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Enabling Delta Life

Dutch Approach to Drought Issues

21 june 2010

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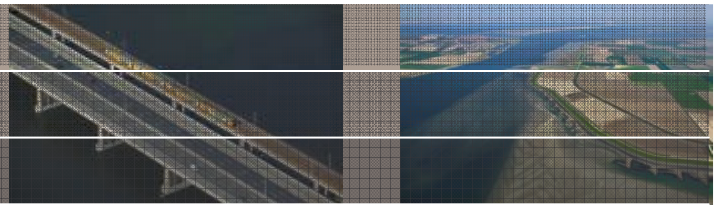

- Introduction
- Dutch Hydrological Toolbox (NHI)
- Effect modules

- Some conclusions & recommendations

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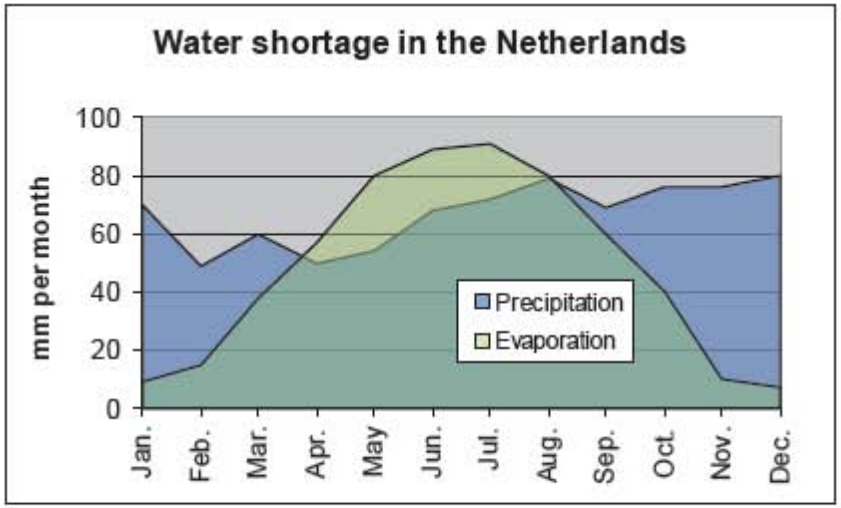
Water scarcity in a low-lying country like?

- In the current situation:
  - drought occurs in extreme dry years (’76, ‘03)
  - scarcity is little

- For the Future this is expected to increase and become more frequent due to:
  - climate change
  - sea level rise
  - socio-economic developments



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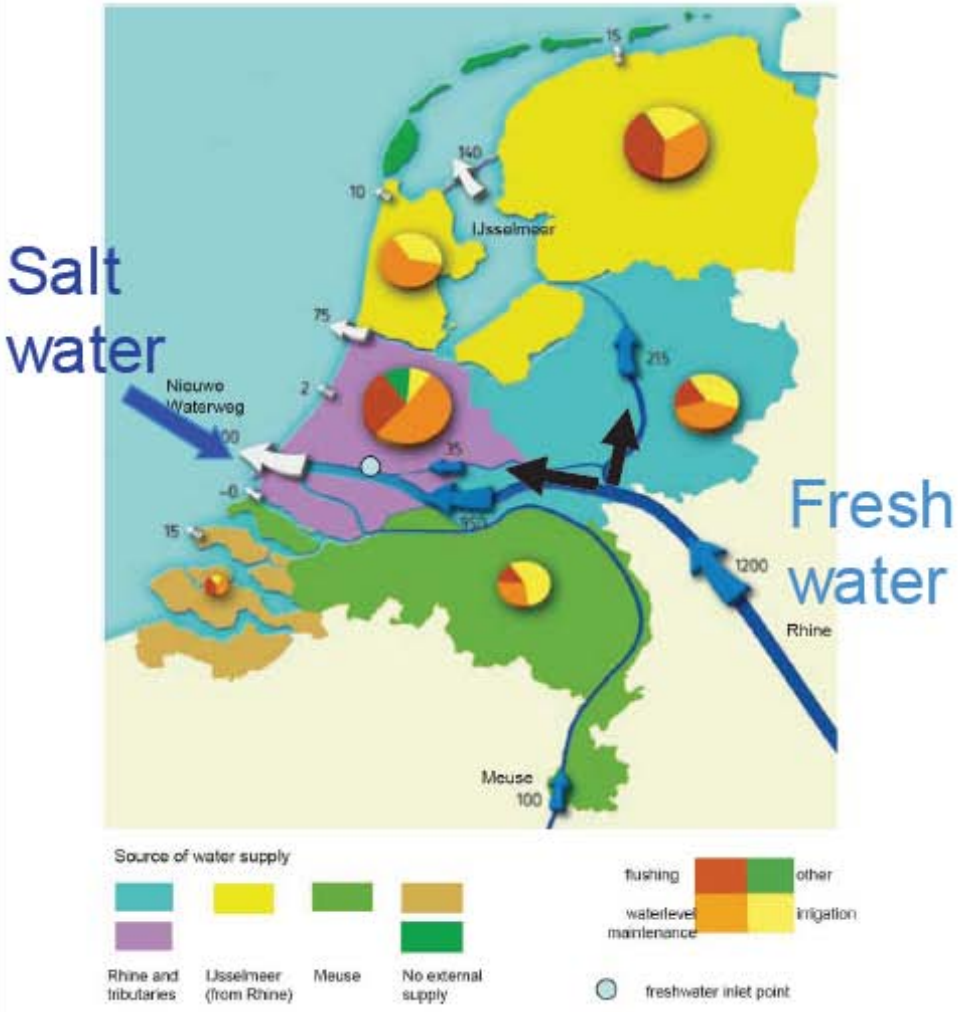
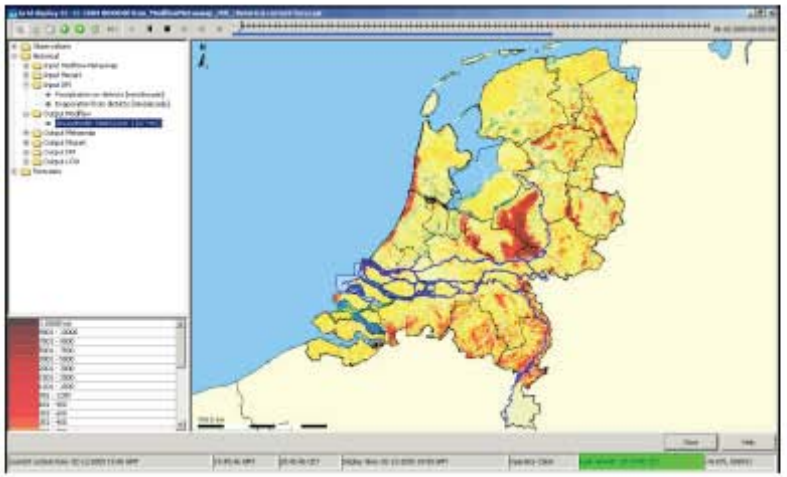
Present policy arrangement



- Physical system of redirecting and distributing water
- Set of voluntary water agreements between neighbouring water managers
- Set of administrative rules for rationing in the case of acute water scarcity
- Drought early warning system



Distribution of river water (m3/s) over the national system and supply to the regional system.
This is the situation in the summer of a dry year (approx 1:10 – 1:15 years).

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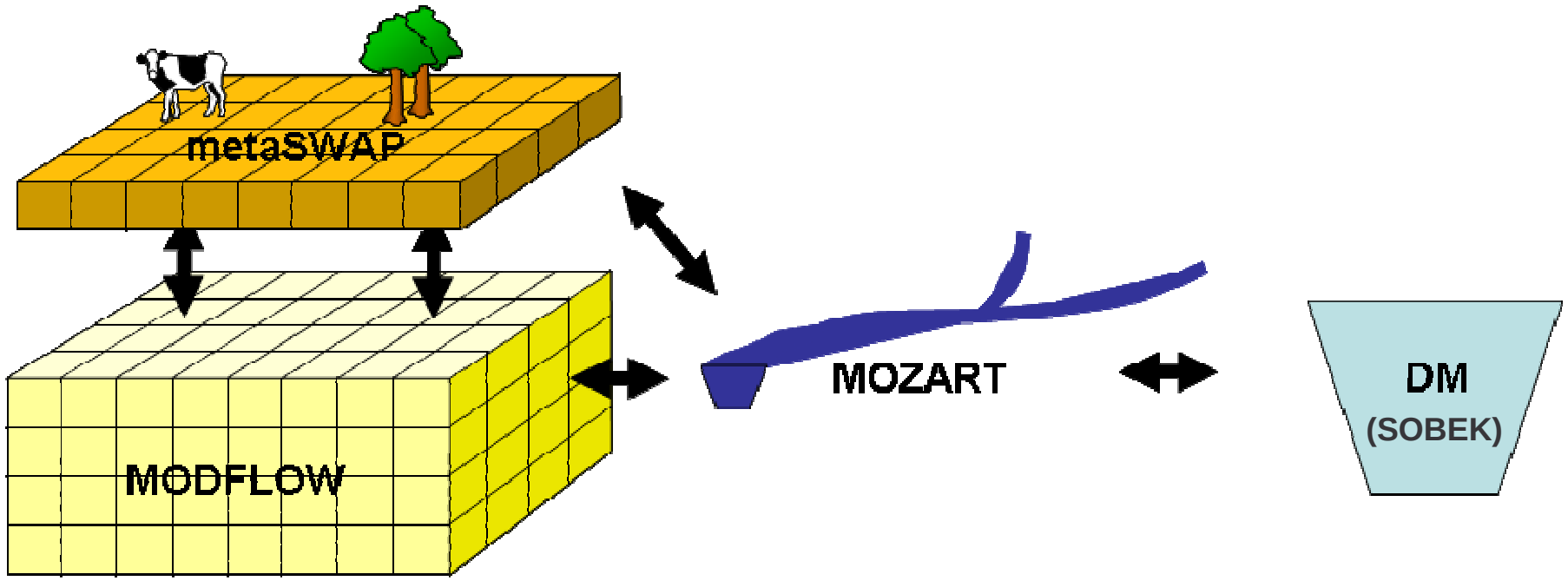
Dutch Hydrological Toolbox (NHI)

- State of the arte coupling of surface water and groundwater models
- Groundwater model 250x250m resolution
- Daily or decade time step

- Also “light” version in development focused on policy analysis



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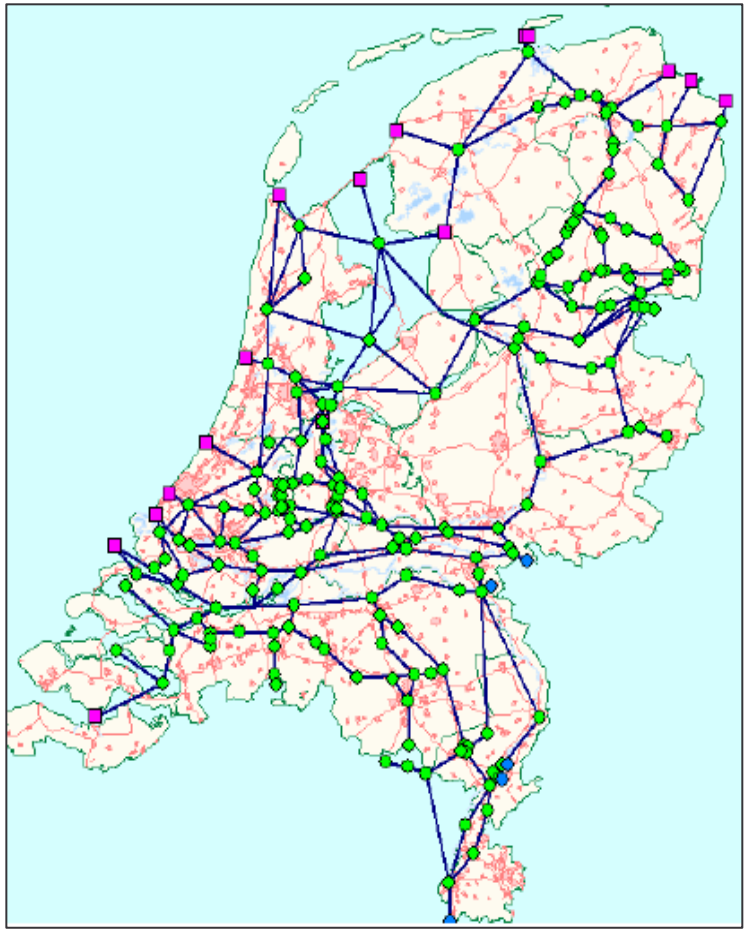
Distribution model

- Network of nodes and branches
- Distribution factors for water supply and demand:
  - In time
  - Water level dependent, supply and salt concentration depependent
- Predefined priorities

- Is currently being included in SOBEK functionality



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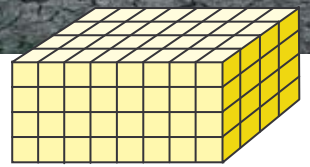
What is NHI used for?



Analyse effects and potential measures due to extreme drought

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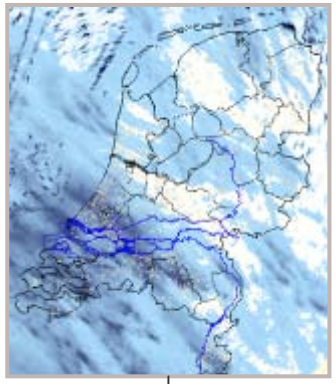
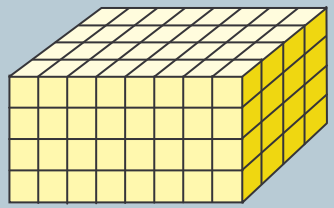
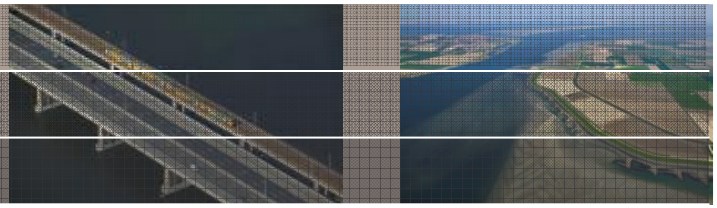
What is NHI used for?



NHI onder FEWS



Effect modules



Component	Module
Agriculture	AGRICOM
Terrestrial Nature	DEMNAT
Aquatic nature	HABITAT
Shipping	BIVAS
Drinking water	
Cooling water / energy	
Water toursism	
Buildings/infrastructure	

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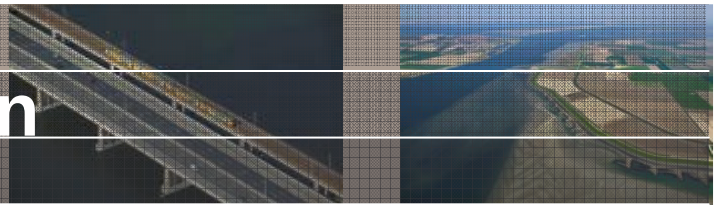
Evaluation criteria per function



Water system function	Criteria and output variables	
	(water system)	(sectors)
Drinking and process water	- Water quantity (limitations on availability) at intake points surface and groundwater - Water quality at intake points	- Additional costs drinking water preparation - Deliver security (leveringsbetrouwbaarheid)
Cooling water	-Water temperature -Availiable cooling capacity	- Costs when limitations - Deviver security
Agriculture	-Availabitliy from national water systm -Availability form regional water system	-Drought damage -Salt damage -Wetness damage -Irrigation costs
Fishing (fesh water)	-Water quality	-Fish production -Costs and income changes
Water tourism	-Available locations -Navigation depth -Water quality	-Recreation volume -Navigation possiblities and waiting times -“Experience” value (belevingswaarde) -Change income in tourist sector
Nature	- Abiotic parameters (water levels, flow and quality) -Ecotope types -Species distribution	-Local nature value indicator -Specie weighted value indicator -Ecological capital index
Shipping (rivers)	-Water levels at navigation routes -Flow velocity at navigation routes	-Navigation time and weighting time -Travel distances -Trip costs -Mean grade of cargo and -Number of trips not allowed

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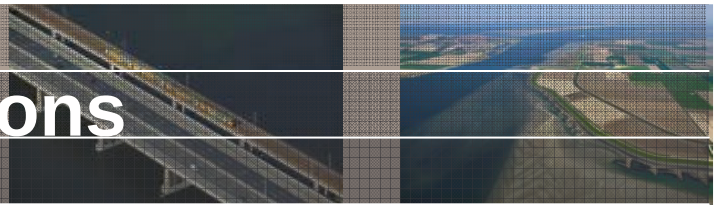
Conclusions & recommendations



- Only part of the drought damage is caused by low river levels or flows; for most sectors water temperature, water quality or groundwater levels are at least as relevant.
- River flows, water heights, water quality and water temperature are strongly linked at the river basin level.
- An integrated modeling system like NHI with effect modules is a rather complex initiative. For the Meuse basin this would be a long term development.

- Some ideas (T. Raadgever, 2004)….

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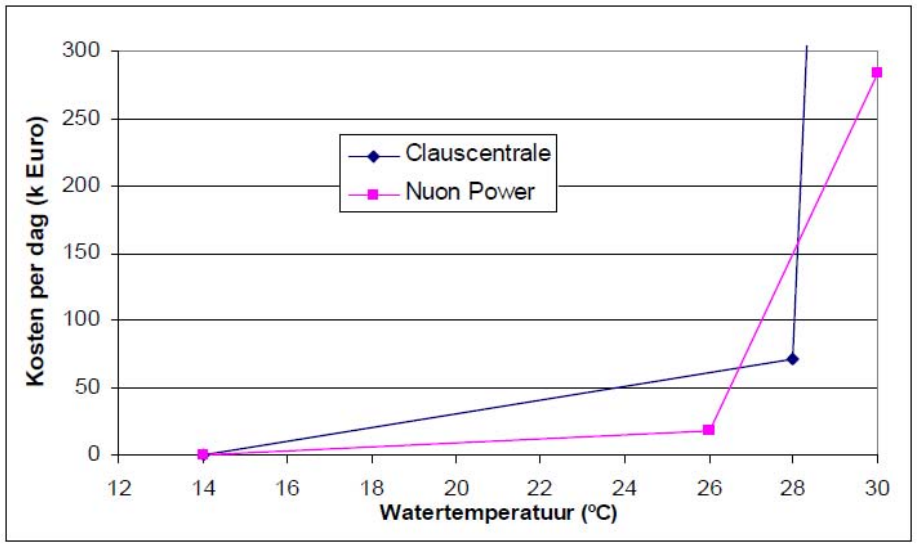
Damage curves

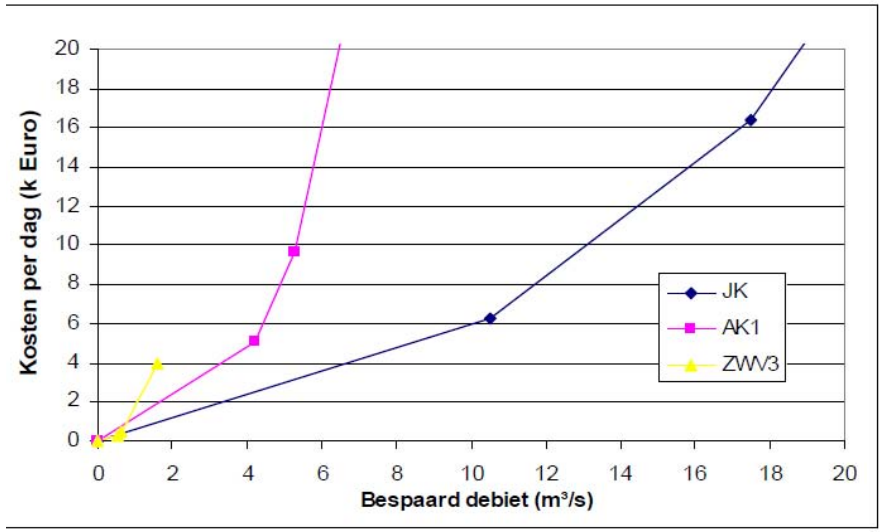
Tabel 4-7. Schadeparameters energiewinning.

Centrale	Clauscentrale Maasbracht	Nuon Power, Buggenum	Electrabel, Mol	Electrabel, Genk
Minimum watertemperatuur traject 1 (°C)	14	14	14	14
Schadeparameter traject 1 (k € / °C / d)	5,1	1,5	1,0	2,4
Minimum watertemperatuur traject 2 (°C)	28	26	?	?
Schadeparameter traject 2 (k € / °C / d)	732	71	?	?

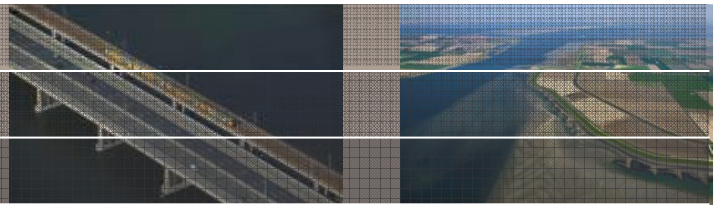
Figuur 4-4. Schadetrajecten kosten beperking productie energiewinning voor de Clauscentrale te Maasbracht en Nuon Power Buggenum.



Figuur 4-3. Schadetrajecten scheepvaartsector (wachtkosten en pompkosten) voor de takken JK n ZWV3.



Shortage percentages



Tabel 4-4. Kortingspercentages per sectoren (per deelgebied) voor verschillende afvoeren te Monsin

Afvoer Monsin (m^3/s)	55	50	45	40	35	30	25	20
Industrie Nederland	0%	0%	0%	0%	0%	0%	0%	0%
Industrie DSM	0%	0%	0%	0%	0%	0%	0%	0%
Industrie Vlaanderen	0%	0%	0%	0%	0%	0%	0%	0%
Landbouw Eijsden-Linne	0%	0%	0%	0%	100%	100%	100%	100%
Waterschap/landbouw MLNBK	0%	6%	25%	45%	45%	45%	54%	66%
Landbouw Vlaanderen	0%	0%	0%	0%	0%	40%	80%	80%
Landbouw overig	0%	0%	0%	0%	0%	0%	0%	0%
Natuur met hoge prioriteit	0%	0%	0%	0%	0%	0%	0%	0%
Drinkwaterwinning Vlaanderen	0%	0%	0%	0%	0%	0%	100%	100%
Korten scheepvaart MLNBK	9%	9%	25%	45%	45%	45%	54%	66%

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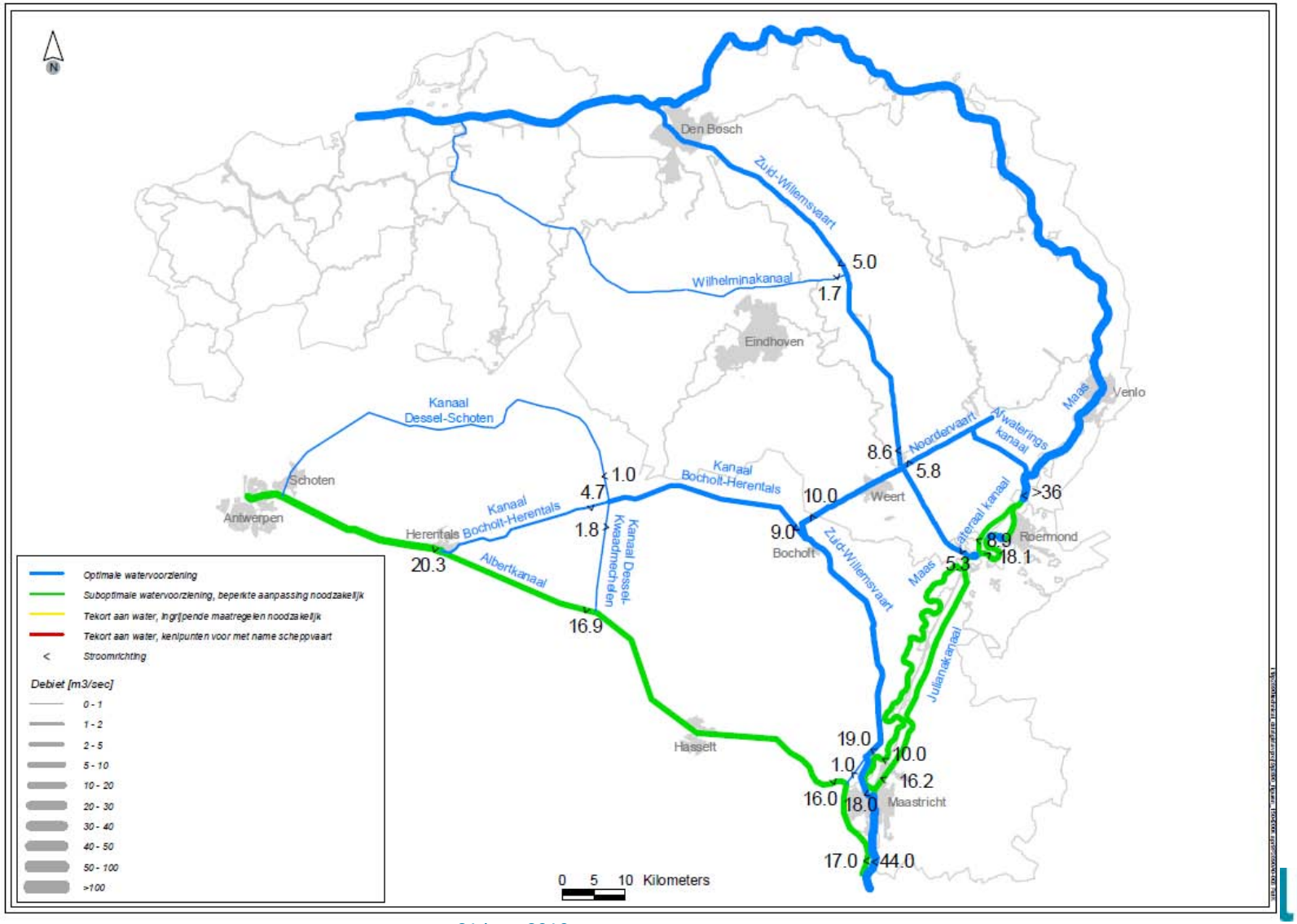
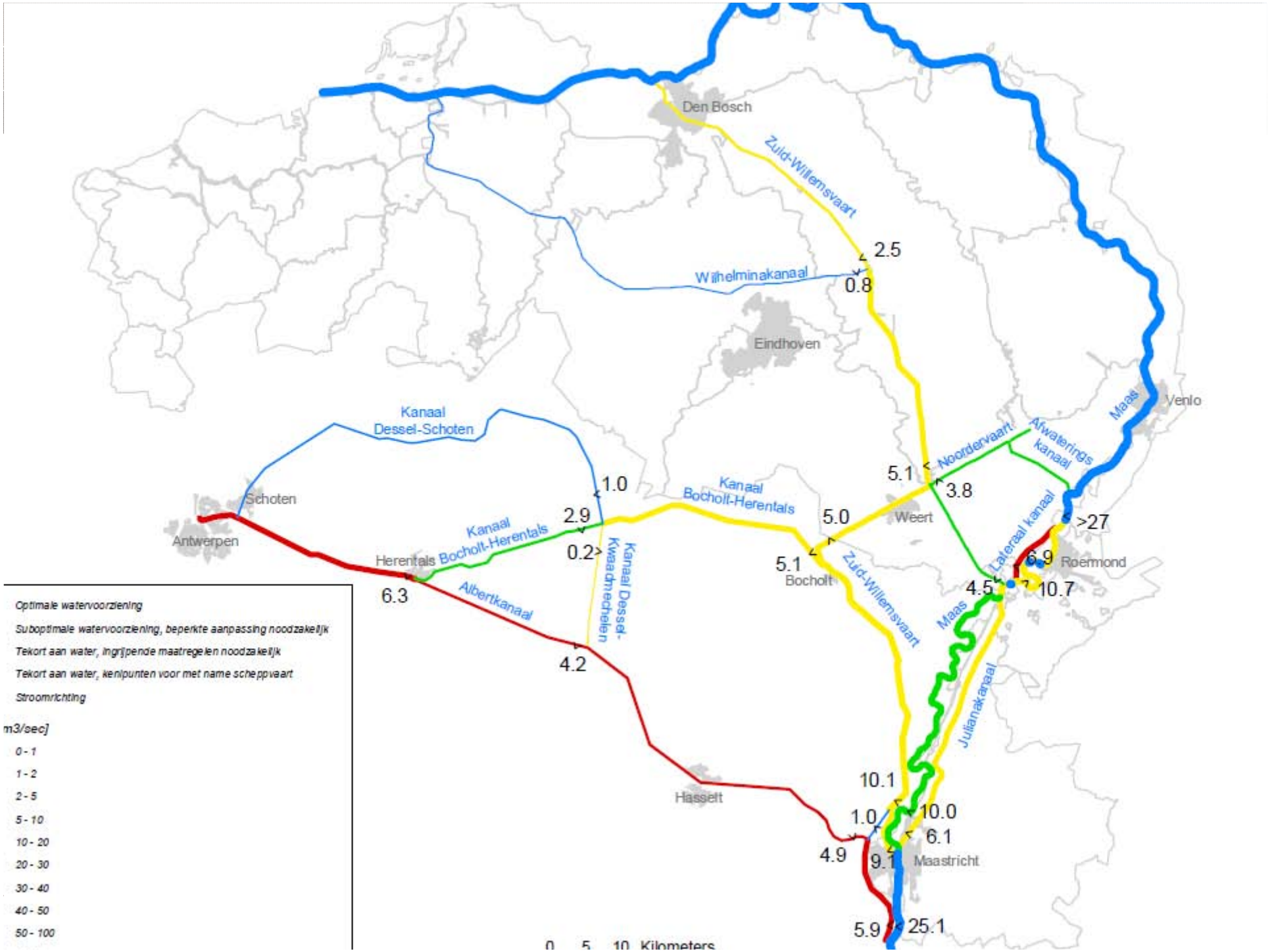
Bij Q=60m3/s


Den Bosch
Zuid-Willemsvaart
Wilhelminakanaal
5.0
1.7
Eindhoven
Kanaal
Dessel-Schoten
Schoten
Antwerpen
1.0
4.7
Kanaal
Bocholt-Herentals
Herentals
Kanaal
Bocholt-Herentals
1.8
20.3
Albertkanaal
Kanaal Dessel-
Kwaadmechelen
16.9
Hasselt
8.6
Noordervaart
5.8
10.0
Weert
9.0
Bocholt
Zuid-Willemsvaart
Maas
Venlo
Zwaterings
kanaal
Maas
>36
Roermond
18.9
18.1
5.3
Julianakanaal
19.0
10.0
1.0
16.2
16.0
18.0
Maastricht
17.0
<44.0
Optimale watervoorziening
Suboptimale watervoorziening, beperkte aanpassing noodzakelijk
Tekort aan water, ingrijpende maatregelen noodzakelijk
Tekort aan water, kenlpunten voor met name scheppvaart
< Stroomrichting
Debiet [m3/sec]
0 - 1
1 - 2
2 - 5
5 - 10
10 - 20
20 - 30
30 - 40
40 - 50
50 - 100
>100
0 5 10 Kilometers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Albertkanaal
4.2
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5.1
Noordervaart
3.8
Afwaterings
kanaal
Maas
Venlo
5.0
Weert
>27
Lateraal kanaal
6.9
Roermond
5.1
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Zuid-Willemsvaart
4.5
10.7
Maas
Julianakanaal
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1.0
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9.1
Maastricht
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25.1
0 5 10 Kilometers
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Suboptimale watervoorziening, beperkte aanpassing noodzakelijk
Tekort aan water, ingrijpende maatregelen noodzakelijk
Tekort aan water, knelpunten voor met name scheepvaart
Stroomrichting
m3/sec]
0 - 1
1 - 2
2 - 5
5 - 10
10 - 20
20 - 30
30 - 40
40 - 50
50 - 100