



**Royal  
HaskoningDHV**  
*Enhancing Society Together*

# **REFLECT, a NSS to support harmonizing spatial developments**

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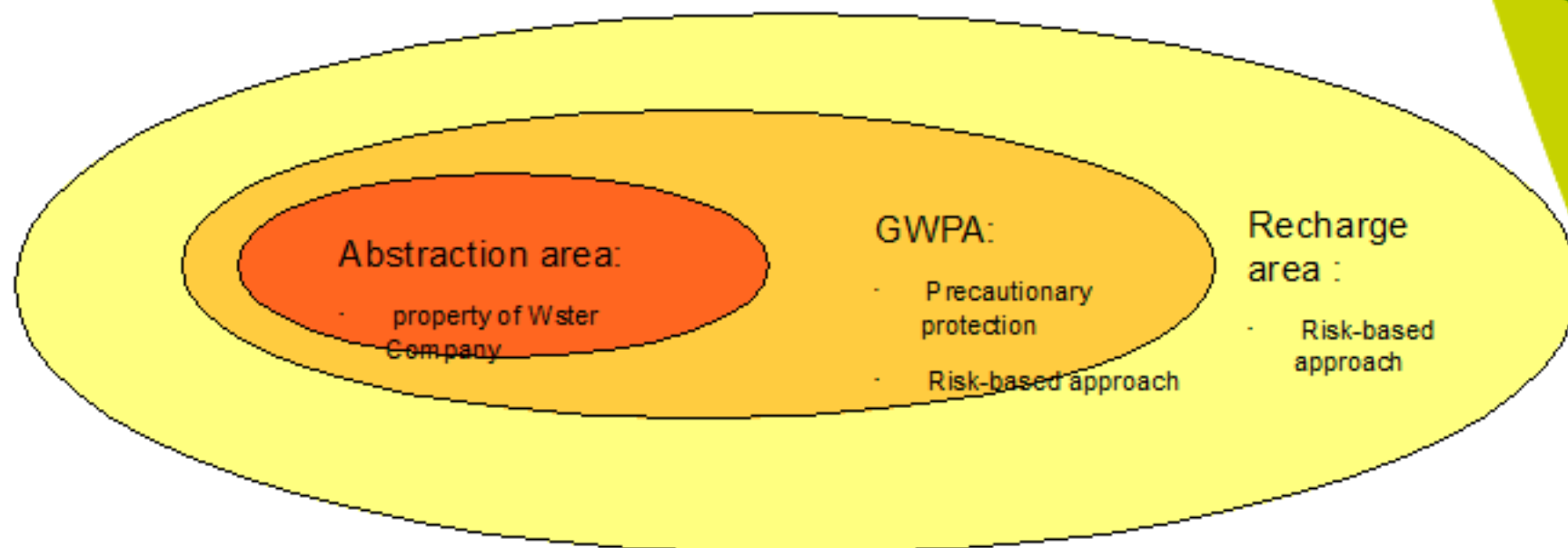
- May 2015



# Public water supply Overijssel

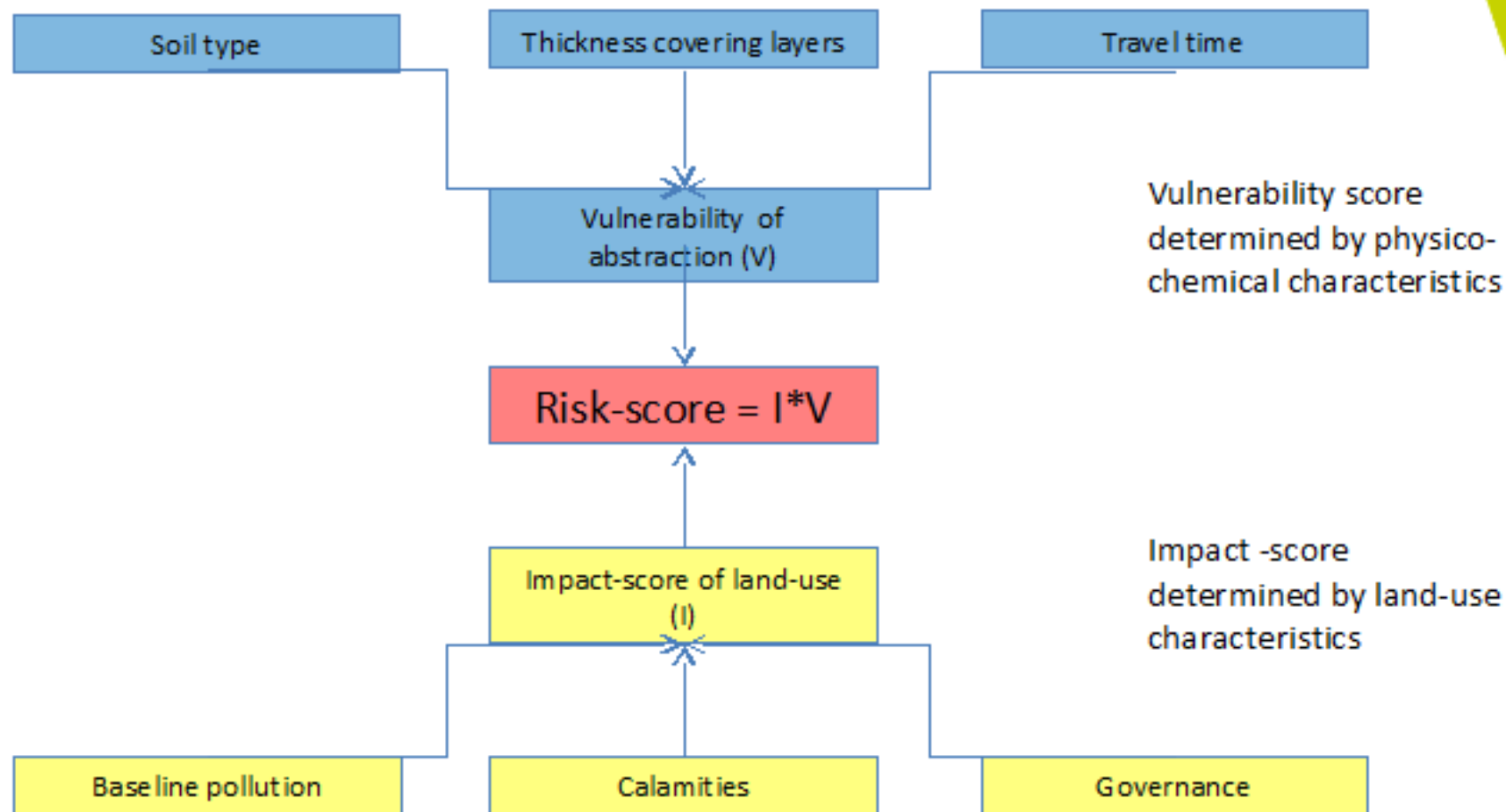
- Province of Overijssel: 24 groundwater abstraction sites, operated by Vitens
- Production rate: 3 – 12 million m<sup>3</sup>/year
- Total capacity appr. 100 million m<sup>3</sup>/year
- 20 abstractions in vulnerable Pleistocene sandy areas
- GWPA cover 10% of provincial land surface
- Land-use within GWPA:
  - 66% agriculture
  - 25% natural areas
  - 9% urban areas
- In 12 out of 24 abstraction sites, standards are exceeded in individual abstraction wells

# Protection strategy



- Abstraction area: single function (drinking water production)
  - GWPA & recharge area: drinking water protection & economic functions
  - Precaution: baseline protection by rules and regulations excluding well defined activities & functions
  - Risk-based approach: protection by stimulating harmonizing land-use planning, i.e. trade-off between land-use functions
- 
- REFLECT is used as NSS in spatial planning

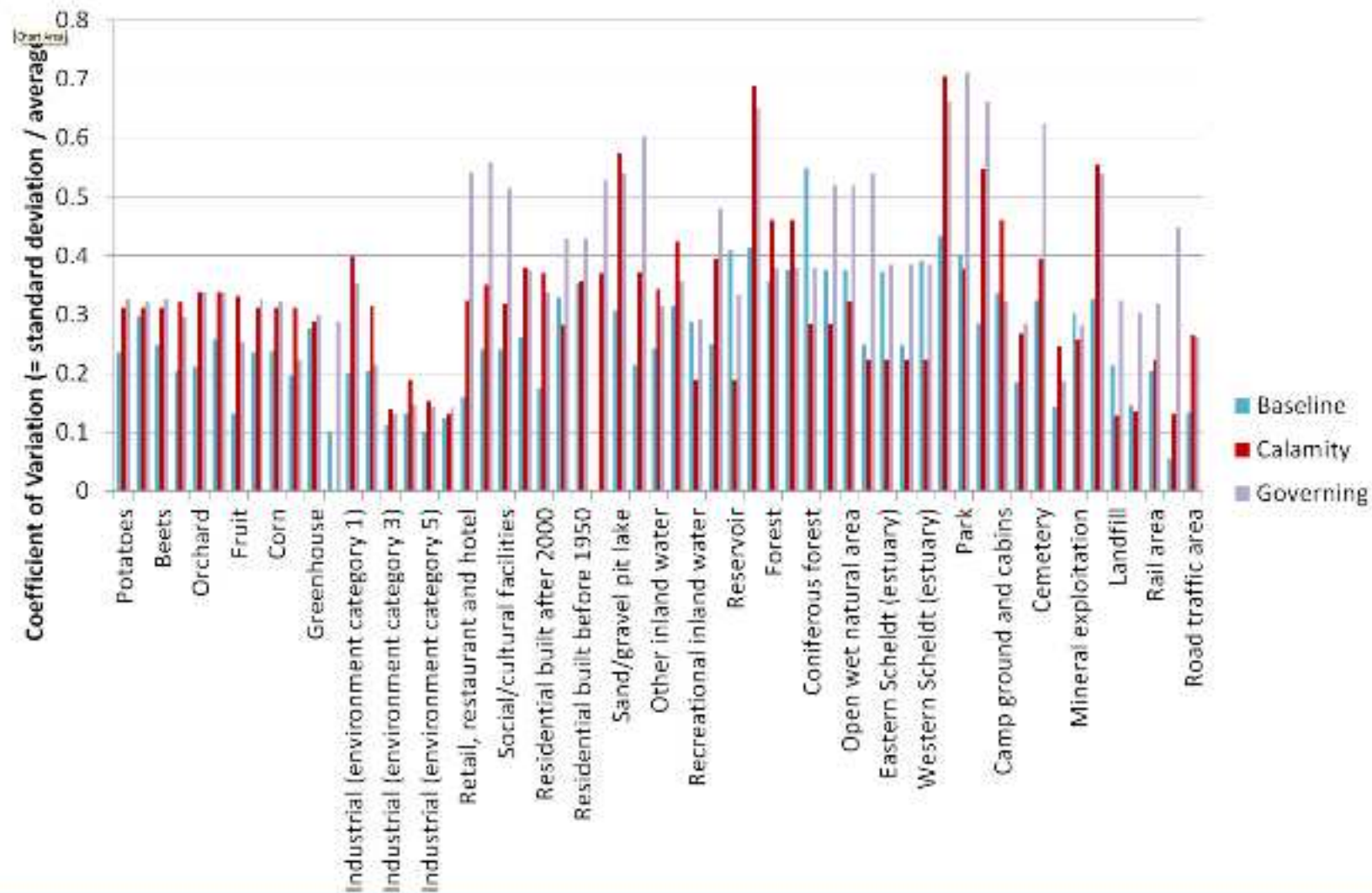
# REFLECT: assessment risks of land-use



## Delphi-scores land-use impact

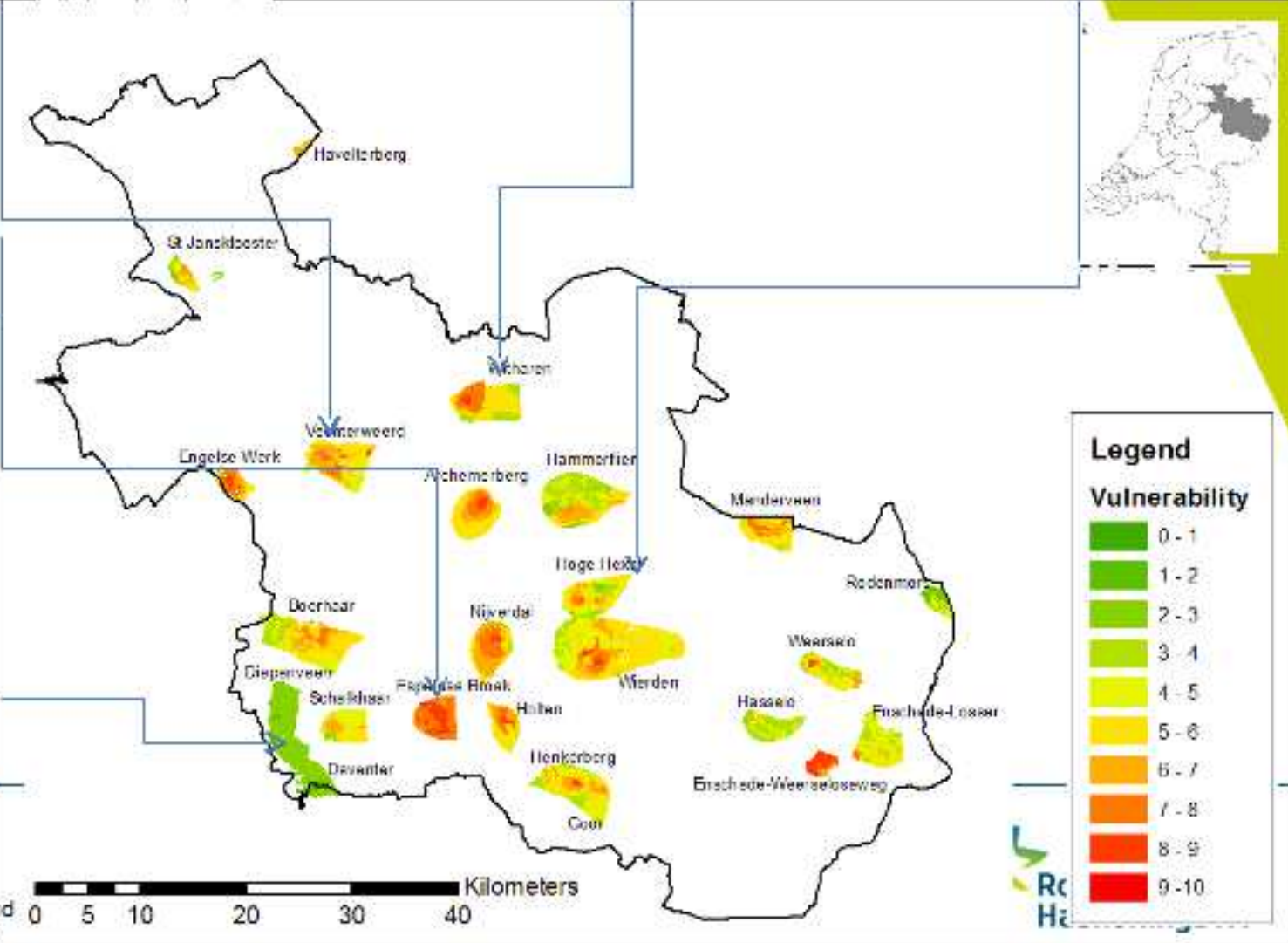
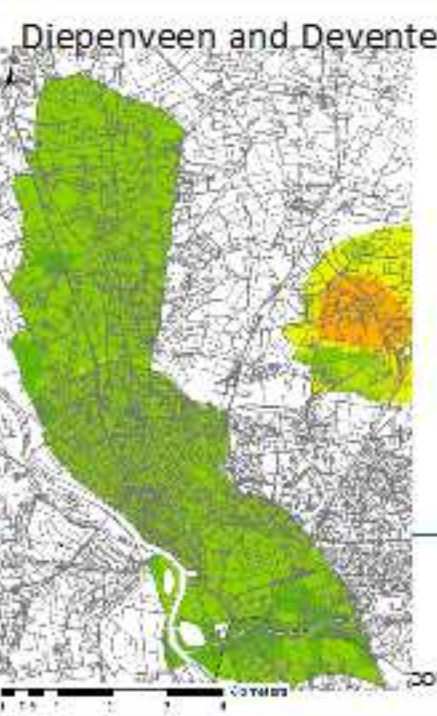
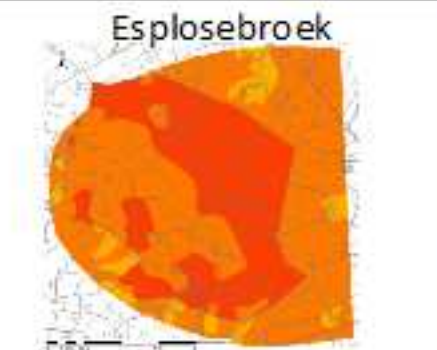
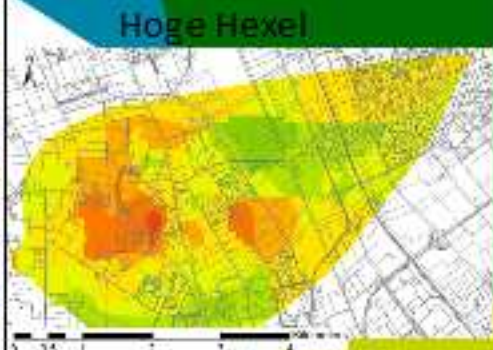
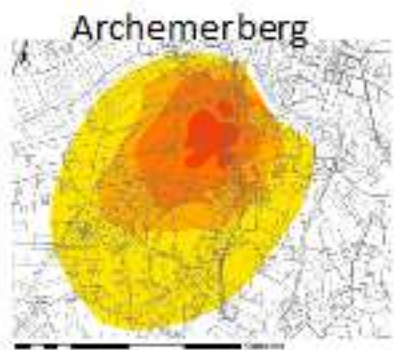
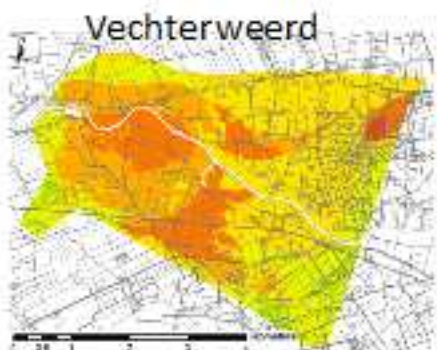
- 30 land-use functions corresponding to the GIS maps of Dutch National Centre of Statistics, refined for agriculture by Dutch Land-Use Map
- 14 experts from universities, knowledge institutes, provinces, water companies, municipalities, consultants
- Average scores returned for feedback

# Reliability of impact scores



# Application of REFLECT

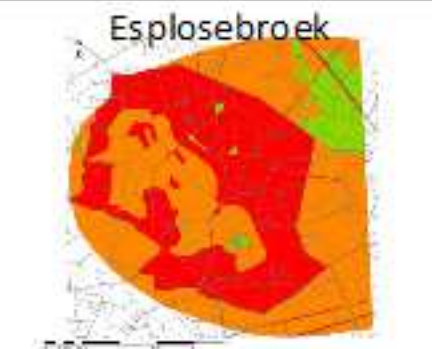
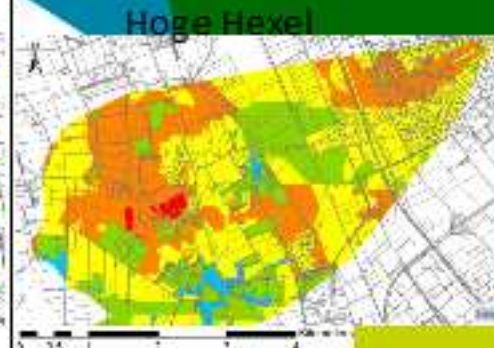
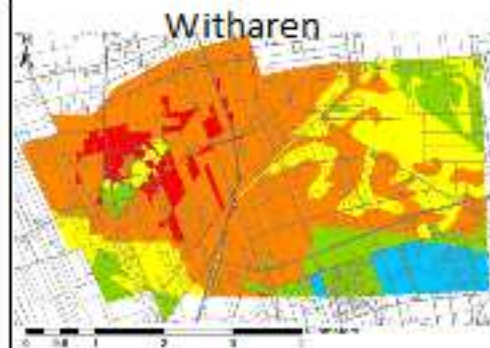
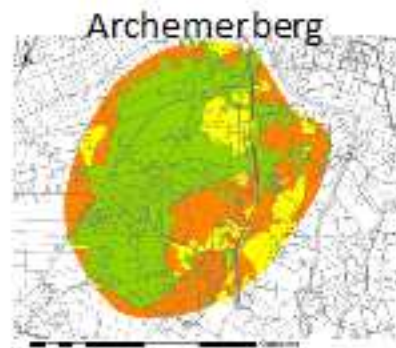
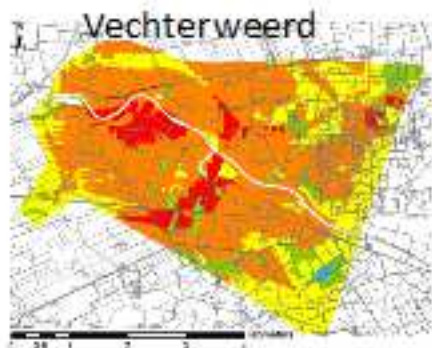
- Assessment of vulnerability of the abstraction sites
- Assessment of risks by land-use
- Use of REFLECT as NSS in spatial planning



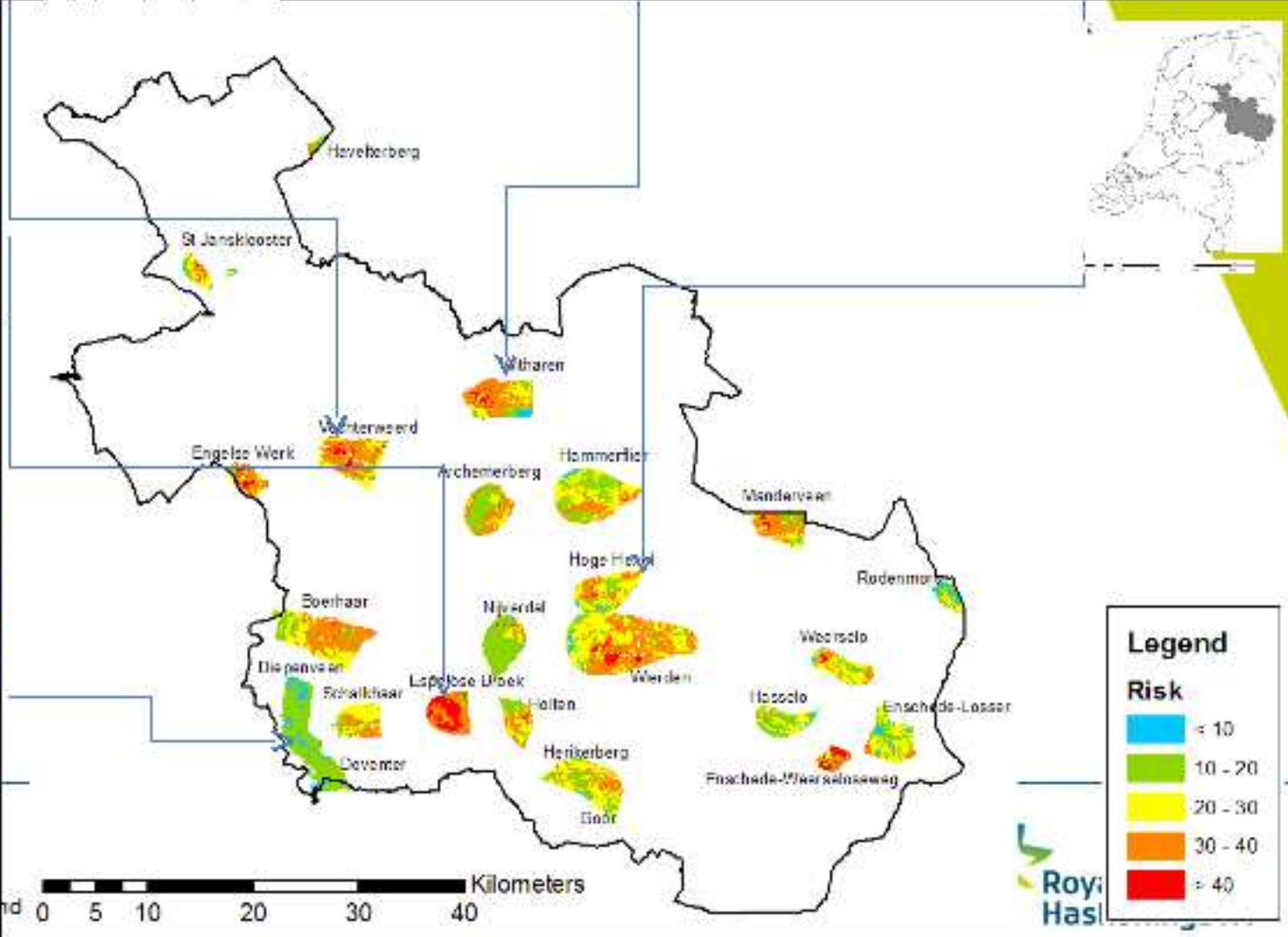
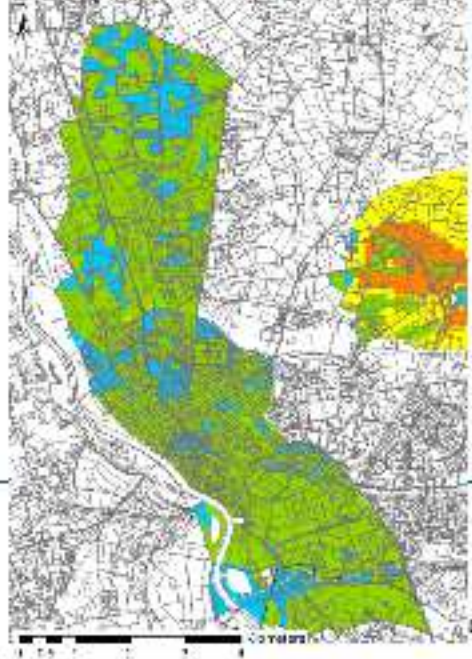


# Use of vulnerability in protection policy

- Vulnerability is the finger print of an abstraction site
- Spatial insight in the vulnerability is used to:
  - Prioritise the investigation and/or remediation of point and line sources
  - Prioritise the protection effort and budget over abstraction sites



### Diepenveen and Deventer



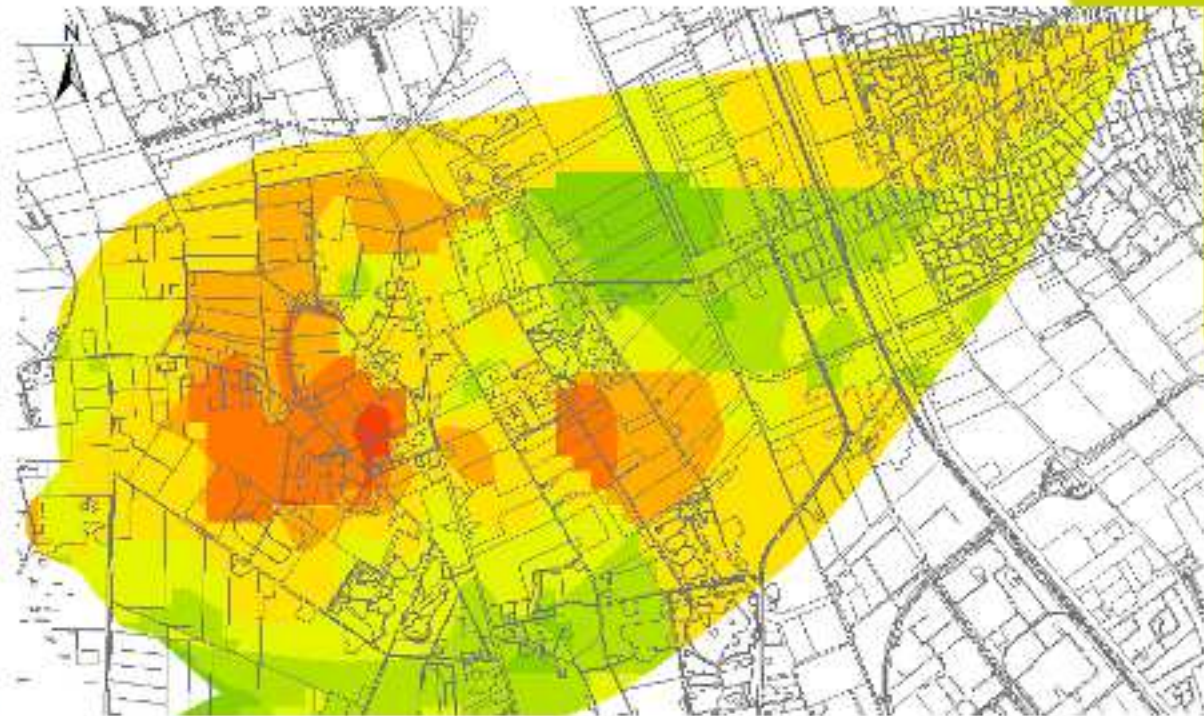
# Use of risk assessment

- Spatial insight in areas in which land-use function may conflict with the drinking water function
- Spatial insight in risks is used to:
  - Identify stakeholders & measures to remediate risks
  - Prioritise the protection effort and budget over abstraction sites

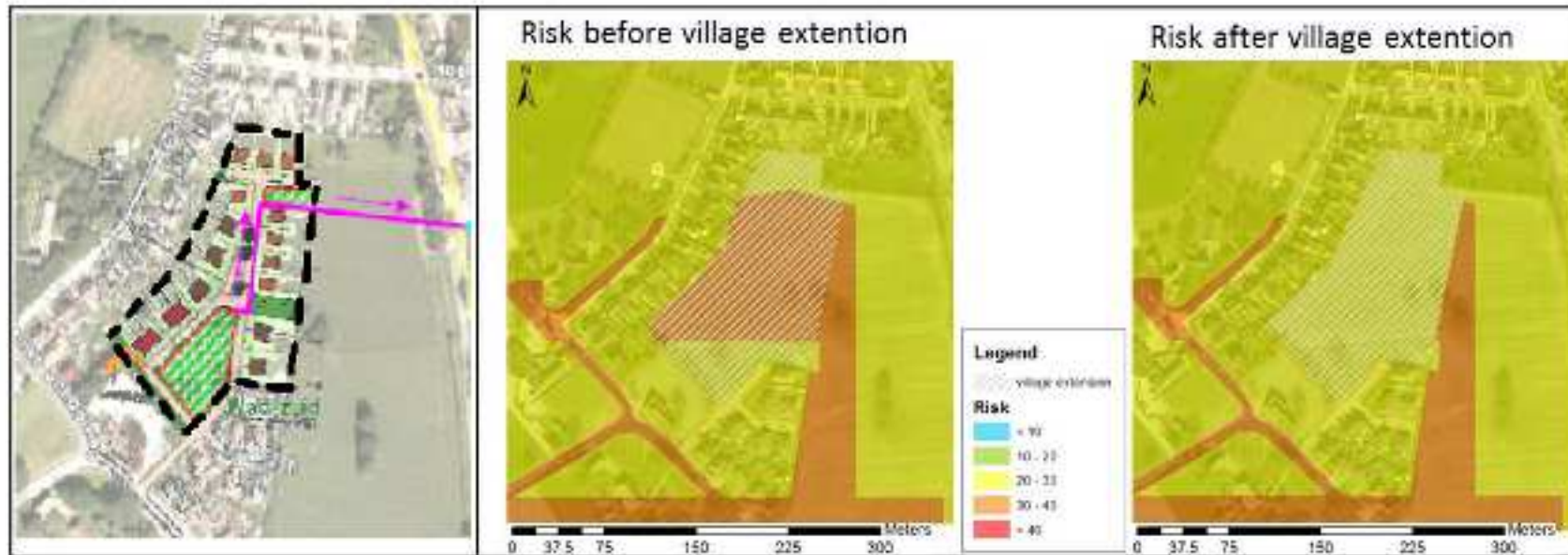
# Use of RELECT in spatial planning

- New residential area of 24 houses in the centre of the village
- Only allowed according to the risk-based protection policy ...
- ... when a step-forward regarding risks is realised

Hoge Hexel



# REFLECT risk-assessment



- REFLECT provides an indication of risks in the planning-stage
- Additional measures were implemented, such as:
  - discharge of storm water
  - raising awareness regarding 'living in a GWPA'

# Conclusions

- REFLECT fits well within risk-based groundwater governance:
  - It helps focussing the protection effort by considering impact and vulnerability as two independent entities
  - ... and provides an overview of vulnerability and risks of all abstraction sites
  - It contributes to joint fact finding & common understanding regarding complex issues as basis of well-informed negotiations between stakeholders

# Thank you for your attention



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