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Green Factor Tool for climate smart and diverse city blocks

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Integrated Stormwater Management
www.integratedstormwater.eu

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Picture: Viliina Evokari

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What is the Green Factor

A practical tool for urban planning

→ ensures sufficient green infrastructure when building new blocks in a dense urban environment

$$\text{Green factor} = \frac{\text{Scored green area}}{\text{Lot area}}$$

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Benefits of green infrastructure

A vital role in the adaptation to climate change

- Reduces the risk of flooding
- Reduces air pollution
- Reduces noise
- Reduces soil erosion
- Cools urban heat islands of built environments
- Reserves carbon dioxide
- Increases wellbeing in urban environments

Picture: Elisa Lähde

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Green Factor in Helsinki

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Helsinki Green Factor

- Developed in the Climate-proof City (ILKKA) – Tools for Planning project in 2013 (EPECC and FCG)
- Updated in the iWater project 2017
- Other Green Factor methods : Berlin, Malmö, Stockholm, Seattle and Toronto
- Adopted in 6 iWater cities: Riga, Jelgava, Tartu, Turku, Gävle and Söderhamn

Ilmastonkestävän kaupungin
suunnitteluopas

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Green Factor in Helsinki city planning

Green factor is made as requirement in the zoning regulations of the detailed plan

Block specific plans by the developer
→ the landscape architect or garden designer calculates the Green Factor of the block

The score card from the Green Factor tool is attached to building permit
→ Building control oversees that the target level is reached

The target levels are defined in the Green Factor tool

Target level depends on the land use type

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The Green Factor Excel Tool

Basic structure of the tool

Five Excel-sheets

- Instructions
- Limitations
- Green Factor (elements)
- Results
- iWater Toolsheets

The tool guides the user step-by-step through the calculation.

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Limitations

The land use type defines the target level

Target level
0,9
Block ID
33397
Lot ID
1
Site area, m^2
4910
Building footprint, m^2
2096
Floor area, m^2
7000
Ratio of building footprint to site area
0,4
Ratio of floor area to site area
1,4

Limitations	No.	Question	Response
Land use	1	*Residential*	◉
		Services and Offices	○
		Commercial	○
		Industrial/logistics	○
Yard type	2	*Share of rooftop courtyard over 50 %*	◉ Yes ○ No
Drainage system	3	*Can the site be connected to a separate drainage system?*	○ Yes ◉ No
Surrounding region	4	*Is there a green corridor comprising a nature reserve/body of water/natural vegetation located within ≤ 50 m of the site?*	◉ Yes ○ No
Soil/groundwater	5	*Is there at least 1 m of permeable soil between surface and any impermeable soil, bed rock or groundwater level?*	◉ Yes ○ No
Stormwater management solutions	6	*What is the estimated average/effective depth [1] of a detention/retention element [2] ? (Area * Depth = estimated capacity)*	0,3
	7	*What is the estimated average/effective depth [1] of a biofiltration element? (Area * Depth = estimated capacity)*	0,25
	8	*If it is possible to provide a share of the necessary storm water retention capacity outside the block/lot, how big is the share (%)?*	20

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Green Factor (elements)

40 different elements

Five element groups:

- Preserved vegetation and soil
- Planted/new vegetation
- Pavements
- Stormwater elements
- Bonus elements

Element group	Element description
Preserved vegetation and soil	Preserved large (fully grown > 10 m) tree in good condition, at least 3 m (25 m² each)
	Preserved small (fully grown ≤ 10 m) tree in good condition, at least 3 m (15 m² each)
	Preserved tree in good condition (1.5–3 m) or a large shrub (3 m² each)
	Preserved natural meadow or natural ground vegetation
More info	Preserved natural bare rock area (at least partially bare rock surface, not many trees)
Planted/new vegetation	Large tree species, fully grown > 10 m (25 m² each)
	Small tree species, fully grown ≤ 10 m (15 m² each)
	Large shrubs (3 m² each)
	Other shrubs
	Perennials
	Meadow or dry meadow
	Cultivation plots
	Lawn
	Perennial vines (2 m² each)
More info	Green wall, vertical area
Pavements	Semipermeable pavements (e.g. grass stones, stone ash)
	Permeable pavements (e.g. gravel and sand surfaces)
More info	Impermeable surface (calculated automatically)
Stormwater management solutions	Rain garden (biofiltration area) with a broad range of layered vegetation
	Intensive green roof / roof garden, depth of substrate 20 – 100 cm
	Semi-intensive green roof, depth of substrate 15 – 30 cm
	Extensive green roof, depth of substrate 6-8 cm
	Infiltration basin or swale covered with vegetation or aggregates (no permanent pool of water
	Infiltration pit (underground)
	Pond, wetland or water meadow with natural vegetation (permanent water surface at least pa remains moist)
	Retention or detention1) basin or swale covered with vegetation or aggregates (permeable so
	Retention or detention1) pit, tank or cistern (underground, notice units: volume!)
More info	Biofiltration basin or swale
Bonus elements, max score 1 per category	Capturing stormwater from impermeable surfaces for use in irrigation or directing it in a contr
	Directing stormwater from impermeable surfaces to constructed water features, such as pond
	Shading large tree (25 m² each) on the south or southwest side of the building (especially decid
	Shading small tree (15 m² each) on the south or southwest side of the building (especially deci
	Fruit trees or berry bushes suitable for cultivation (10 m² each)

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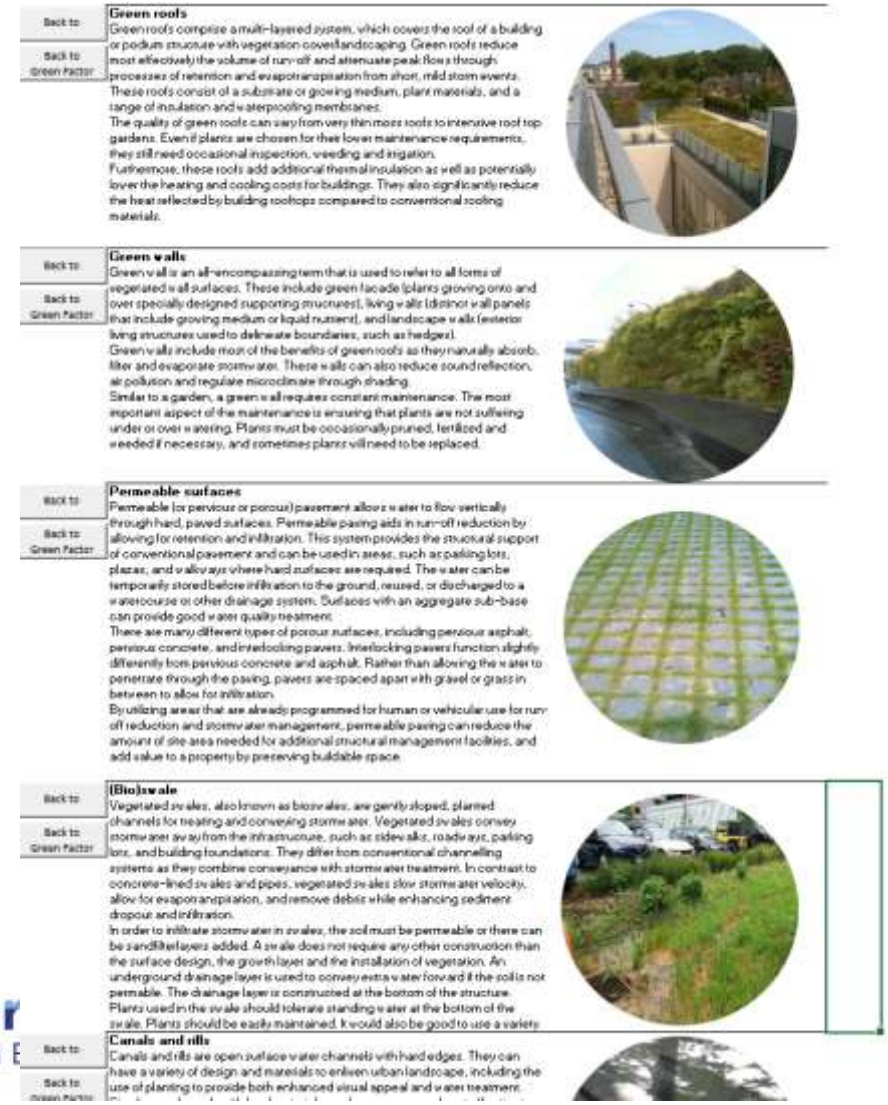
iWater Toolsheet

Brief descriptions of selected stormwater elements



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Green roofs

Green roofs comprise a multi-layered system, which covers the roof of a building or podium structure with vegetation cover/landscaping. Green roofs reduce most effectively the volume of run-off and attenuate peak flows through processes of retention and evapotranspiration from short, mild storm events. These roofs consist of a substrate or growing medium, plant materials, and a range of insulation and waterproofing membranes.

The quality of green roofs can vary from very thin moss roofs to intensive roof top gardens. Even if plants are chosen for their lower maintenance requirements, they still need occasional inspection, weeding and irrigation.

Furthermore, these roofs add additional thermal insulation as well as potentially lower the heating and cooling costs for buildings. They also significantly reduce the heat reflected by building rooftops compared to conventional roofing materials.

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Green walls

Green wall is an all-encompassing term that is used to refer to all forms of vegetated wall surfaces. These include green facade (plants growing onto and over specially designed supporting structures), living walls (distinct wall panels that include growing medium or liquid nutrient), and landscape walls (exterior living structures used to delineate boundaries, such as hedges).

Green walls include most of the benefits of green roofs as they naturally absorb, filter and evaporate stormwater. These walls can also reduce sound reflection, air pollution and regulate microclimate through shading.

Similar to a garden, a green wall requires constant maintenance. The most important aspect of the maintenance is ensuring that plants are not suffering under or over watering. Plants must be occasionally pruned, fertilized and weeded if necessary, and sometimes plants will need to be replaced.

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Permeable surfaces

Permeable (or pervious or porous) pavement allows water to flow vertically through hard, paved surfaces. Permeable paving aids in run-off reduction by allowing for retention and infiltration. This system provides the structural support of conventional pavement and can be used in areas, such as parking lots, plazas, and walkways where hard surfaces are required. The water can be temporarily stored before infiltration to the ground, reused, or discharged to a watercourse or other drainage system. Surfaces with an aggregate sub-base can provide good water quality treatment.

There are many different types of porous surfaces, including pervious asphalt, pervious concrete, and interlocking pavers. Interlocking pavers function slightly differently from pervious concrete and asphalt. Rather than allowing the water to penetrate through the paving, pavers are spaced apart with gravel or grass in between to allow for infiltration.

By utilizing areas that are already programmed for human or vehicular use for run-off reduction and stormwater management, permeable paving can reduce the amount of site area needed for additional structural management facilities, and add value to a property by preserving buildable space.

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(Bio)swale

Vegetated swales, also known as bioswales, are gently sloped, planted channels for treating and conveying stormwater. Vegetated swales convey stormwater away from the infrastructure, such as sidewalks, roadways, parking lots, and building foundations. They differ from conventional channelling systems as they combine conveyance with stormwater treatment. In contrast to concrete-lined swales and pipes, vegetated swales slow stormwater velocity, allow for evapotranspiration, and remove debris while enhancing sediment dropout and infiltration.

In order to infiltrate stormwater in swales, the soil must be permeable or there can be sand/filter layers added. A swale does not require any other construction than the surface design, the growth layer and the installation of vegetation. An underground drainage layer is used to convey extra water forward if the soil is not permable. The drainage layer is constructed at the bottom of the structure.

Plants used in the swale should tolerate standing water at the bottom of the swale. Plants should be easily maintained. It would also be good to use a variety

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Canals and rills

Canals and rills are open surface water channels with hard edges. They can have a variety of design and materials to enliven urban landscape, including the use of planting to provide both enhanced visual appeal and water treatment.

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Results – Score card

Achieved Green Factor

Amount of stormwater handled on the lot

Results are given in graphics and tables

Score card

Date 2.2.2019

Block ID 33397

Lot ID 1

Green Factor calculation

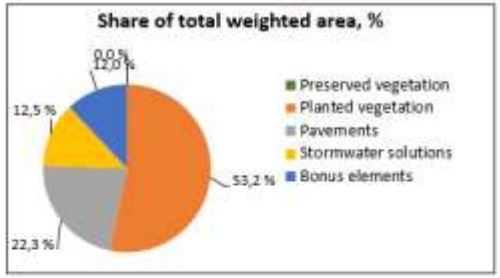
Green Factor	0,90
Target level	0,90

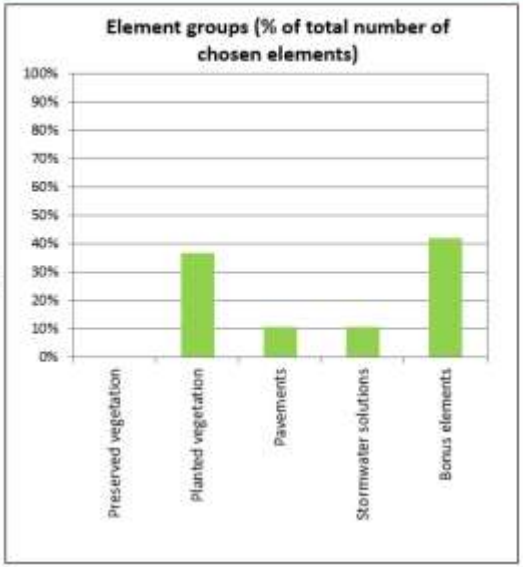
Stormwater volume m³	
33,1	
Average runoff coefficient C	Possibility to retain stormwater outside block/lot
0,7	Yes
Necessary retention vol. m³ on the lot	
26,5	
Retention volume of chosen elements m³	Remaining retention demand m³
28,0	0,0
Share of total impermeable surface	
58 %	

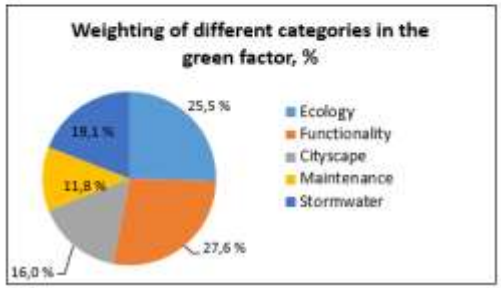
Elements included in the green factor

Element group	Elements filled	Total number of elements in group
Preserved vegetation	no elements!	5
Planted vegetation	7	10
Pavements	2	2
Stormwater solutions	2	9
Bonus elements	8	12
Total	19	38

Comments







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Green Factor materials


DEVELOPING THE CITY OF HELSINKI
GREEN FACTOR METHOD

Report summary

English summary of the original report in Finnish Viherkerroinmenetelmän kehittäminen Helsingin kaupungille by Elina Inkiläinen (EPECC), Topi Tähonen (EPECC) and Eeva Eltsi (FCG)

City of Helsinki Environment Centre
Helsinki 2016

www.integratedstormwater.eu/content/green-area-factor-and-other-tools

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Take home message

Green Factor is a user friendly and flexible planning tool that helps cities adapt to climate change by ensuring sufficient green infrastructure in new building blocks.

Pictures: Elisa Lähde

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Thank you!

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