Functional Complexity

of SUDS/GI and Grey Infrastructure under flood conditions (including exceedance and inundation)

FACTSHEET

Project area: *System interactions of SuDS/GI (green infrastructure)*
Intended readership: *Practitioners, academics and other interest groups*

SuDS/GI can provide multiple functions, from stormwater management to carbon sequestration and green space accessibility. However, under flood conditions, SuDS/GI needs to perform hydrological functions as a priority, which may temporarily reduce other ecological and social functions. This factsheet highlights the interdependencies relating to SuDS/GI multi-functionality under flood conditions beyond the design capacity (including exceedance and inundation) and key impacts of SuDS/GI on the urban system.

Both SuDS/GI and traditional urban drainage systems/flood protection installations rely on multiple urban components to perform their **hydrological function** (Figure 1). Their performance under controlled exceedance is strongly affected by other components in the network and by the flows, debris and pollutants the system carries. Flood protection installations under uncontrolled inundation often receive and transmit flows from surrounding land and watercourses and therefore exhibit strong **geographical i**nterdependency with the neighbouring infrastructure. Conventional piped systems may also require energy for pumping and operation thus bearing **physical** interdependency to the energy system.

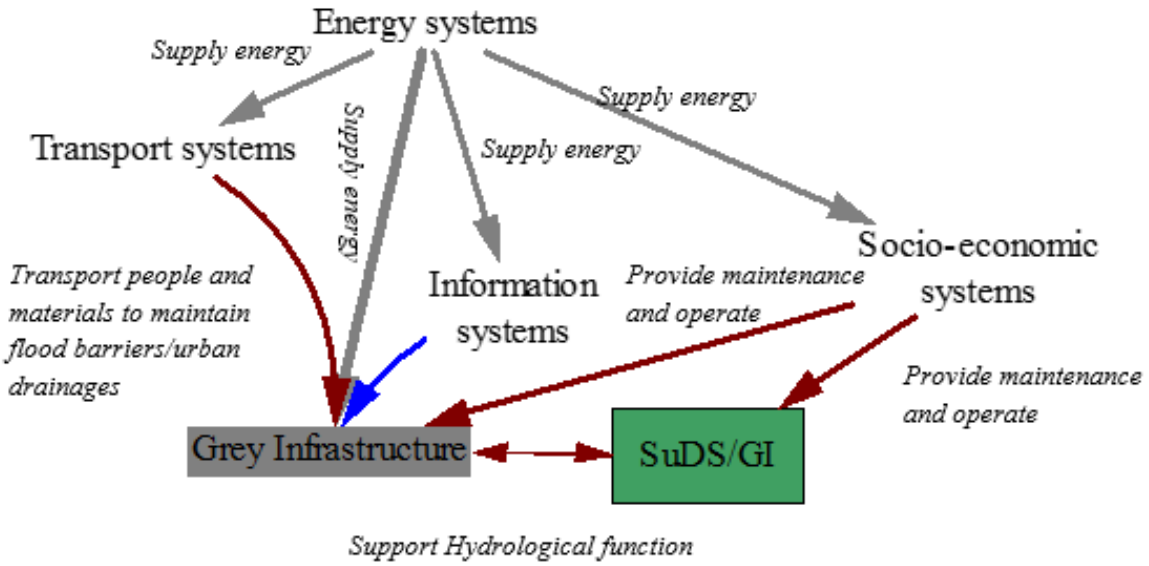

Figure 1 *Examples of interdependencies of grey infrastructure and SuDS/GI to perform their hydrological function under flood conditions. Grey arrows represent physical interdependencies, brown arrows represent logical interdependencies and blue arrows represent cyber interdependencies*

However, since SuDS/GI also provide other social and ecological functions, there are impacts to connecting systems and potential compromises on other functions, including health and transport. Table 1 shows the impacts of SUDS/GI on the urban system under the flood condition, including during controlled exceedance and uncontrolled flood inundation.

Table 1

Systems	SuDS/GI	
	Controlled exceedance	**Uncontrolled flooding**
Water supply (sources)	✓ Facilitate water infiltration enhancing groundwater recharge ✓ Pollutant and sediment sink, hence: ✓ Reduce contamination risks on water sources × Might prolong attenuation flows, affect minimum flows of receiving waters × Might affect local groundwater quality and flood mounding	× Might transmit pollutants to surrounding areas when surface storage is surpassed × Might prolong attenuation flows, affect minimum flows of receiving waters × Might affect local groundwater quality and flood mounding
Wastewater (conveyance and treatment)	✓ Relieve pressure on downstream treatment ✓ Reduce pollutant loads	× Might increase debris load and blockage on the urban drainage system
Food and agriculture	✓ Reduce crops contamination and livestock impacts due to pollutant reduction × May require short term flooding of marginal land	× Might spread pathogen and pest risks previously contained
Transport	× Might affect traffic due to changes in available road surfaces and car parks × Roads as flow pathways × Ice risk under low temperature	✓ Mitigate sediment load and flows on key roads × Potential to affect network connectivity due to fallen leaves / branches or sites being used for flood purposes
Health	✓ Reduce widespread health risks due to restricting and treating pollutants at sources × Potential for creating unpleasant smells, allergy or health risks due to rotten leaves/trees or pollens × Possible exposure to waterborne diseases	× Might increase health risks to surrounding areas due to pathogens and pests when surface storage is surpassed × Risks of physical impacts from branches and trees falling due to weakened soil structure × Danger from drowning at amenity sites
Energy	n/a	× Fallen branches might affect power lines
Communication	n/a	× Fallen branches might affect network connectivity
Social	× Potential for temporarily disabling the use of social amenities × Increase the visibility of exposure to floods × May add to insurance risk	× Further disrupt the functioning of social amenities due to more sites being inundated × Can induce psychological impacts due to fear of falling tree branches and pest risks
Ecology	✓ Act as a refugia for wildlife species × Might disturb the existing ecosystem	× Might spread pest or water-borne diseases onto other ecosystems
Economic	✓ Reduce economic impacts via reducing pollution and exceedance risks to property	✓ May reduce flood damages but × Could also increase costs regarding subsequent maintenance and other impacts

Overall, SuDS/GI offers additional benefits but also potential impacts in the flood condition, and this needs to be addressed in the design and implementation process.

***For further information see**: Hoang & Fenner (2015) System interactions of stormwater management using sustainable urban drainage systems and green infrastructure. Urban Water Journal, DOI:10.1080/1573062X.2015.1036083.*

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