PROMOTING THE USE OF PUBLIC AREAS FOR SUSTAINABLE STORMWATER MANAGEMENT IN CITIES WITH MEDITERRANEAN CLIMATE

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PRESENTATION OUTLINE

- Introduction
- Study Area
- Proposed Methods
- Conclusions
- Future Plans
AIM OF THIS WORK

- Small scale sustainable stormwater management techniques
- Can be implemented into public areas
- Transformation of public areas into multifunctional spaces
- Standalone or supplementary to the conventional drainage system

*The goal is to incorporate sustainable practices into the way of thinking and designing infrastructure*
INTRODUCTION

- Drainage ranks highly among the needs of all societies

- The philosophy of designing drainage systems, has remained the same for many centuries;

  *to guide the water as quickly as possible away from the area of rainfall*
CONVENTIONAL DRAINAGE SYSTEMS

- Rapid conveyance of the runoff and its direct discharge to the recipients
- Disturbance of the hydrologic cycle
  - Reduction of soil infiltration
  - Reduction of evapotranspiration
  - Reduction of surface and subsurface flows
  - Reduction of aquifer level
  - Increase of runoff volume and
  - Deterioration of the recipients’ quality

- Change of philosophy into:
  
  *managing water in a more sustainable way,*
  
  *from the use of conventional drainage systems to the use of Sustainable Drainage Systems (SuDS)*
SUSTAINABLE DRAINAGE SYSTEMS (SuDS)

- Systems that mimic the natural behavior and the processes of the water cycle and incorporate them into the urban environment
  - Detention basins, ponds and wetlands
  - Filter strips/drains
  - Bioretention Systems
  - Permeable pavements
  - Rainwater Harvesting
  - Green Roofs

- Considered all aspects
  - Energy efficiency
  - Biodiversity
  - Social amenity
  - Quality of water
  - The quantity of runoff
AREA OF INTEREST - LIMASSOL

- Its climate is typical Mediterranean
  - Mild winters
  - Long, hot and dry summers.
  - Sunshine during the whole year
    - 11.5 hours per day in summer and 5.5 hours in winter.
  - Evapotranspiration is high (over 80% of the rainfall)
Area Of Interest - Limassol

- Coastal city
- Flat on the south
- High elevations and intense slope on the north
Area Of Interest - Limassol

- Several rivers and streams
- Dry all year
- Flow only during and after rainfalls
Annual Precipitation

- The average annual precipitation in Limassol is 457.5 mm
  - High seasonality (62% falls during the winter and almost none falls at summer).
ANNUAL PRECIPITATION

- Remarkable decrease in the amount of precipitation

- Every drop matters
TECHNIQUES PROPOSED

- Bioretention systems in green areas
- Detention basins and bioretention systems in roundabouts
- Permeable pavements in bus stops, parking spaces
- Use existing spaces
- No need to acquire extra space

- Simple calculations which involve only the amount of water stored on the surface of the systems
- The calculation of underground storage requires exact dimensions and materials of the systems
BIORETENTION SYSTEMS (RAINGARDENS)

- Shallow landscaped depressions
  - Engineered soils
  - Enhanced vegetation

- Benefits
  - Reduce peak velocity
  - Reduce volume of runoff
  - Filter contaminants
  - Recharge groundwater
  - Provide habitat for wildlife
  - Provide high aesthetic value
Applicability

- Applicable to all types of sites residential, commercial or industrial
- Can be adapted into a large variety of shapes depending on the site
- Treat runoff from streets, parking lots, driveways e.c.t.
- Like a bowl that collects water which is then able to slowly infiltrate into the underlying soil.
Installed on green spaces, small roundabouts
50m² of bio retention
7m³ of water storage
Enough for a rainfall of $T=5$ years, 15 min
**Linear Bioretention**

- Installed on coastal road
- Receive flow from the road
- 100m of bio retention strip
- 15m³ of water storage
- Enough for rain of $T=5$ years, 15 min
STORMWATER MANAGEMENT IN ROUNDABOUTS

- Detention basins roundabouts
  - Provide flow control and attenuation of stormwater runoff

- The transformation of a roundabout
  - with a diameter of about 30m
  - store 1000 m³ of peak runoff water

- Enough to drain an area of 10 ha for a rainfall of $T=5\text{years}$ and duration of 15 min
PERMEABLE PAVEMENTS

- Surfaces that allow runoff to infiltrate into a storage reservoir underneath.
  - Infiltrate into the subsoil
  - In cases of low infiltration soils, an underdrain that convey the water to the storm sewer can be used.

- This system provides exceptional hydrologic performance in reducing the peak runoff
Linear Bioretention System – Permeable Pavement

- Supplementary permeable pavement
- Flow from pedestrian road
- Perforated pipes to disperse water uniformly
USE OF PERMEABLE PAVEMENTS

- Parking lots, bus stops, in-line parking spaces e.c.t.

- 20m² area of system
- 9m³ storage of peak runoff water
- Effective for rain of T=5 years, duration 30 min
CONCLUSIONS

- Three SuDS techniques were presented which can be easily adopted or retrofitted into a city.

- Large impact on the urban landscape enhancing the presence of plants.

- Reduce
  - the peak runoff,
  - the volume of water.

- Improve the quality of the water flowing to the recipient.
FUTURE WORK

- The creation of tools such as technical guides, fact sheets and maps
- The creation of showcases in public properties

The goal is to incorporate sustainable practices into the way of thinking and designing infrastructure, thus guiding the city closer to a sustainable city.
THANK YOU

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