# The Nature Smart Cities Business Model

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# Today's Webinar



**Interviews** with Green Infrastructure implementers from Local Authorities

Review of **finance options** for Green Infrastructure

**Geographical, Biophysical & Economic Data**

Review of existing Green infrastructure **valuation tools**

**New Business Model for Local Authorities to invest in Green Infrastructure**

**Test Business Model in 7 Green Infrastructure Pilots**

**Step-by-Step Methodology** for Local Authorities to apply the Business Model

4. BUSINESS MODEL

**NATURE SMART CITIES**
ACROSS THE 2 SEAS

# The Nature Smart Cities Business Model
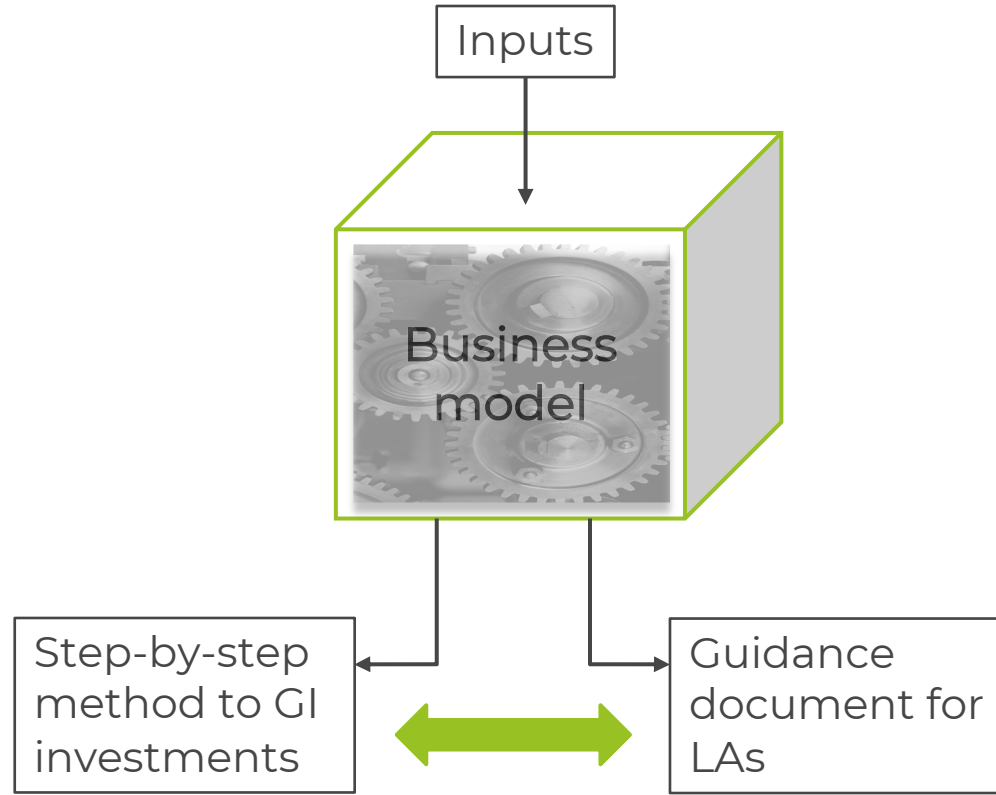
BUSINESS MODEL

Excel
tool

Guidance
Document

+ Demonstration videos

# What does the business model consist of?

# Input required

1.  Information on type and amount of GI

    Number of trees?

    $m^2$ flowerfield?

    $m^2$ grassland?

2.  Extra parameters
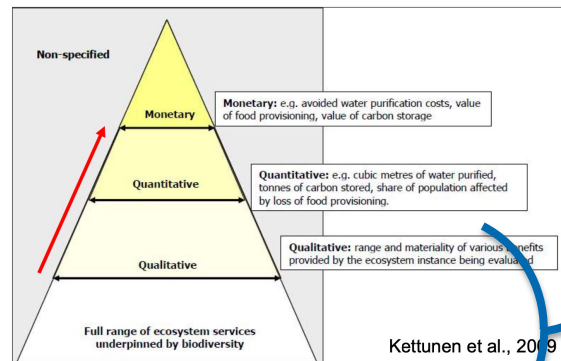
    Number of people living in project area?

    Average annual rainfall?

    Average price of electricity?

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# Business Model tool: the steps

- Step 0: Project description
- Step 1: Selection of ESS
- Step 2: Parameters selection
- Step 3: Qualification
- Step 4: Quantification
- Step 5: Monetization (costs and benefits)
- Step 6: Summary & preview factsheet



Non-specified

Monetary

**Monetary:** e.g. avoided water purification costs, value of food provisioning, value of carbon storage

Quantitative

**Quantitative:** e.g. cubic metres of water purified, tonnes of carbon stored, share of population affected by loss of food provisioning.

Qualitative

**Qualitative:** range and materiality of various benefits provided by the ecosystem instance being evaluated

Full range of ecosystem services underpinned by biodiversity

Kettunen et al., 2009

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# Step 0: Project description

- General characteristics of project area

- Current situation?

- Information about types and amounts of GI

| Background information | | | | |
|---|---|---|---|---|
| **Characteristics of the target area** | | | **Description of the target area** | |
| **Country** | Netherlands | | Wemeldinge is a village in the municipality of Kapelle, a municipality in the South-West of the Netherlands. Occasional pluvial flooding occurs in the village after heavy rain showers, due to an aged sewerage system and limited water buffering capacity. | |
| **Municipality** | Kapelle | | | |
| **My project area can be qualified as** | Town or suburb | | | |
| **Surface of the project area** | 110.000 m2 | | | |
| **Number of people living in project area** | +/-477 | | | |
| **Defining your (public) green/blue/grey infrastructure** | | | | |
| | **Public green/blue elements** | **Type** | **Amount (or surface)** | **Description** |
| **Baseline Scenario** (fill in the amount of green, grey and blue infrastructure before engaging in a GI project) | Single and park-related trees | single deciduous tree (>12m) | 69 | |
| | Single and park-related trees | Shrubby plants = middle green | 650m2 | |
| | urban green space | amenity grassland / lawn | 4795 m2 | |
| | Grey infrastructure | Impermeable surface | 12695 m2 | |
| **Scenario 1: Grey scenario** (fill in the total amount of green, grey and blue infrastructure, old and new infrastructure) | Grey infrastructure | Sewage expansion | ? | |
| | Single and park-related trees | single deciduous tree (>12m) | 69 (=2324m2) | |
| | Single and park-related trees | Shrubby plants = middle green | 650m2 | |
| | urban green space | amenity grassland / lawn | 4795 m2 | |
| | Grey infrastructure | Impermeable surface | 12695 m2 | |
| **Scenario 2: Green +** (fill in the total amount of green, grey and blue infrastructure, old and new infrastructure) | Single and park-related trees | single deciduous tree (6-12m) | 78 | |
| | Single and park-related trees | Shrubby plants = middle green | 1068m2 | |
| | urban green space | amenity grassland = lawn | 3374m2 | |
| | (Semi-)permeable surface | semi-permeable grow-through pavers | 7704m2 | |
| | Grey infrastructure | impermeable surface | 4988m2 | |
| | Grey infrastructure | Sewage expansion | ? | |
| | Sustainable drainage systems | filter (buffer) strips or swales | 889m2 | |
| | urban green space | flower field/tall grass | 719m2 | |

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# Step 1: Selection of ESS

| | Ecosystem services | Include in assessment? | Description |
|---|---|---|---|
| Provisioning | Food | NO | There is a citizen request for fruittrees instead of usual trees. The municipality of Kapelle is thinking about a way to make this possible. |
| | Materials | NO | The municipality is looking into the possibilities to use old trees for street furniture. |
| Regulating | Carbon sequestration (global climate regulation) | YES | Because green plants take carbon dioxide (CO2, an important greenhouse gas) out of the air via photosynthesis. More trees, plants and suds have a positive impact against climate change. Trees absorb and store carbon. |
| | Micro climate regulation (local climate regulation) | YES | By introducing more green space in the area the municipality is aiming to reduce the heat island effect. |
| | Noise pollution | NO | |
| | Water retention and infiltration | YES | One of the main goals of the project is the reduction of pluvial flooding. In the realisation of the project sea-level rise is an issue, because of underflow from the Eastern Scheldt. The municipality also aims to create awareness by the inhabitants that the problem can't be solved by the municipality alone and that the inhabitants have a role in water management. |
| | Air filtering | NO | More green infrastructure means better air quality. |
| Supporting | Habitat for biodiversity (plants & animals) | YES | By using the right plants the municipality aims to support the local biodiversity year long. Providing necessary needs for insects and other species. |
| | aesthetic appreciation | YES | The municipality aims to make the green area in the neighbourhood easy accessible and a playground for children. Green infrastructure in an area has a positive effect on the psychological and emotional wellbeing of inhabitants. |
| Cultural | Physical and mental health (jogging, playing, etc.) | NO | The municipality aims to stimulate children to play outside in a natural environment |
| | Recreation and tourism by external visitors | NO | |
| | Real estate prizes | NO | |
| | Education and raising awareness | YES | The involvement of the primary school has an educational function, but also is aimed tTo create awareness climate related issues at a young age. By creating a climate adaptive neighbourhood the municipality also aims to raise awareness by inhabitants of the effects of climate change. |
| | Social cohesion | NO | |
| | Attractor for companies and investments | NO | |
| Extra | (if necessary, fill in other relevant ESS) | / | |

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# Step 2: Parameters selection

- Extra information
- Depends on ESS chosen in previous step

| ESS | Nessesary data for calculations | Value |
|---|---|---|
| **Water runoff retention** | average yearly rainfall in m^3 | 900 mm |
| | | |
| | | |
| **Microclimate regulation** | average number of hot days (+20°C) | (fill in) OR (generic data) |
| | average number of tropical days (+29°C) | (fill in) OR (generic data) |
| | price of electricity | (fill in) OR (generic data) |
| | Number of houses in neighbourhood | 191 |
| | inhabitants | 477 |
| | | |
| **Carbon sequestration** | Current year | 2021 |
| | | |
| | | |
| **Habitat for biodiversity** | See tab S3.1 and S3.2 for biodiversity assessment | (fill in tab S3.1 and S3.2) |
| | | |
| | | |
| | | |
| **Aesthetic appreciation** | Is the primary intention of the GI project to promote tourism or to improve the neighbourhood? | Neighbourhood |
| | | |
| | Do the changes make the area/city a more attractive place to live? | yes |
| | Do the changes encourage outside activities? | yes |
| | Would you describe the changes in the area/city aesthetically pleasing? | yes |
| | | |
| **Awareness raising/Education** | Are there one or more signs/boards with information? | No |
| | Were local residents involved in the process of designing the GI project? | yes |
| | Were local residents informed of the benefits of GI? | yes |
| | Is there a website/social media account with information about the GI project? | yes |
| | | |

# Step 3: Qualification
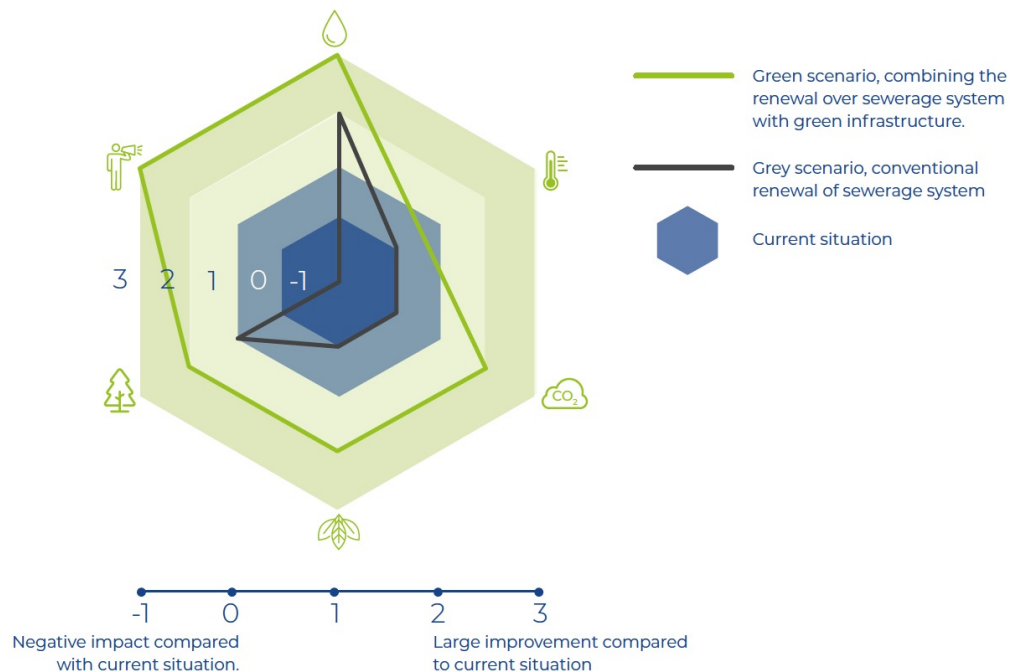


Green scenario, combining the renewal over sewerage system with green infrastructure.

Grey scenario, conventional renewal of sewerage system

Current situation

3   2   1   0   -1

-1   0   1   2   3

Negative impact compared with current situation.

Large improvement compared to current situation

**Aesthetic appreciation**

✓ Increased functional green space makes Wemeldinge a more attractive place to live.

✓ Green space encourages cycling and walking.

✓ Green areas and wadis will encourage children's outdoor play.

# Step 4: Quantification

**Water run-off reduction**

**Grey** ⟷ **Green**

0 m3/year by grass road verges     4300 m3/year

**Micro climate regulation**

**Grey** ⟷ **Green**

0 °C     -0,09 °C

**Carbon Sequestration**

**Grey** ⟷ **Green**

0 tonne $CO^2$ by 2060     135 ton $CO^2$ by 2060

# Step 5: Monetization (costs and benefits)

| Choose an exchange rate (if not €) | 1 |
|---|---|
| Cost calculation | MIN |

| COSTS | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Construction cost | | | | | | Maintenance cost / year | | | | | |
| Baseline Scenario | LB | UB | Custom Value | Units | Total Cost | | LB | UB | Custom Value | Units | In which year should the maintenance cost start? | Total Cost |
| Single deciduous tree (>12) | € - | € - | | €/pc | € - | | € 37,31 | € 37,31 | | €/pc | 1 | € 2.574,39 |
| Shrubby plants | € 10,00 | € 30,00 | | €/m3 | € - | | € 5,80 | € 5,80 | | €/m3 | 1 | € 3.770,00 |
| Amenity grassland | € 5,00 | € 10,00 | | €/m² | € - | | € 0,41 | € 0,41 | | €/m² | 1 | € 1.965,95 |
| Impermeable surface | € 100,00 | € 112,00 | | €/m2 | € - | | € 0,23 | € 0,27 | | €/m | 1 | € 2.979,09 |
| | | | € - | | | | | | | | | |

| SUMMARY | CONSTRUCTION | Maintenance costs / year | | |
|---|---|---|---|---|
| | Initial | Yearly | 20Yrs | 40Yrs |
| Baseline scenario | € - | € 11.289,43 | € 164.375,68 | € 244.984,73 |

# Step 5: Monetization (costs and benefits)

## Initial investment

- Sewage construction
- Road construction
- Bioswale construction
- Landscaping and trees

€ 1.551.702

€ 1.307.175

€ 32.457

€ 11.415

## Maintenance costs
Euro/year

- Sewage maintenance
- Road maintenance
- Green maintenance

## Monetary benefits
Euro/year

- Water runoff retention carbon sequestration aesthetic appriciation heat island education & awareness

€ 12.797

€ 0

# Step 6: Summary & preview factsheet

## Wemeldinge Noord, Netherlands

Wemeldinge is a village in the municipality of Kapelle, a municipality in the South-West of the Netherlands. Occasional pluvial flooding occurs in the village after heavy rain showers, due to an aged sewerage system and limited water buffering capacity.
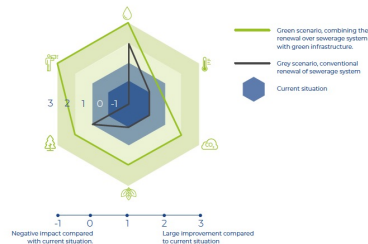
**Landscape**
(Sub)urban residential area

**Public area**
2,5 ha, of which 68% paved

**Climate problem**
Pluvial flooding

## Scenario Comparison

— Green scenario, combining the renewal over sewerage system with green infrastructure.

— Grey scenario, conventional renewal of sewerage system

◆ Current situation

-1    0    1    2    3
Negative impact compared          Large improvement compared
with current situation.           to current situation.

## Grey ↔ Green

| Grey | Green |
|------|-------|
| Renewing the sewerage system with wide pipes for draining storm water. | Increasing green area with at least 0,6 ha. |
| Adding a large pipe which carries the water from rainstorm peaks to a lower-lying area. | Construct permeable green streets, parking places and wadis. |
| Improving the road quality using asphalt only. | Complement with new grey sewage system, such as the wide pipe which is also part of the grey scenario. |

**Water run-off reduction**
Grey: 0 m3/year by grass road verges ↔ Green: 4300 m3/year

**Micro climate regulation**
Grey: 0 ℃ ↔ Green: -0,09 ℃

**Carbon Sequestration**
Grey: 0 tonne $CO_2$ by 2060 ↔ Green: 135 ton $CO_2$ by 2060

**Biodiversity**
Grey: Structural diversity 2,2/6 ↔ Green: Structural diversity 3,3/6

Birds  Butterflies  Bees
80%-100%
63%-80%
43%-60
21%-40%
0%-20%

Birds  Butterflies  Bees
80%-100%
63%-80%
43%-60
21%-40%
0%-20%
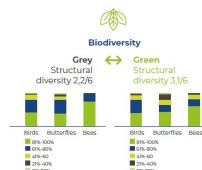
**Awareness raising/Education**
✓ Designed in collaboration with residents, to stress what citizens can do to avoid flooding.
✓ Wadis show raised water levels after rain storms.
✓ Organisation of fairs with demonstrational setups.
✓ Concrete example of Kapelle's ambitions on sustainability.

**Aesthetic appreciation**
✓ Increased functional green space makes Wemeldinge a more attractive place to live.
✓ Green space encourages cycling and walking.
✓ Green areas and wadis will encourage children's outdoor play.

## Financial information

### Initial investment
○ Sewage construction
○ Road construction
○ Bioswale construction
○ Landscaping and trees

€ 1.551.702
€ 1.307.175
€ 32.457
€ 11.415

### Maintenance costs
Euro/year
○ Sewage maintenance
○ Road maintenance
○ Green maintenance

€ 12.797
€ 0

### Monetary benefits
Euro/year
○ Water runoff retention carbon sequestration aesthetic appriciation heat island education & awareness

# To conclude...

Produce **information** that assists/supports decision makers

Generate **estimations and ballpark figures**

Provide the **handles to facilitate GI** investments

**Decision and planning support** tool