



**Pilot Project - Atmospheric Precipitation -
Protection and efficient use of Fresh Water:
Integration of Natural Water Retention
Measures in River basin management**

Service contract n° 07.0330/2013/659147/SER/ENV.C1

What can NWRM effectively deliver?

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Natural Water Retention Measures

**Web-based knowledge
Community of practice
NWRM practical guide**



1- Potential impacts of NWRM

NWRM are:

- Multi-functional measures which can have multiple benefits
- Effective green measures able to protect water resources
- Good candidate to address water-related challenges
(by restoring ecosystems and natural features and characteristics of water bodies)

NWRM may thus be good on their own, because:

- They help restore the environment
- They also help ecosystem functions and services

1- Potential impacts of NWRM

Main focus by applying NWRM:

- To **enhance the retention capacity** aquifers, soils and aquatic ecosystems with a view to **improve their status**
- To **improve the quantitative status** of water bodies and to **reduce the vulnerability to floods and droughts**
- To positively affect the **chemical and ecological status** of water bodies by restoring natural functioning of ecosystems and the services they provide
- To contribute to **climate change adaptation and mitigation**

1- Potential impacts of NWRM

NWRM could have many positive effects on the environment:

→ They can have multi-benefits



1- Potential impacts of NWRM

Biophysical impacts

“ The means by which the measure alters the function or structure of the ecosystem or hydrological system. ”

On the website

By clicking in the BP you're interested in, you will obtain a list of the measures which have an effect on it
(High, medium or low)

Mechanisms of Water Retention

Slowing and storing Runoff

- BP1 Store Runoff
- BP2 Slow Runoff
- BP3 Store river water
- BP4 Slow river water

Reducing Runoff

- BP5 Increase evapotranspiration
- BP6 Increase infiltration and/or recharge
- BP7 Increase soil water retention

Biophysical Impacts Resulting from Water Retention

Reducing Pollution

- BP8 Reduce Pollutant Sources
- BP9 Intercept Pollution Pathways

Soil conservation

- BP10 Reduce erosion and/or sediment delivery
- BP11 Improve soils

Creating Habitat

- BP12 Create aquatic habitat
- BP13 Create riparian habitat
- BP14 Create terrestrial habitat

Climate alteration

- BP15 Enhance precipitation
- BP16 Reduce peak temperature
- BP17 Absorb and/or retain CO₂

1- Potential impacts of NWRM

Biophysical impacts

Matrix example:

“ Biophysical Impacts for Urban sector’s measures ”

Legend: Qualitative Scale	
	High
	Medium
	Low
	None
	Negative

		Mechanisms of Water Retention							Biophysical Impacts Resulting from Water Retention										
		Slowing and Storing Runoff				Reducing Runoff			Reducing Pollution		Soil Conservation		Creating Habitat			Climate Alteration			
		BP1	BP2	BP3	BP4	BP5	BP6	BP7	BP8	BP9	BP10	BP11	BP12	BP13	BP14	BP15	BP16	BP17	
		Store runoff	Slow runoff	Store river water	Slow river water	Increase evapotranspiration	Increase infiltration and/or recharge	Increase soil water retention	Reduce Pollutant Sources	Intercept Pollution Pathways	Reduce Erosion and/or Sediment Delivery	Improve Soils	Create Aquatic Habitat	Create Riparian Habitat	Create Terrestrial Habitat	Enhance Precipitation	Reduce Peak Temperature	Absorb and/or Retain CO ₂	
U1	Green Roofs					High												Low	
U2	Rainwater Harvesting	Low																	
U3	Permeable Paving and other permeable surfaces		Low			Low	Medium	Low											
U4	Swales		High			Low	Medium	Low		Low	Medium								
U5	Channels and Rills		Low			Low	Medium	Low		Low	Medium								
U6	Filter Strips		Low			Medium	High	Medium		High	High								
U7	Soakaways	Low				High	High	High		Low	Medium								
U8	Infiltration Trenches					Low	High	High		Low	Medium								
U9	Rain Gardens	High	High			High	High	High		Low	Medium							Low	
U10	Detention Basins	High	High			Low	High	High		Low	Medium							Low	
U11	Retention Ponds	High	High			High	High	High		Low	Medium		High	Low					
U12	Infiltration Basins	High	High			Low	High	High		Low	Medium				Low				
U13	Managed Aquifer Recharge	High	High			High	High	High		Low	Medium								

 On the website

Also coming soon

Legend: Qualitative Scale	
	High
	Medium
	Low
	None
	Negative

		Mechanisms of Water Retention							Biophysical Impacts Resulting from Water Retention										
		Slowing and Storing Runoff				Reducing Runoff			Reducing Pollution		Soil Conservation		Creating Habitat			Climate Alteration			
		BP1	BP2	BP3	BP4	BP5	BP6	BP7	BP8	BP9	BP10	BP11	BP12	BP13	BP14	BP15	BP16	BP17	
		Store runoff	Slow runoff	Store river water	Slow river water	Increase evapotranspiration	Increase infiltration and/or recharge	Increase soil water retention	Reduce Pollutant Sources	Intercept Pollution Pathways	Reduce Erosion and/or Sediment Delivery	Improve Soils	Create Aquatic Habitat	Create Riparian Habitat	Create Terrestrial Habitat	Enhance Precipitation	Reduce Peak Temperature	Absorb and/or Retain CO ₂	
U1	Green Roofs					High													
U2	Rainwater Harvesting	Medium																	
U3	Permeable Paving and other permeable surfaces		Medium			Low	High	Medium	Low										
U4	Swales		High			Low	Medium	Low		Medium	Medium								
U5	Channels and Rills									Low									
U6	Filter Strips									High	High								
U7	Soakaways	Medium					High	High		Low	Medium								
U8	Infiltration Trenches	Medium				Medium	High	High		Low	Medium								
U9	Rain Gardens	High	High			High	High	Medium	Medium	Medium	Medium								
U10	Detention Basins	High	High			Medium				Medium	Medium								
U11	Retention Ponds	High	High			High				Medium	Medium								
U12	Infiltration Basins	High	High			Medium	High	Medium		Medium	Medium								
U13	Managed Aquifer Recharge	High						High											

High efficiency of these 4 measures on runoff storing and slowing



No or little efficiency of this set of measures on habitat creation or on climate mitigation

1- Potential impacts of NWRM

Meet
Policy
objectives

“How NWRM contribute to meeting EU Policy Objectives.”

 On the website

By clicking in the PO
you're interested
in, you will obtain a
list of the measures
which have an
effect on it
(High, medium or low)

Policy Objectives

Water Framework Directive

- PO1 Improve Status of Biology Quality Elements
- PO2 Improve Status of Physico-Chemical Quality Elements
- PO3 Improve Status of Hydromorphology Quality Elements
- PO4 Improve Chemical Status & Priority Substances
- PO5 Improve Quantitative Status
- PO6 Improve Chemical Status
- PO7 Prevent Surface Water Status Deterioration
- PO8 Prevent Groundwater Status Deterioration

Flood Directive

- PO9 Take Adequate and Coordinated measures to reduce flood risks

Habitats and Birds Directive

- PO10 Protection of Important Habitats

2020 Biodiversity Strategy

- PO11 Better Protection for ecosystems and more use of Green Infrastructures
- PO12 More sustainable agriculture and forestry
- PO13 Better management of Fish stocks
- PO14 Prevention of biodiversity loss

1- Potential impacts of NWRM

Meet Policy
obj

Matrix example:

Policy Objectives

ology sector's

Legend: Qualitative Scale

Dark Blue	High
Medium Blue	Medium
Light Blue	Low
White	None
Red	Negative

Or

Als

		Policy Objectives													
		PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PO13	PO14
		Water Framework Directive								FD	HD & BD	2020 Biodiversity Strategy			
		Improving Status of Biology Quality Elements	Improving Status of Physico-Chemical Quality Elements	Improving Status of Hydromorphology Quality Elements	Improving Chemical Status & Priority Substances	Improved Quantitative Status	Improved Chemical Status	Prevent Surface Water Status Deterioration	Prevent Groundwater Status Deterioration	Take Adequate and Co-ordinated measures to reduce flood risks	Protection of Important Habitats	Better protection for ecosystems and more use of Green Infrastructure	More sustainable agriculture and forestry	Better management of fish stocks	Prevention of biodiversity loss
N1	Basins and Ponds	Low	None	None	None	Low	None	None	None	None	None	None	None	None	None
N2	Wetlands	Medium	Low	None	None	Low	None	None	None	None	None	None	None	None	None
N3	Floodplain Reconnection	None	None	Low	None	None	None	None	None	None	None	None	None	None	None
N4	Re-Meandering	High	None	None	None	None	None	None	None	None	None	None	None	None	None
N5	Revitalisation of Flowing Waters	High	Medium	None	None	None	None	None	None	None	None	None	None	None	None
N6	Temporary Tributaries	None	None	None	None	None	None	None	None	None	None	None	None	None	None
N7	Hydraulic Annexes	None	None	None	None	None	None	None	None	None	None	None	None	None	None
N8	Riverbed - Alluvial Mattress	High	Medium	None	None	None	None	None	None	None	None	None	None	None	None
N9	Levelling of Dams and Longitudinal Barriers	None	None	None	None	None	None	None	None	None	None	None	None	None	None
N10	Natural Bank Stabilisation	None	None	High	None	None	None	None	None	None	None	None	None	None	None
N11	Elimination of Riverbank Protection	High	None	None	None	None	None	None	None	None	None	None	None	None	None
N12	Lake Restoration	None	None	None	None	None	None	None	None	None	None	None	None	None	None
N13	Aquifer Restoration	None	None	None	None	None	None	None	None	None	None	None	None	None	None
N14	Floodplain Restoration	None	None	None	None	None	None	None	None	None	None	None	None	None	None

1- Potential impacts of NWRM

**Restore or maintain
Ecosystem Services**

“The benefits that derive from the changes to the function or structure of the ecosystem or hydrological system.”

 **On the website**

By clicking in the ES you're interested in, you will obtain a list of the measures which have an effect on it
(High, medium or low)

Ecosystem Services Benefits

Provisioning

- ES1 Water Storage
- ES2 Fish Stocks and Recruiting
- ES3 Natural Biomass Production

Regulatory & Maintenance

- ES4 Biodiversity Preservation
- ES5 Climate Change Adaptation and Mitigation
- ES6 Groundwater/Aquifer recharge
- ES7 Flood Risk Reduction
- ES8 Erosion/Sediment Control
- ES9 Filtration of Pollutants

Cultural

- ES10 Recreational Opportunities
- ES11 Aesthetic/Cultural Value

Abiotic

- ES12 Navigation
- ES13 Geological Resources
- ES14 Energy Production

1- Potential impacts of NWRM

Restore or maintain Ecosystem Services

Matrix example:
 “ Ecosystems services for the Agriculture sector’s measures”

 **On the website**

Also coming soon

ES: Ecosystem Services Benefits

		ES1	ES2	ES3	ES4	ES5	ES6	ES7	ES8	ES9	ES10	ES11	ES12	ES13	ES14
		Provisioning			Regulatory & Maintenance					Cultural		Abiotic			
		Water Storage	Fish Stocks and Recruiting	Natural Biomass Production	Biodiversity Preservation	Climate Change Adaptation and Mitigation	Groundwater/Aquifer Recharge	Flood Risk Reduction	Erosion/Sediment Control	Filtration of Pollutants	Recreational Opportunities	Aesthetic/Cultural Value	Navigation	Geological Resources	Energy Production
A1	Meadows and Pastures					High	High	High	High	High					
A2	Buffer Strips and Shelter Belts			Medium	Medium	High	High	High	High	High					
A3	Crop Rotation						High	Medium	Medium	High					
A4	Strip Cropping						High	High	High	High					
A5	Intercropping						High	High	High	High					
A6	No Tillage						High	High	High	High					
A7	Reduced or Conservation Tillage						High	High	High	High					
A8	Green Cover			Medium	Medium	High	High	High	High	High					
A9	Early Sowing					High	High	High	High	High					
A10	Traditional Terracing						High	High	High	High					
A11	Controlled Traffic Farming						High	High	High	High					
A12	Reduced Stocking Density						High	High	High	High					
A13	Mulching						High	High	High	High					

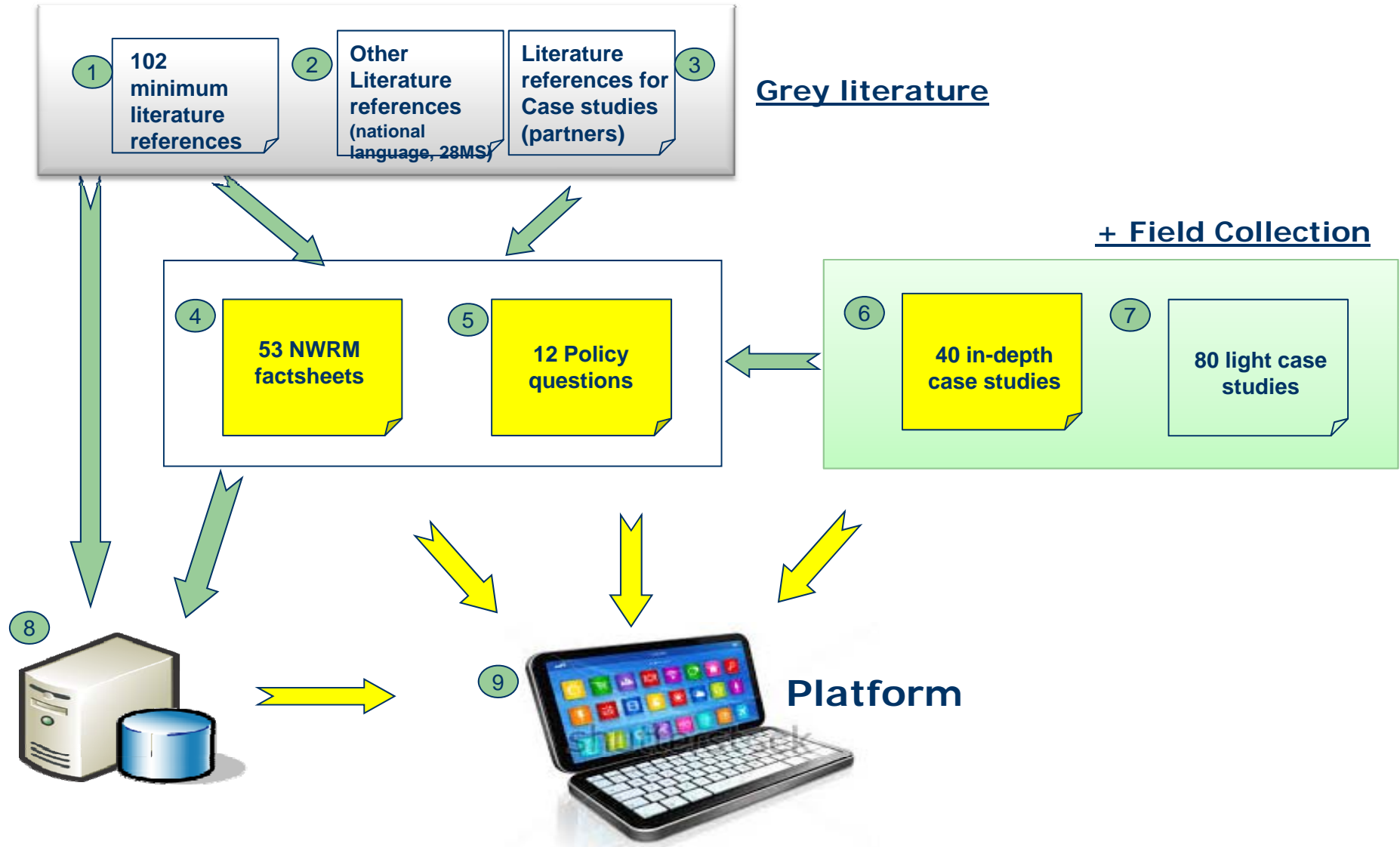
ES: Ecosystem Services Benefits

Legend: Qualitative Scale	
	High
	Medium
	Low
	None
	Negative

		ES1	ES2	ES3	ES4	ES5	ES6	ES7	ES8	ES9	ES10	ES11	ES12	ES13	ES14
		Provisioning			Regulatory & Maintenance					Cultural		Abiotic			
		Water Storage	Fish Stocks and Recruiting	Natural Biomass Production	Biodiversity Preservation	Climate Change Adaptation and Mitigation	Groundwater/Aquifer Recharge	Flood Risk Reduction	Erosion/Sediment Control	Filtration of Pollutants	Recreational Opportunities	Aesthetic/Cultural Value	Navigation	Geological Resources	Energy Production
A1	Meadows and Pastures														
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A11	Controlled Traffic Farming														
A12	Reduced Stocking Density														
A13	Mulching														

2- Real impacts of NWRM

Evidence providing by the NWRM project team comes from grey literature and field collection of case studies



2- Real impacts of NWRM

Biophysical Impacts - Some illustrations for Urban measures
issued from Nick Jarritt previous presentation (AMEC)

Project has identified 13 types of “urban” NWRM

- Effectively Sustainable (urban) Drainage Systems
- Although can be applied outside of urban areas!



2- Real impacts of NWRM

Biophysical Impacts - Some illustrations for Urban measures

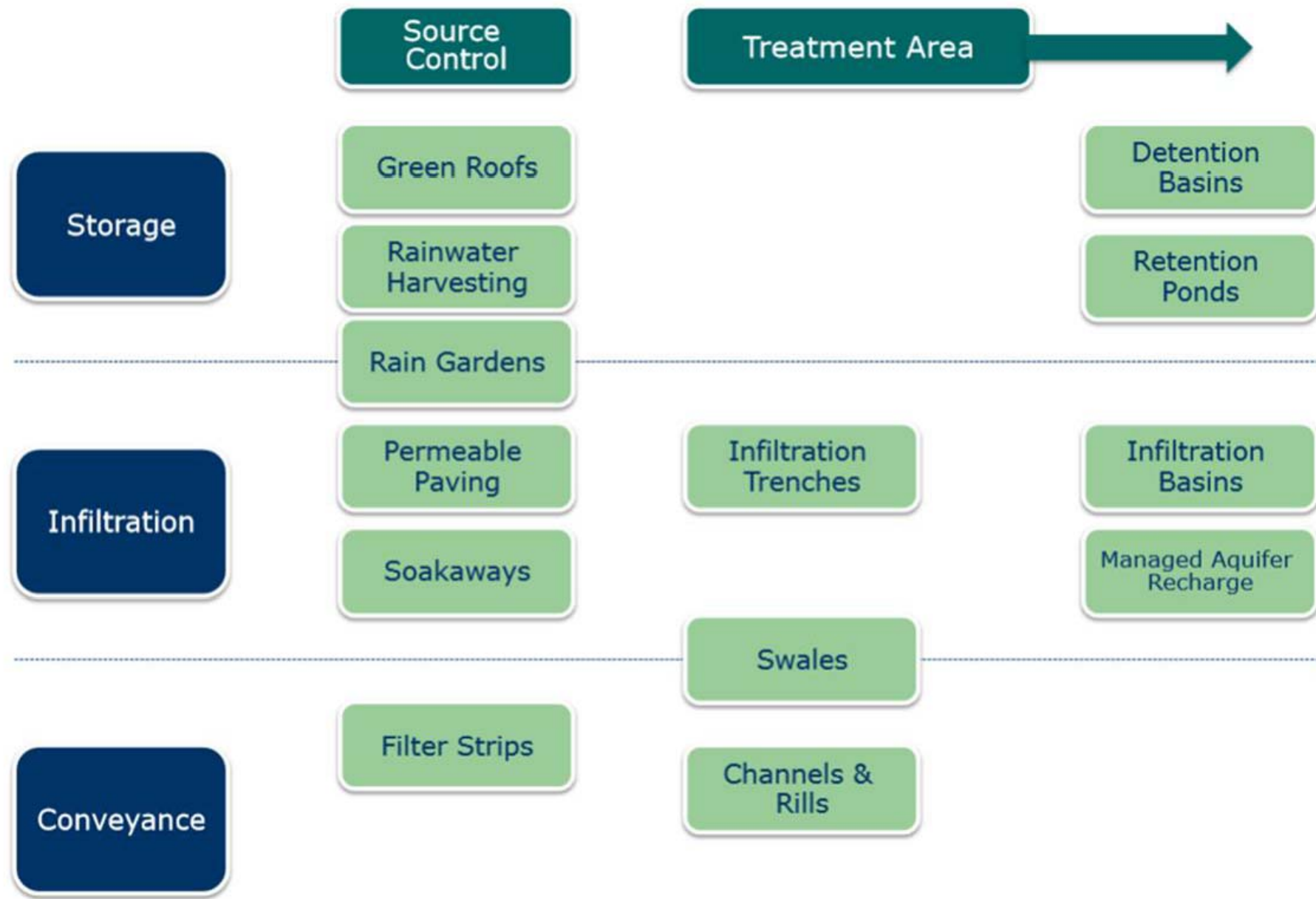
Project has identified 13 types of “urban” NWRM

- Effectively Sustainable (urban) Drainage Systems
- Although can be applied outside of urban areas!

SuDS can be considered in terms of:

- Mechanism (type)
 - * Storage
 - * Infiltration
 - * Conveyance
- Scale
 - * Source Control
 - * Increasing treatment area (drainage catchment)

2- Real impacts of NWRM



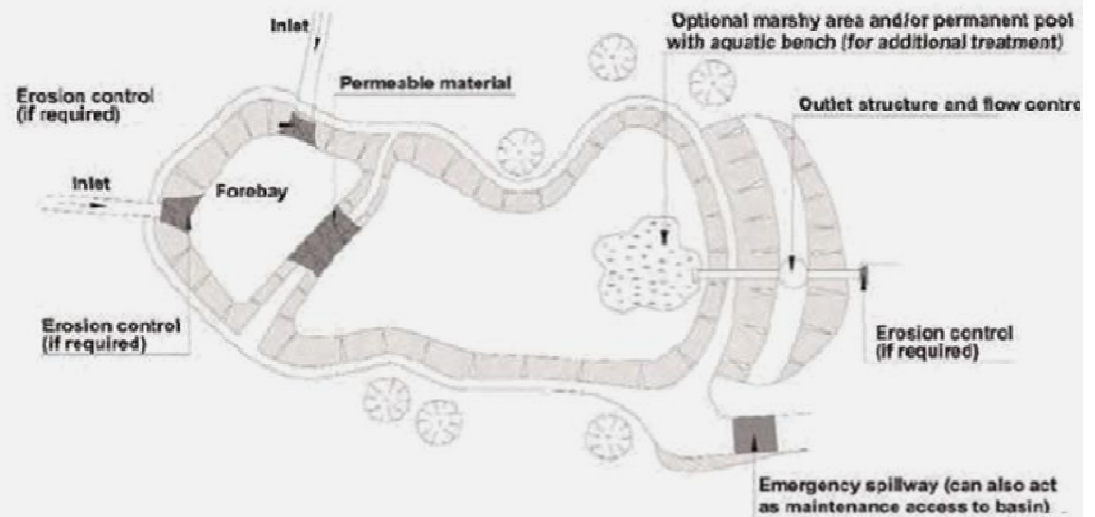
2- Real impacts of NWRM

Detention Basins



Primary purpose to store and slow runoff

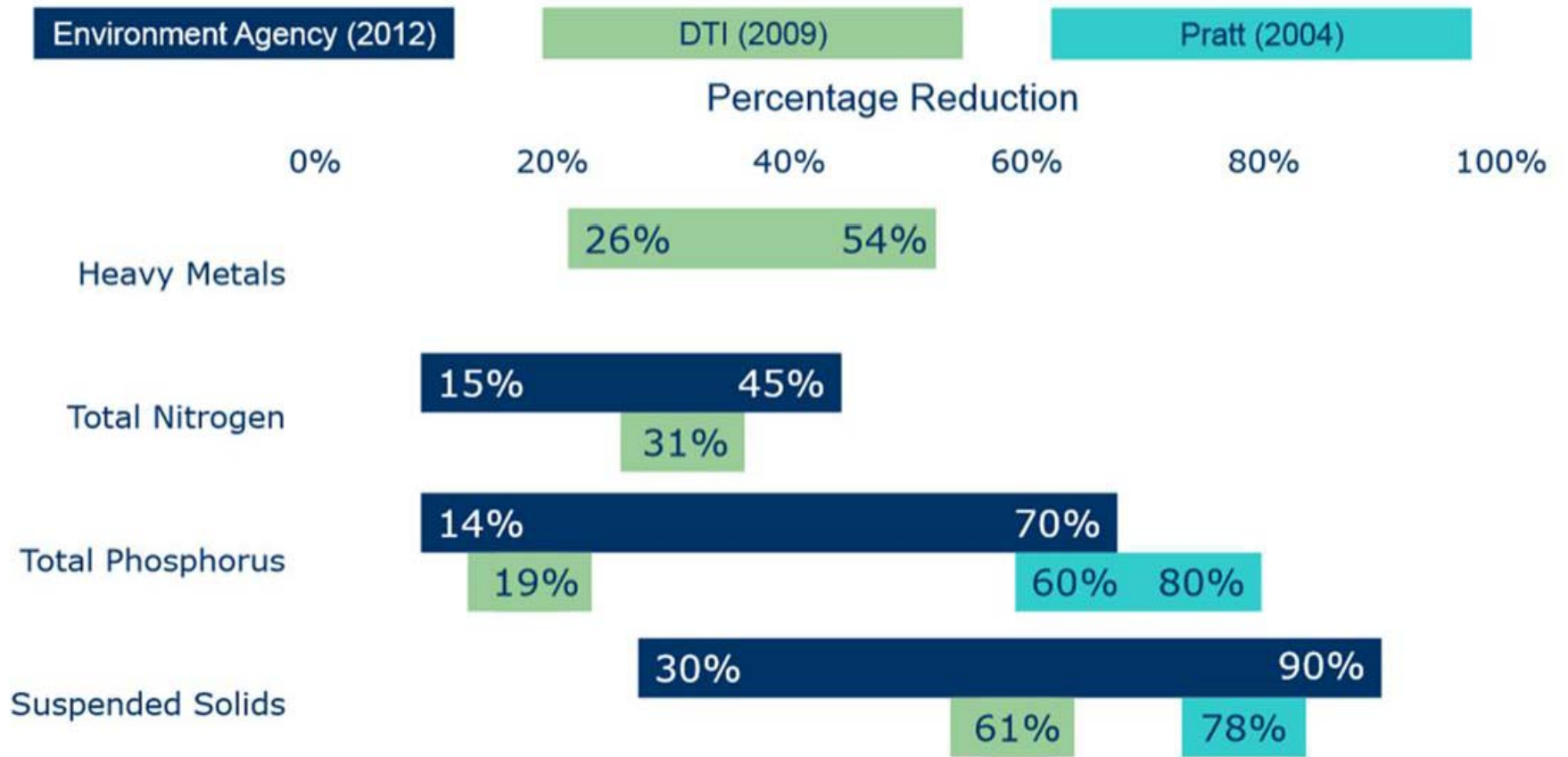
Also delivery improved water quality



2- Real impacts of NWRM

Detention Basins: Water Quality Improvement

Use of sand/gravel substrate to filter outflow can significantly reduce sediment delivery during storm events



2- Real impacts of NWRM

Lamb Drove SuDS Monitoring Project

Showcase project to demonstrate effectiveness of Sustainable Drainage Systems in residential developments

Long-term study

- Development completed in 2006
- Ongoing monitoring from 2006-2011
- Aim to investigate how SuDS perform

Promoted by Cambridge County Council

- Forward-thinking authority
- Keen to promote use of SuDS

Application of a range of SuDS techniques

- | | |
|----------------------|------------------|
| Rainwater harvesting | Permeable paving |
| Green roofs | Swales |
| Filter strips | Detention basins |
| Retention ponds | |

Comparison against a control site on same estate with no SuDS implemented

Lamb Drove SuDS Monitoring Project



2- Real impacts of NWRM

Lamb Drove SuDS Monitoring Project



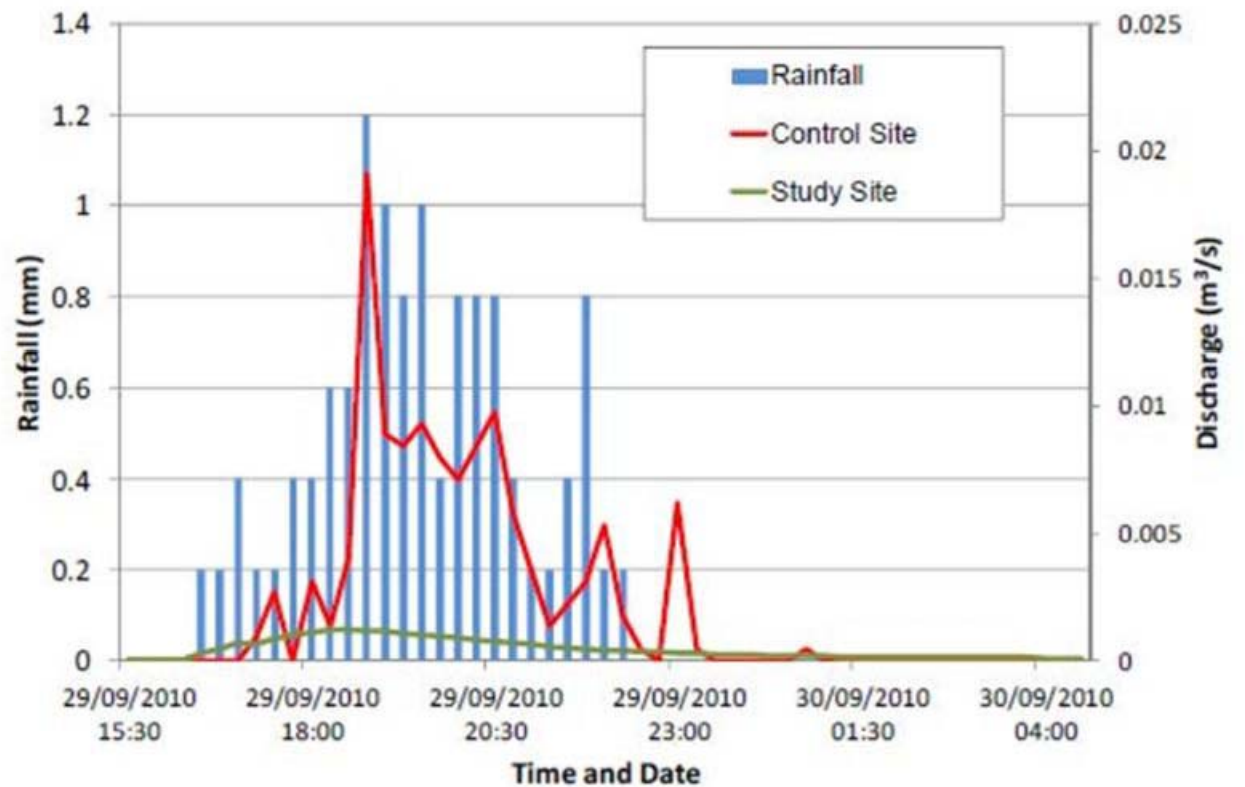
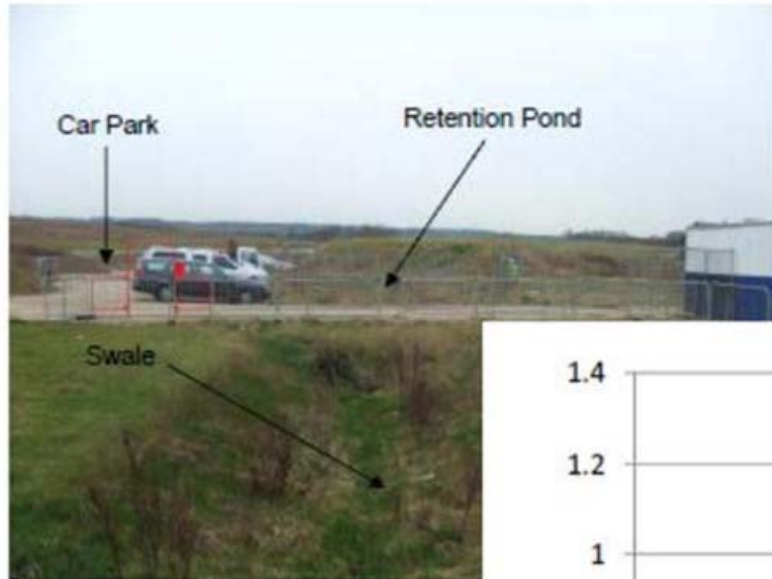
2- Real impacts of NWRM

Lamb Drove SuDS Monitoring Project



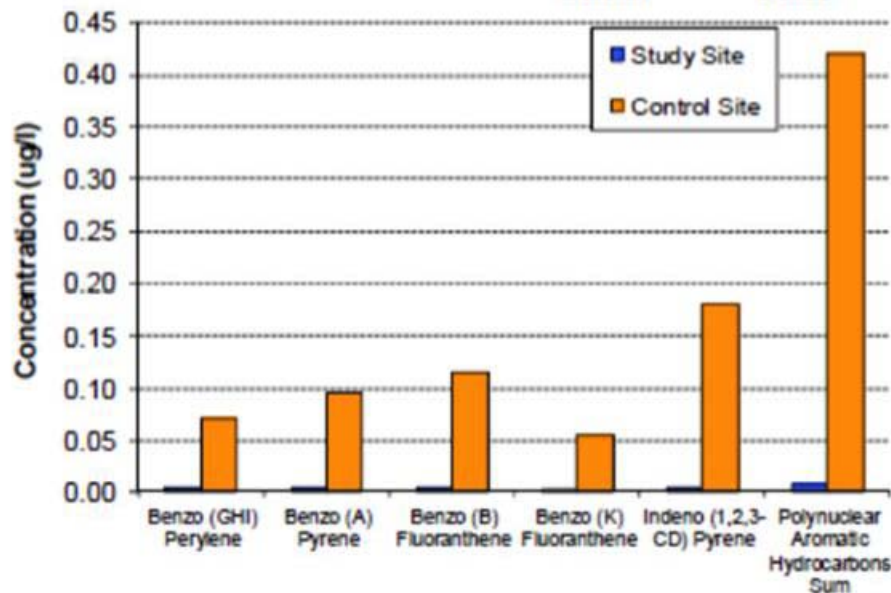
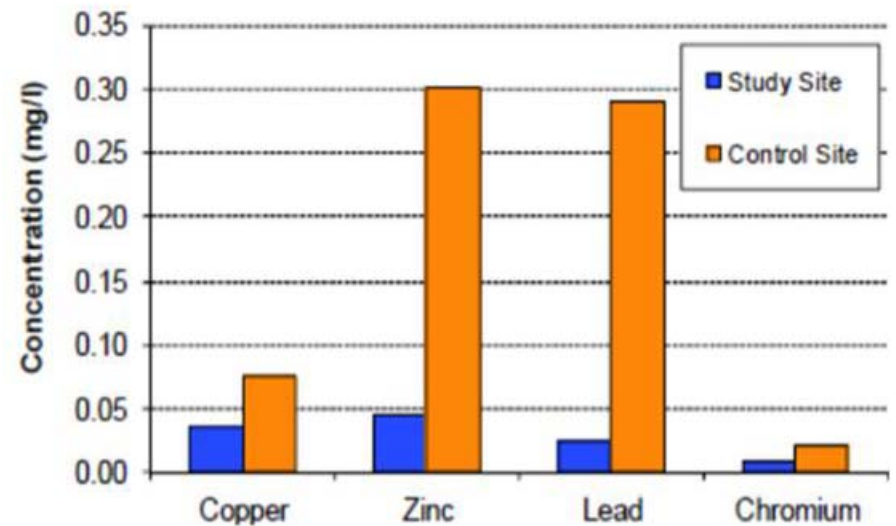
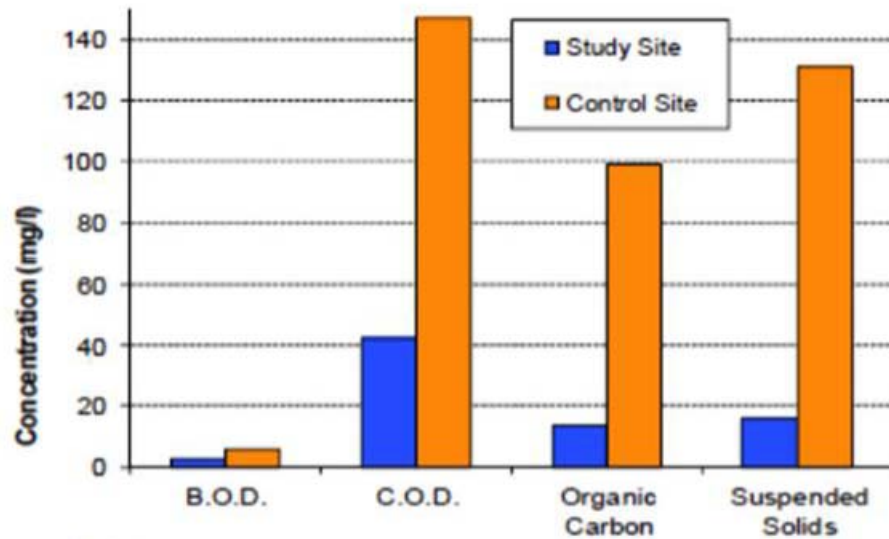
2- Real impacts of NWRM

Lamb Drove SuDS Monitoring Project



2- Real impacts of NWRM

Lamb Drove SuDS Monitoring Project



Comparison of water quality parameters summarised across multiple storm events

Significant impact of SuDS measures to filter pollutants from urban runoff

3- Summary

Evidence of biophysical impacts of SuDS shows that they work

- Effective in delivering runoff control that they are designed to provide
- Also effective at intercepting and filtering urban diffuse pollution

Understanding and demonstrating biophysical impacts allows us to understand the benefits of NWRM

- linking impacts to ecosystems services benefits & policy objectives

But what about €€€...

Thank you for attention

