Imperial College London

Deltares
Enabling Delta Life

eit Climate-KIC

Smart Sustainable Districts

Attractive resilient districts

using Blue Green Solutions

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SSD Webinar, 18 September 2017

Climate Resilient urban planning

Process

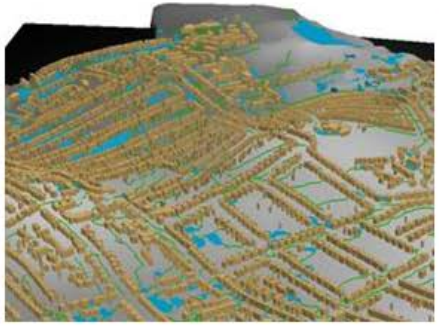
- Planning process
  - Blue Green Systems approach
  - Vulnerability analysis
  - Stakeholders
  - Collaborative planning

Tools

- Goal driven planning targets
- BGD - Adaptation Support Tool
-

Challenges our cities face

Flooding

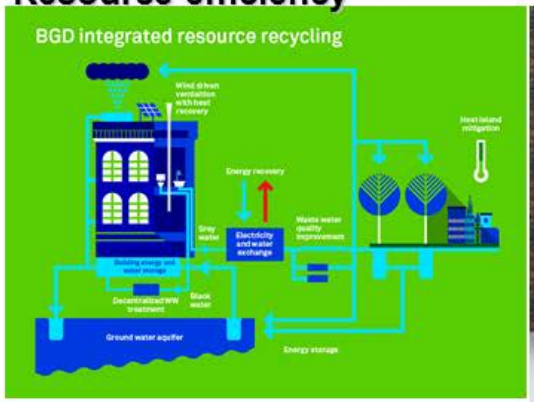


Water pollution

Droughts

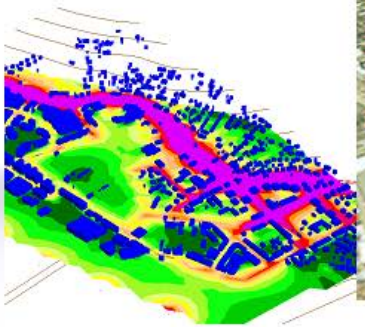
Air pollution

Resource efficiency

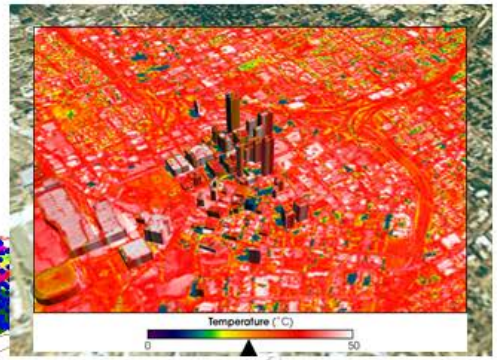


Crime

Noise



Urban Heat island



Blue Green Solutions

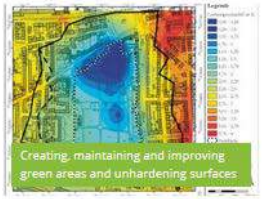
- **Blue Green Solutions** are urban interventions that use **vegetation** and **water** to achieve:
  - **sustainable and resilient solutions**
  - **cost-effective solutions**

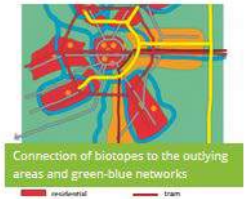


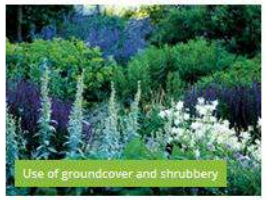


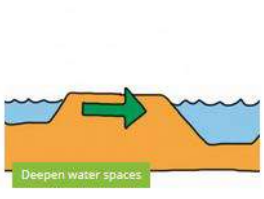

Process

Lots of measures can be taken









http://www.urbangreenbluegrids.com/design-tool/

Blue Green solutions have many functions

TREE FUNCTIONS

RESULTING SYNERGY BENEFITS

Urban heat island effect reduced	Building envelope cheaper	Reduced noise and air pollution
Outdoor air evaporative cooling	Surface flood risk reduction	Better conditions for pedestrians
Buildings more comfortable	Higher property value	Socialising more intensive
Buildings using less energy	Humans healthier	Water management more effective

A system is needed to get the best out of Blue Green Solutions

Blue Green (BG) Systems approach

A **framework** for resilient, sustainable and cost-effective urban development

Main features:

- **Systematic use of synergies**
- **Full quantification** of the benefits of BG solutions
- Extensive **stakeholder involvement**
- **Pre-planning for optimal design**

See the guide on http://bgd.org.uk

Systematic pre-planning methodology

Goal Driven Planning Matrix
Systematically defines requirements and resources

Interaction Matrix
Synergies identified and quantified

Overall result
Conceptual design brief with proposed concept solutions

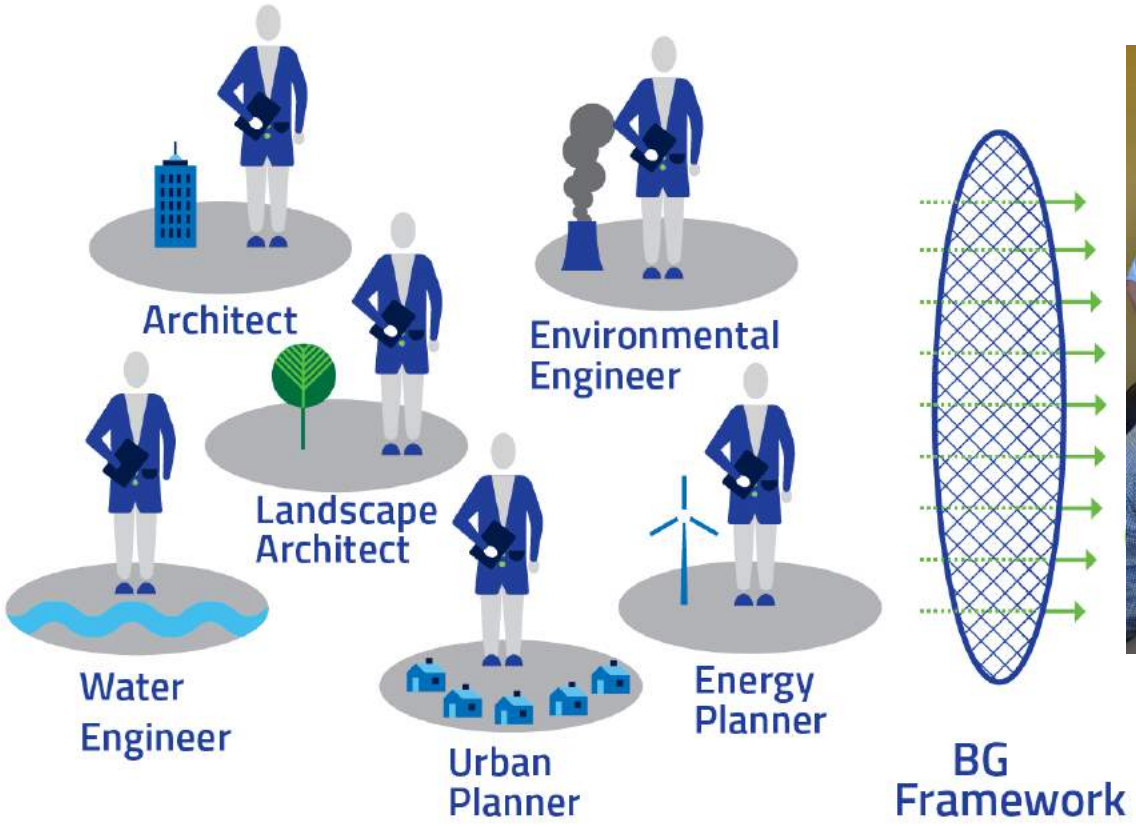
Cost Dependence Matrix
Potential capital cost reductions identified

Climate Resilience Matrix
Integration of resilience concept solutions

Goal Driven Planning Matrix example

	GOALS	TARGETS	FUNCTIONS / CONCEPTS	REQUIRED ANALYSES
1	Improve the attractiveness of the city for citizens and tourists	Boost housing in the inner city		Urban microclimate simulations (including greenery)
		Reopen the inner city to the functions of the river	FACILITIES	Solar loading and indoor comfort analysis
2	Make the city more resilient to climate extremes.	Strengthening historically significant spaces		Transport and mobility
		Profiling downtown for the "image effect"	INDICATORS	Urban flooding and resilience
3	Reduce the reliance on cars in the city center	Increase the quality of stay around the river	Outdoor Environmental Quality Indicators: 1. Thermal comfort; 2. Auditory comfort; 3. Visual comfort.	Acoustic and visual studies
		University accentuate more as an image factor		
4	….	Formation of focal points in the neighborhoods	Time spent outdoors (activities, cycling etc)	…
		strengthen the residential areas by upgrading apartment clearances	Expected number of yearly visitors	
		…	…	

Collaborative planning:
experts + local stakeholders



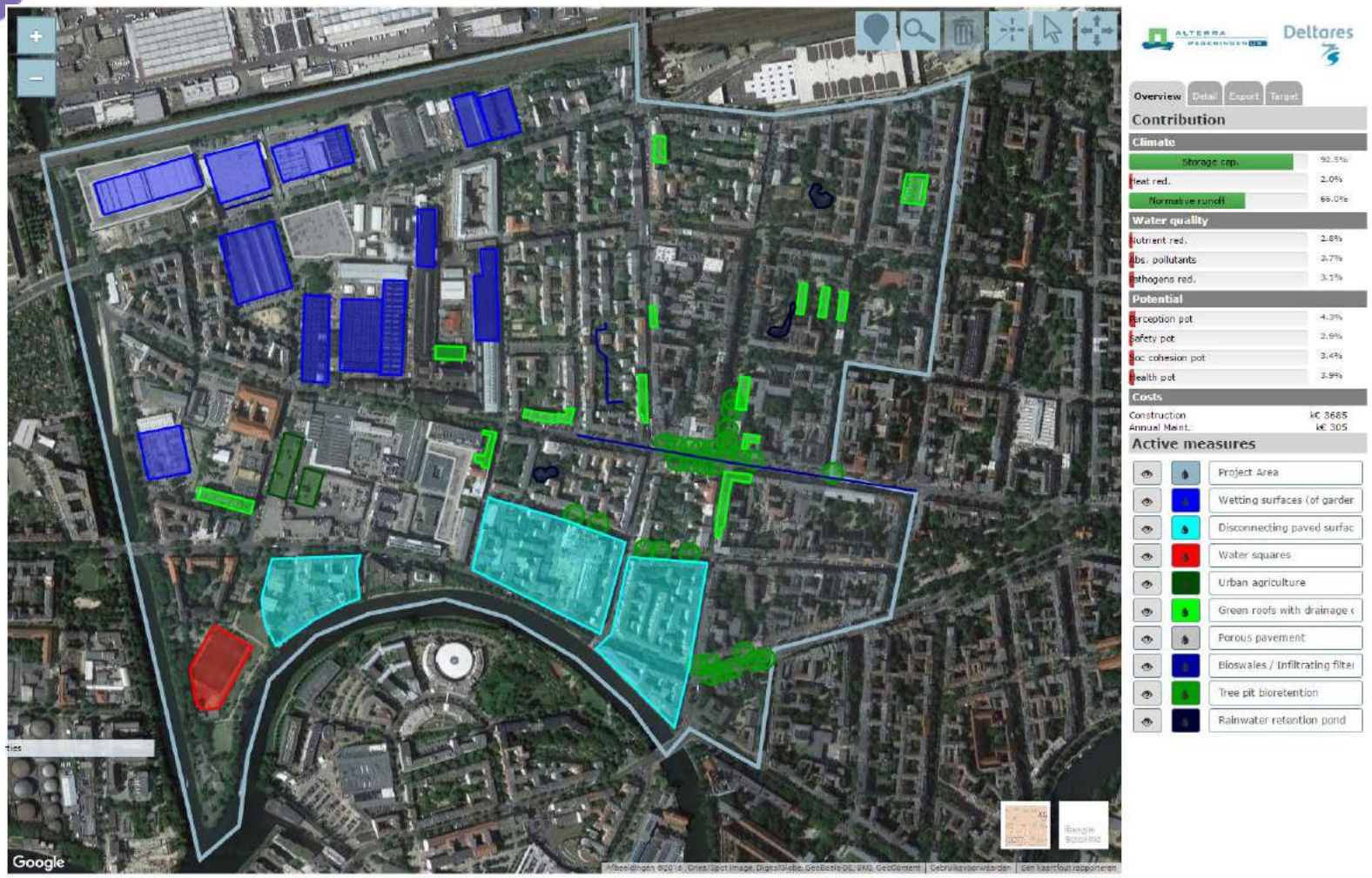
Tools

Adaptation Support Tool to see

- what can be done
- how effective that is

Adaptation Support Tool to see

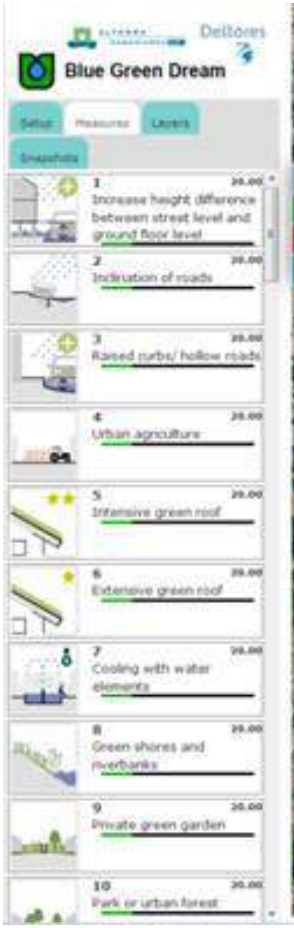
- what can be done where
- where and how effective that is



Planning workshop

Van de Ven, Frans H.M., Robbert P.H. Snep, Stijn Koole, Reinder Brolsma, Rutger van der Brugge, Joop Spijker, Toine Vergroesen (2016). Adaptation Planning Support Toolbox: Measurable performance information based tools for co-creation of resilient, ecosystem-based urban plans with urban designers, decision-makers and stakeholders, Environmental Science & Policy, http://dx.doi.org/10.1016/j.envsci.2016.06.010

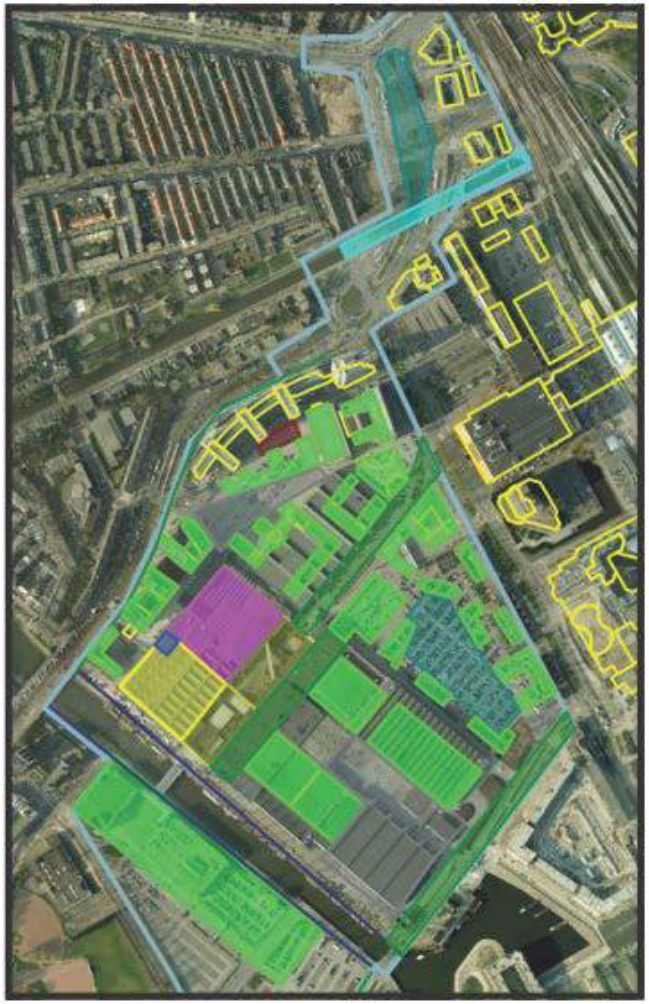
Resilience metrics



Resilience metrics can include:

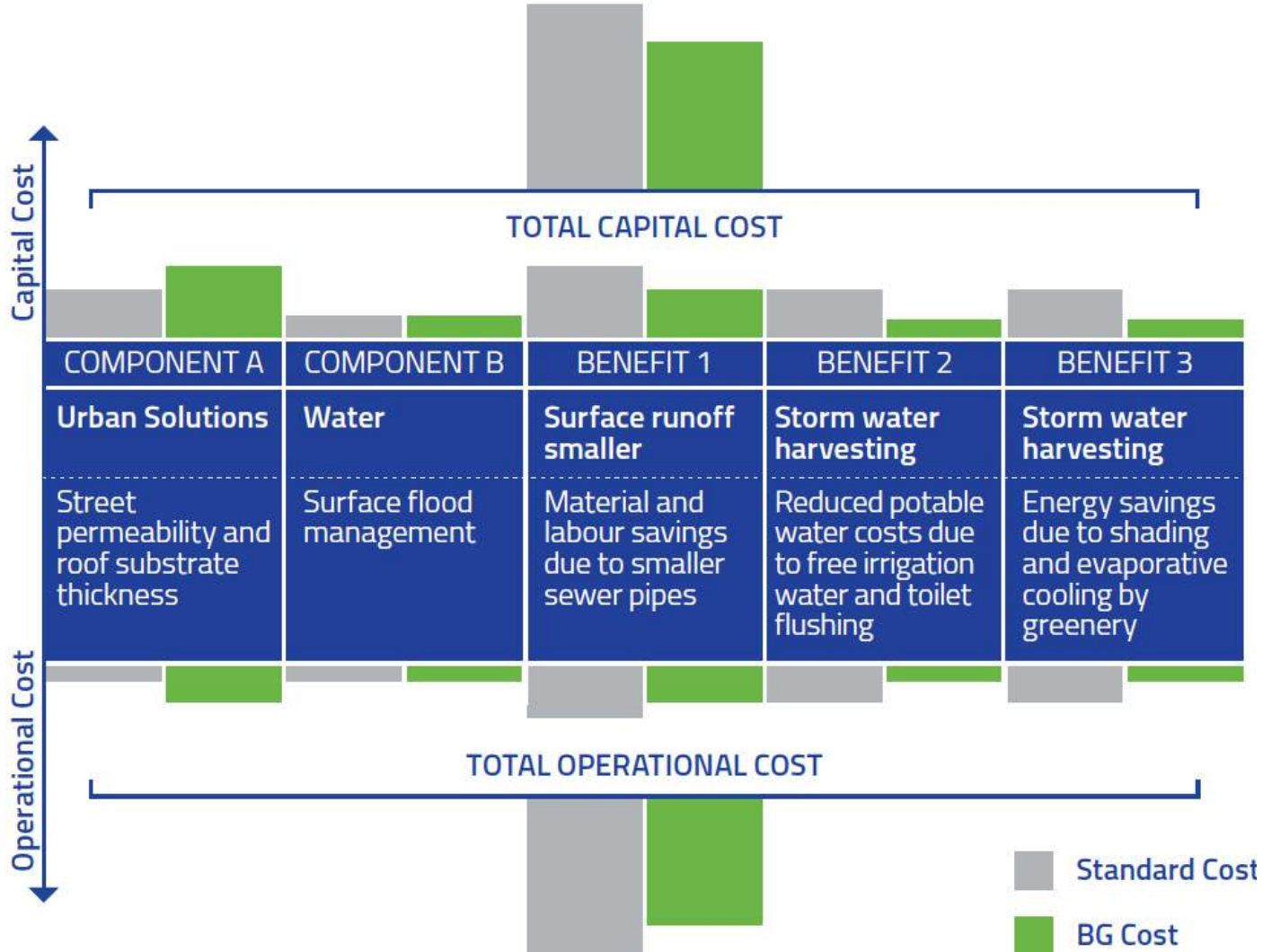
- Detention capacity
- Peak flow reduction
- Cooling effect
- Groundwater recharge
- Water quality improvement:
- Costs of implementation & maintenance
- Safety
- Health
- Social cohesion
- ….

Compare alternative plans performance



Van de Ven, F.H.M., P. Bosch, R.J. Brolsma, J.J. Kok, E.S. van der Meulen, F.E. Schasfoort, C.L. ten Velden, A.J.J. Vergroesen (2016) Green, comfortable, attractive and climate resilient Utrecht Centre-West area : Smart Sustainable Districts – deep dive Utrecht opportunity 3. Deltares/TNO report 1220357, http://publications.deltares.nl/1220357_000.pdf

Reducing capital and life-cycle costs + maximize benefits (cost dependence matrix)



Benefits

- Co-investment opportunities
- Fair distribution of costs and benefits

Distribution of benefits over the beneficiaries

Services/ Stakeholders	Municipality Utrecht	Water manager	Jaarbeurs	Residents	Travelers	Visitors	Other companies	Leisure companies
Climate adaptation								
Decrease pluvial flooding	+++	+++	++	++	+	+	++	++
Increase air quality	++		+	+++	+	+	+	+
Decrease heat stress	++		+	+++	+	++	+	+
Increase water quality*	+	+++		+		?		?
Replenish ground water**		++						
Climate mitigation								
Decreased energy use	+++		+++	+			++	++
Decreased CO2 emission	++		++					
Circular economy								
Increase lifetime of infrastructure***	+++							
Add to closing water cycle		++	+				+	+
Add to closing energy cycle****	+++		+++	+			++	++
Add to closing nutrient/resources cycle		??						
Other services								
Increase recreation opportunities	++		+++	+++	+	+++	+	+++
Increase landscape quality	+++		+++	+++	++	+++	++	+++
Increase social cohesion	+++			+++				
Increase physical activity	++			+++		++		
Decrease noise pollution	++		+++	+++		+		
Improve habitat function and biodiversity	++			++				
Increase food production								
Decrease criminality								
Decrease management & maintenance	+		+				+	+

?: only if water recreation is part of the new developments - in this case water recreationst and - companies will benefit

??: Financial benefits may be derived by the waste water treatment plants as costs are lower when water quality is higher

*: Only if there is demand for improved water quality and a substantial improvement is realized, this is a benefit

**: Only if there is currently a problem with the ground water level - unknown at the time of writing

***: Undertain effect, and not likely very strong

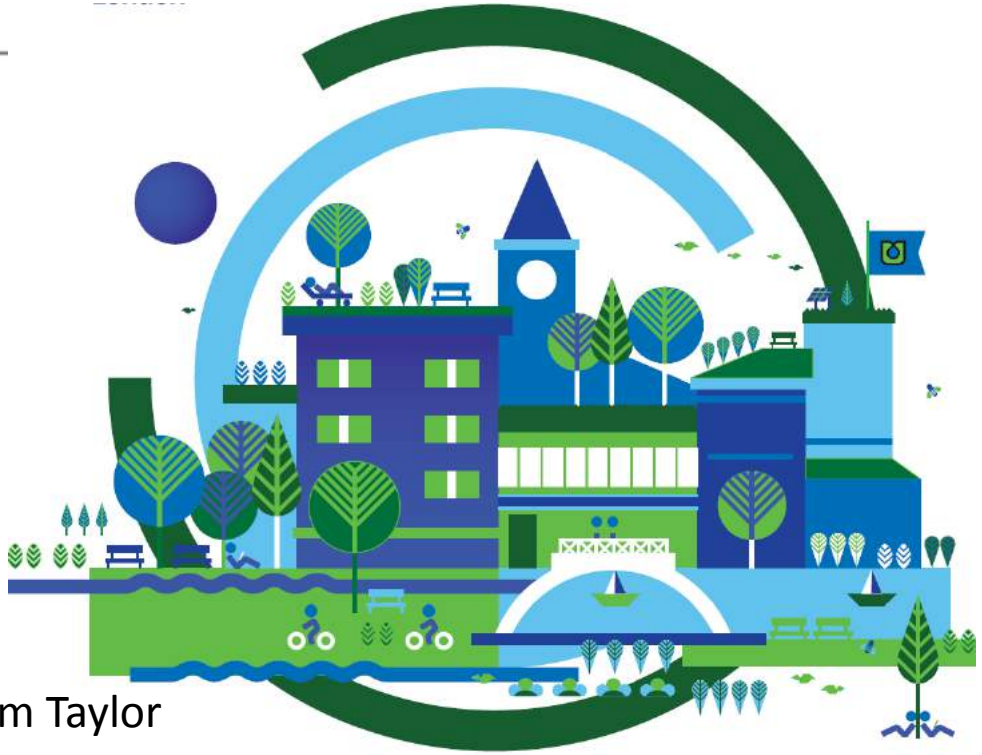
****: There is double counting here with 'decreased energy use'

Creating urban transitions together

- BG Systems Approach as a platform + tools to:
  - Collaboratively plan and design to maximise synergetic solutions
  - Optimise master plan costing and efficiency
  - Apply to any development or reconstruction project
  - Apply in conceptual (pre-)planning phase
  - **Tools have been proven beneficial for several projects**

There is a large potential to enhance new and retrofit projects by systematically using BGS planning

Blue Green Solutions



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