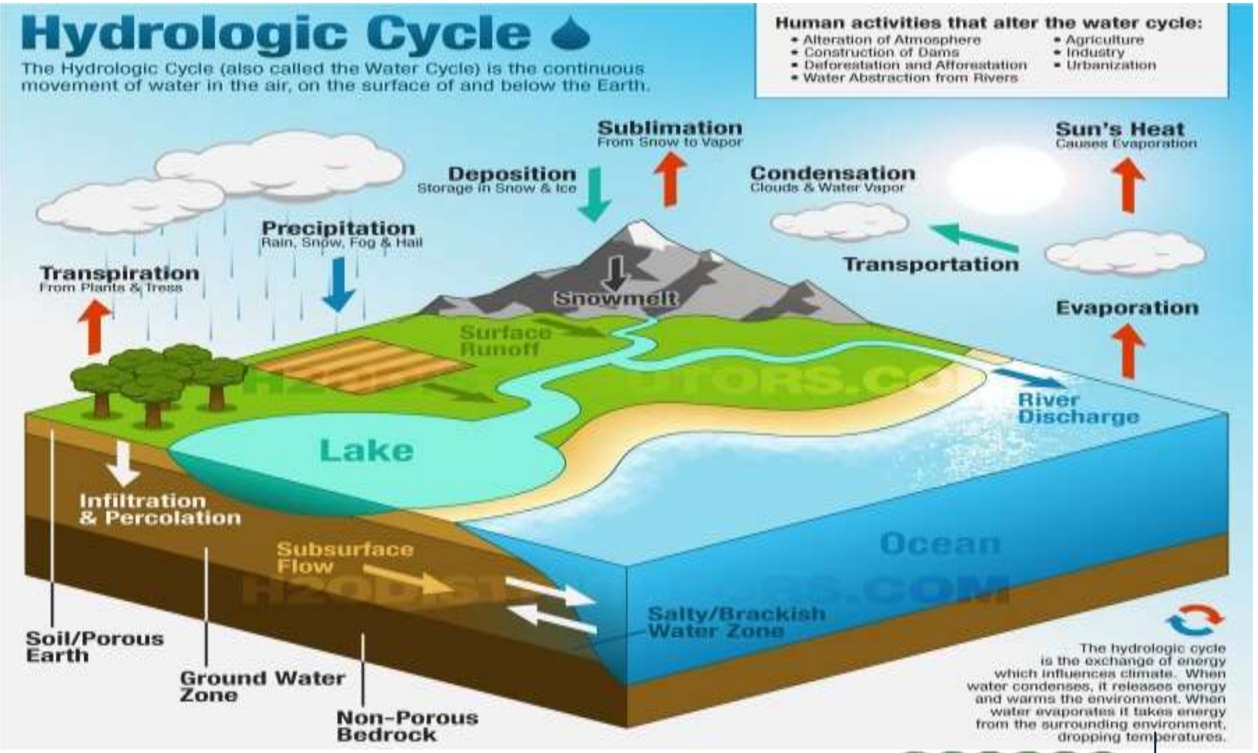
- A flood inundates a **floodplain.**

- **Categories of Flooding:**

  - Riverine Flooding

  - Coastal Flooding

  - Shallow Flooding



FLOODING IS A NATURAL OCCURRENCE

- Rivers, creeks and lakes will periodically overflow their banks and inundate adjacent land areas.

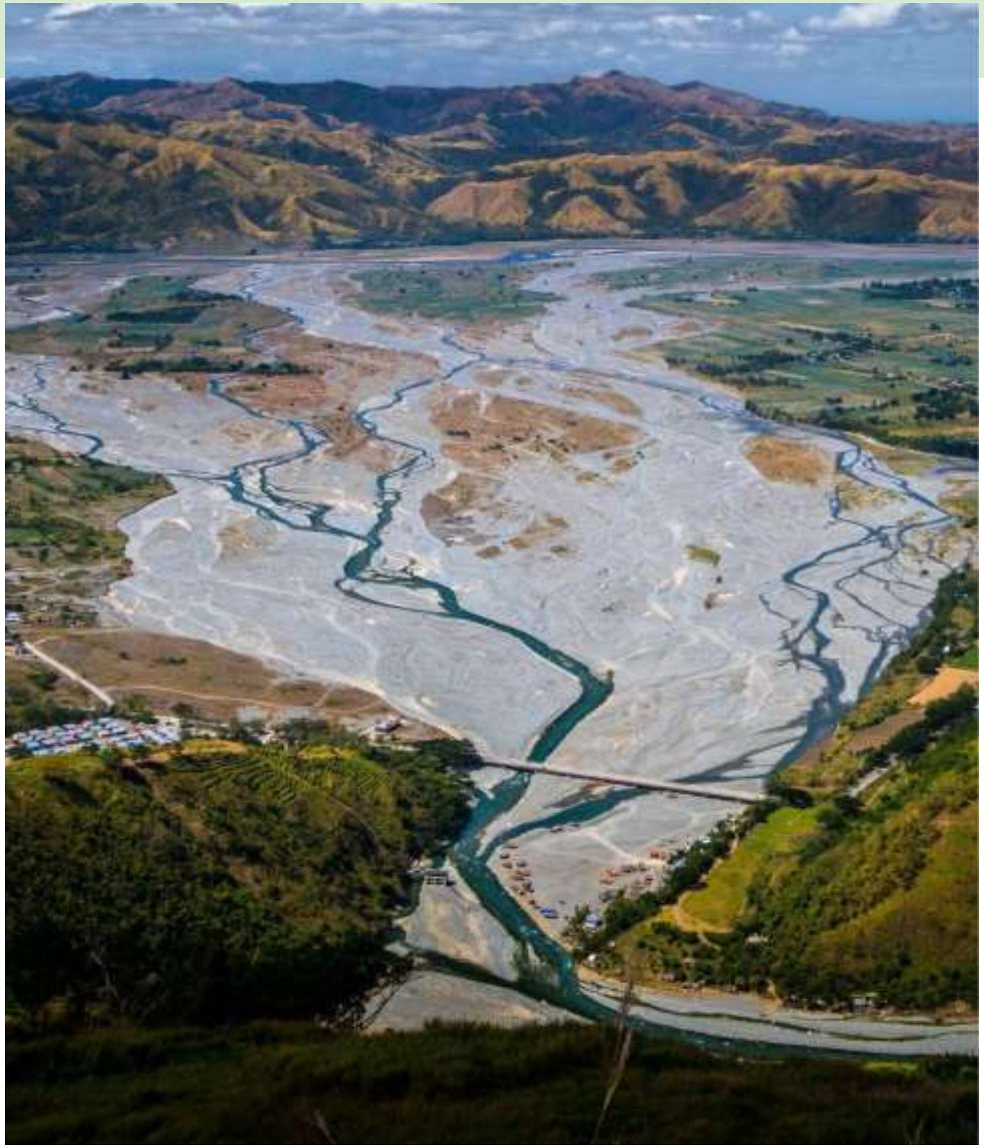
- These areas – known as floodplains – will temporarily store this excess water.

- **Flood damages occur only when human beings interfere with the natural flooding process by:**

- altering the watercourse

- developing areas in upstream of the watershed

- building in the floodplain itself



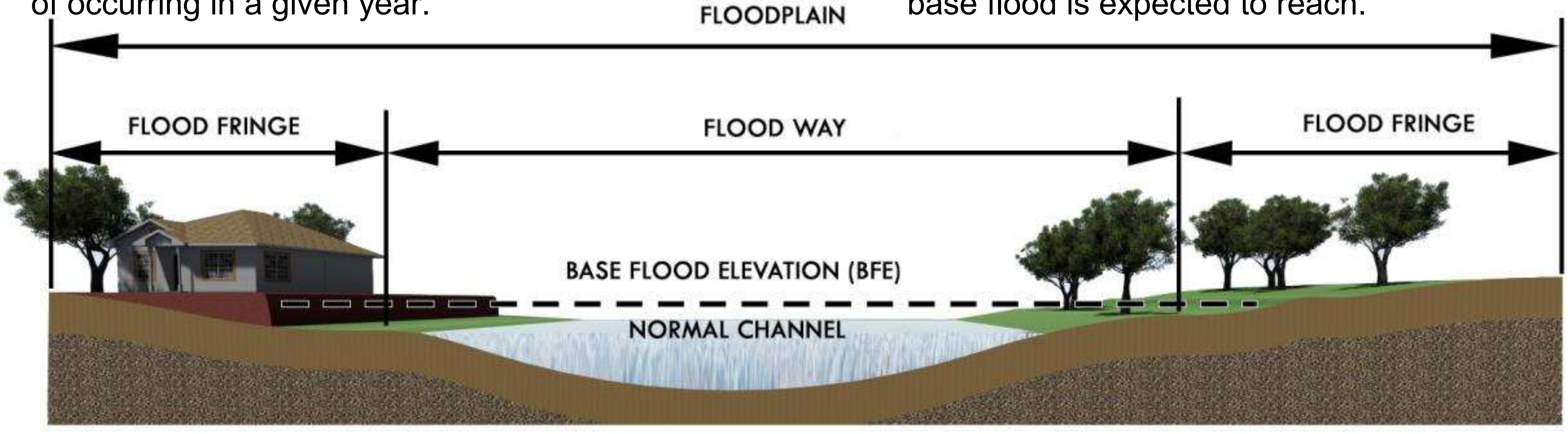
1. FLOODPLAIN MANAGEMENT

The basic goal **IS NOT TO PROHIBIT development** in floodplains, but rather to **GUIDE development** in floodplain areas in such a way as to greatly lessen the economic losses and social disruption caused by flooding events.

FLOODPLAIN MANAGEMENT CONCEPTS

THE BASE FLOOD - sometimes referred to as the 100-year flood, which has a 1% chance of occurring in a given year.

BASE FLOOD ELEVATION (BFE) - the elevation (expressed in meters above sea level) which the base flood is expected to reach.



CHARACTERISTICS OF A FLOODPLAIN

FLOODWAY - includes the channel of a river or creek and the overbank areas adjacent to the channel. It carries the floodwater downstream and is usually the area where water velocities and forces are greatest and most destructive.

FLOOD FRINGE - the area on either side of the floodway, which is subject to inundation by the base flood, but conveys little or no velocity flows.

FLOODPLAIN MANAGEMENT POLICIES (EXAMPLES)

Floodways

No development is permitted in the floodway.

Subdivisions

All subdivisions must be designed to minimize flood damage and to not increase flood levels.

Watercourse Alteration

These should not reduce the carrying capacity of the stream or increase the Base Flood Elevation.

Flood Fringe

Development is permitted in the Flood Fringe but subject to regulations.

BENEFITS OF NATURAL FLOODPLAIN FUNCTIONS

- **Natural flood and erosion control –** provides floodwater storage; reduces flood velocities and flood peaks; curbs sedimentation; filters nutrients and refreshes aquifers

- **Biological resources and functions –** supports a high rate of plant growth; maintains biodiversity and integrity of ecosystems; provides good habitat for fish and wildlife

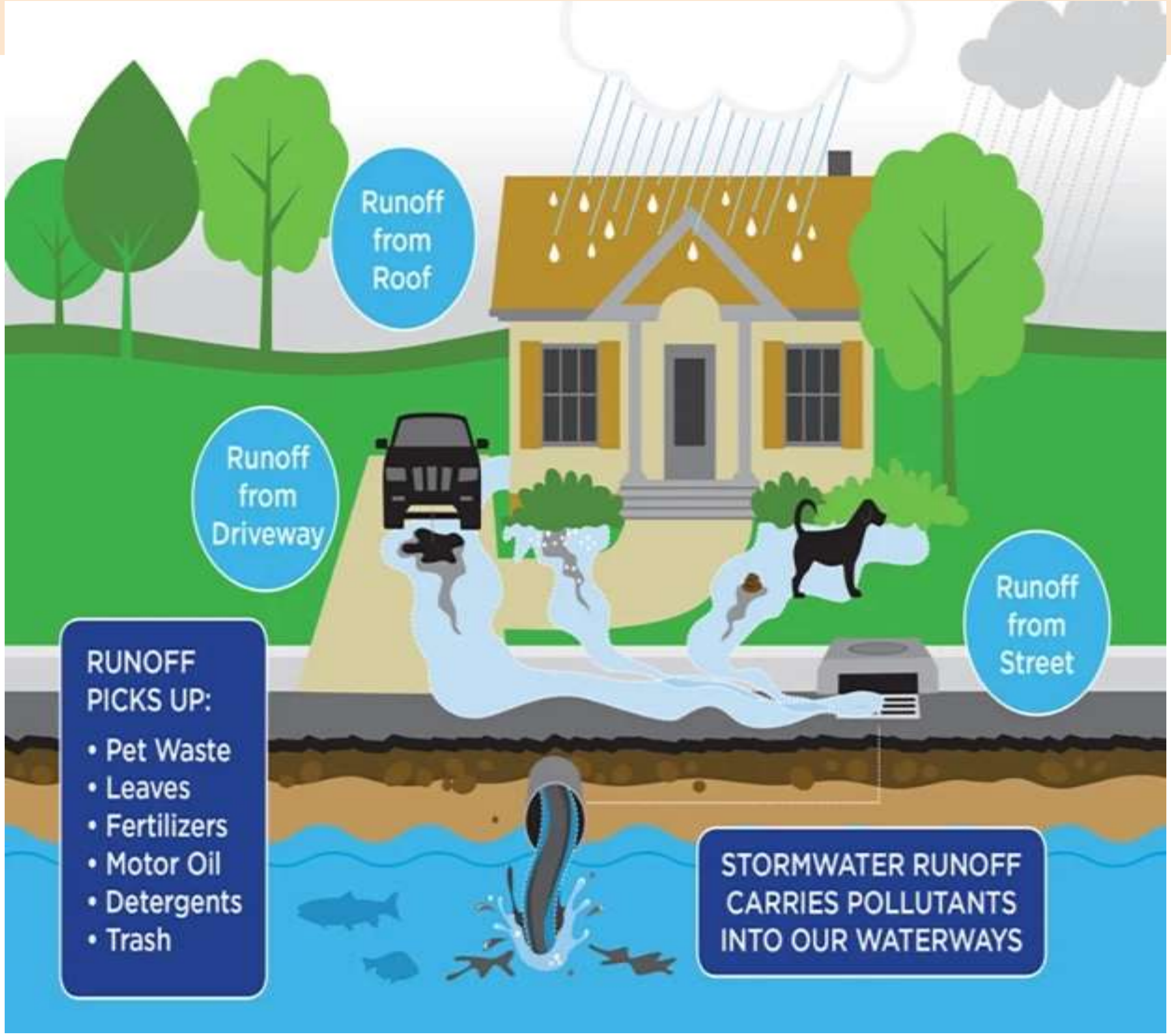
BENEFITS OF NATURAL FLOODPLAIN FUNCTIONS

- **Societal resources and functions –** enhances agricultural lands by sediment deposits; provides open space to restore or enhance forest lands, or for recreational opportunities, or simple enjoyment of their aesthetic beauty.

- **Cost-effective –** The natural processes of floodplains cost far less money than it would take to build facilities to correct floods, stormwater, water quality, and other community problems.

2. STORMWATER MANAGEMENT

- Stormwater management is the **process of controlling the rainwater** that runs off primarily from imperious surfaces like streets, parking lots, driveways, and rooftops.
- Rural areas are typically comprised of pervious areas, such as farmlands, pastures, and forests. These areas **absorb and infiltrate the rainfall** and generate a small amount of runoff.
- Urban areas typically **contain a large percentage of imperious surfaces,** such as pavements and rooftops. The quantity of runoffs from these areas quickly overwhelms creeks and rivers, causing channel erosion, localized flooding, and property damage.



- Most of the existing conventional drainage systems in our towns and cities **have not considered or integrated climate change adaptation** in their designs, resulting in flooding even during the dry season.

- In typical urban drainage systems, flooding occurs when the capacity of **components of the system are overwhelmed,** and runoff accumulates at the surface or follows unintended paths.

- Whereas natural watersheds evolve and adapt to changes in climate over time, fixed-dimension **grey infrastructure does not inherently possess the ability to adapt.**

- Thus, researchers and practitioners are exploring how to **incorporate future climate scenarios into the design of stormwater management systems (SMS)** to ensure that they function well into the future.

- The response of drainage systems to projected climate change is **site dependent and highly spatially variable** across the country. For example, runoff volume reduction, peak flow mitigation, and water quality treatment will be impacted by changes in temperature.

- The **design alterations** are to either on a) the physical properties of the SCM (eg, depth of ponding); or b) the hydrologic design criteria of the SCMs (designing based on recent typhoons), or both.

DESIGNING STORMWATER MANAGEMENT SYSTEMS (SMS)

- The design of SMS starts with examining the impacts of climate change on **SCM performance at the site and watershed scales** to enhance resilience.
- **Nature based solutions (NBS)** are now recognized by the stormwater experts as a means to help mitigate the expected increases in surface runoff and flooding caused by climate change.
- **Green stormwater infrastructure** is now considered an integral component of adaptation planning, which includes permeable pavements, bioretention ponds, green roofs and walls, rainwater harvesting systems, rain gardens, grassed drainage swales, and constructed wetlands.

Examples of Floodplain & Stormwater Management Systems

EXAMPLE # 1: AUSTRALIA'S WATER SENSITIVE URBAN DESIGN (WSUD)

WSUD focuses on stormwater management which aims at promoting sustainability and livability as **part of an overall urban strategy** that's applied to all government and private development projects.

WSUD integrates urban water cycle management with urban planning and design, with **the aim of mimicking natural systems** to minimize impacts on the natural water cycle and receiving water bodies.

It offers an alternative to the traditional conveyance approach to stormwater management by **acting at the source**, and thereby reducing the required size of the structural stormwater management system.

EXAMPLE # 2: CHINA'S SPONGE CITIES

- China's Sponge Cities Program addresses the country's **rapid urbanization and climate-related hazards** from increased frequency and severity of extreme weather events.

- It has **adopted nature-based solutions (NBS)** to complement the existing system of stormwater management that comprises of both grey infrastructure and non-structural measures (disaster preparedness and early warning systems).

- The NBS and **green infrastructure projects** include wetlands, water retention ponds and parks, pervious pavements, bioswales, rain gardens, and green roofs.

EXAMPLE # 3: UK'S SUSTAINABLE DRAINAGE SYSTEMS (SUDS)

- SuDS is an approach **to manage the flow rate and volume of surface runoff to reduce the risk of flooding and water pollution.**
- SuDS are national standards to manage surface runoff in accordance with the Flood Water Management Act of 2010, which **requires new development and redevelopment to have drainage plans for surface runoff** approved by the SuDS Approving Body.
- "SuDS" also refer to structures such as retention ponds, wetlands, infiltration basins or swales (shallow ditches) that **allow surface water to soak slowly into the ground over time.**
- SuDS also may create important areas of natural habitat, and in doing so, generate additional biodiversity and community benefits. SuDS can also contribute to the **recharging of the natural water table.**

EXAMPLE # 4: USA'S LOW IMPACT DEVELOPMENT (LID)

LID's objective is to control stormwater through the creation of **a hydrologically functional landscape that mimics the natural hydrologic regime.** This objective is accomplished by:

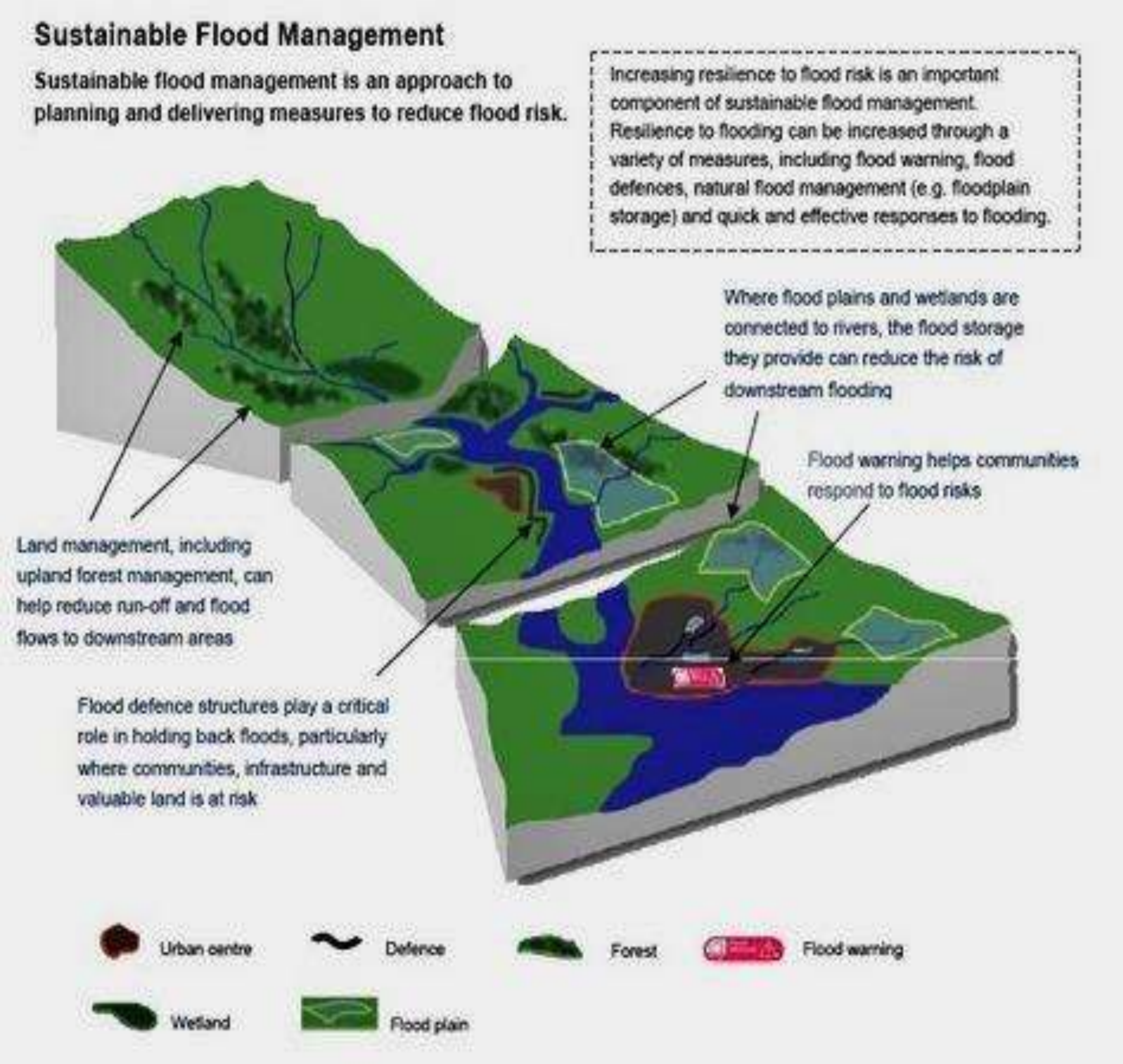
- **Minimizing stormwater impacts** by reducing imperviousness, conserving ecosystems, maintaining natural drainage courses, reducing the use of pipes, and minimizing clearing and grading.

- **Providing runoff storage measures dispersed uniformly throughout a site's landscape** with the use of a variety of detention, retention and runoff practices.

- Implementing effective public education programs to encourage property owners to use pollution prevention measures and **maintain on-lot hydrologically functional landscape management practices.**

LID does not rely on the conventional end-of-pipe or in-the-pipe structural methods, but instead strategically integrates stormwater controls throughout the urban landscape.

COMMON FEATURES OF THE 4 SMS EXAMPLES



- Mimicking natural location-specific hydrologic regime
- Adaption of nature-based solutions (NBS), which can be combined with hard or grey infrastructure where required
- Objective of addressing the interrelated issues of; a) water scarcity; b) flooding; and c) water pollution
- Use of multifunctional landscapes
- Emphasis on reducing impervious surfaces
- Integrates urban water cycle management with urban planning and design

Conclusion

MOVING FORWARD . . .

1. Accepting uncertainty -- Approaches for planning under uncertainty (eg, scenario planning) should be integrated into long term planning to produce robust and resilient solutions to a changing climate and the range of future conditions.

2. Thinking at the system scale ("ridge-to-reef") -- Coordinated, systematic implementation of SCMs in a watershed is necessary to reduce urban water pollution and improve the health of receiving water bodies, as well as to use stormwater as a possible component of the water supply system.

3. Use multifunctional landscapes -- LGUs should consider a diverse mix of SCMs to build redundancy in their urban drainage system. For example, public school playgrounds may be retrofitted to serve as multifunctional stormwater parks, utilizing bioretention ponds.

4. Prioritize preservation of green open space -- LGUs should assess risks and ecosystems as the basis for planning and protecting green open spaces where construction will not be allowed, or where NbS and/or blue-green infrastructure may be appropriate.

5. Scale-up climate change adaptation investments -- Climate change adaptation and the SMS approaches presented here deserve a high level of priority and adequate resource allocation. This applies to retrofitting urban areas with risk mapping and risk-informed planning of new areas.

6. Transform the policy-regulation-engineering-construction nexus to overcome the mindset that sees hard engineering and grey infrastructure as the only form of stormwater control. This includes changing university curricula and engineering handbooks.

The experience with existing drainage infrastructure has largely been inadequate, as evidenced by the more frequent and increasingly more severe flooding that we are experiencing.

Grey and green solutions should be systematically integrated in floodplain and stormwater management systems to achieve the goal of making our towns and cities more resilient in the face of a climate-defined future.

End of Presentation

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