

WHAT IS STORMWATER RUNOFF?

Excess rainwater that flows over land surfaces and collects in stormwater systems, such as drains, pipes, and ditches.

Key characteristics:

- 1 A **subcatchment** is a specific area of land that drains rainwater into the stormwater system
- 2 Land covered by **impervious surfaces** like roofs and roads infiltrates less water and generates more runoff.
- 3 Urban development increases impervious surfaces, reduces water infiltration, and increases chances of flooding.



WHAT IS STORMWATER STORAGE?

Collection and retention of stormwater runoff in specific structures or areas.

- 1 Detention systems like dry ponds, wet ponds, and underground storage hold rainwater temporarily and release it slowly.
- 2 This slows down how quickly the water flows into streams and rivers.
- 3 A larger storage volume allows the system to hold more water during heavy rains.



Tokyo's Flood Tunnel



Kuala Lumpur's Smart Tunnel

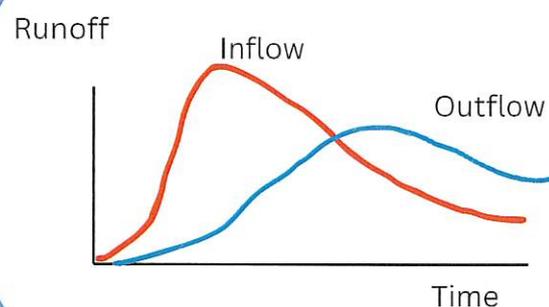
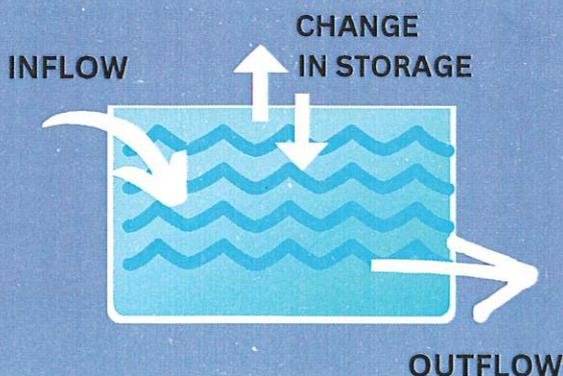
STORMWATER MODEL: THE PRINCIPLES OF CONTINUITY

$$\text{INFLOW} = \text{OUTFLOW} + \text{CHANGE IN STORAGE}$$



Detention systems work like a bath tub. They control the outflow through the size of the storage and outflow pipes.

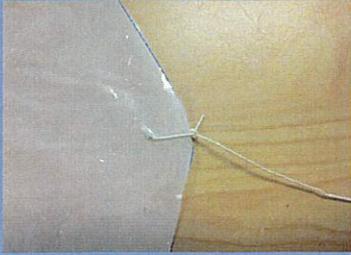
Computer software helps engineers calculate the storage needed to slow runoff from new developments.



PLASTIC PARACHUTE

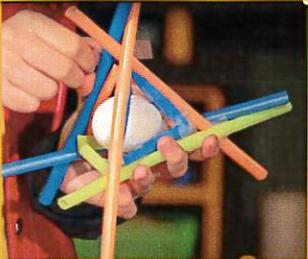
AEROSPACE ENGINEERING

1 CREATE SUSPENSION LINES

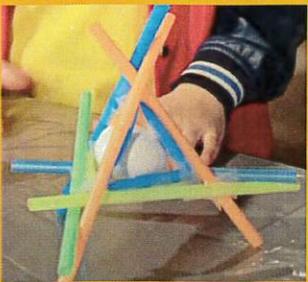


Tie a string to each corner of the parachute.

2 BUILD THE EGG CAGE WITH STRAWS

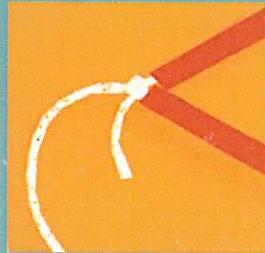


1. Use straws to build a cage around the egg. Tape the straws together at the corners to form a cube or pyramid shape.



2. Carefully place the egg inside the straw cage and use tape to hold it in place.

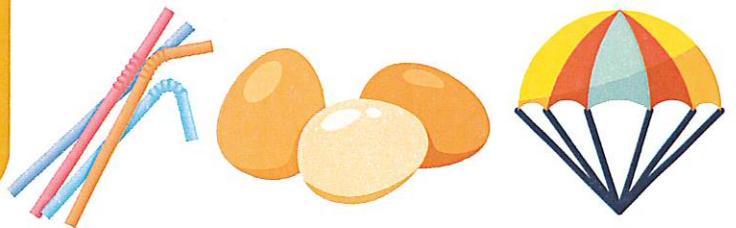
3 ATTACH PARACHUTE TO STRAW CAGE



Tie the loose ends of the parachute strings to the corners of the egg cage. Make sure the strings are even, so the cage hangs balanced.

4 TEST THE DROP

Drop the parachute from a height and watch how the parachute slows the fall while the straw cage protects the egg.



KEY ENGINEERING CONCEPTS

1 Drag & Air Resistance

The parachute works by creating drag, a force that slows down the fall of an object by increasing air resistance.

3 Gravity

Gravity is the force that pulls objects toward the Earth, causing the parachute to fall.

2 Terminal velocity

Force of air resistance (drag) from the parachute = the force of gravity. At this point, the object stops accelerating and falls at a constant speed.