SUSTAINABLE COASTAL & DELTA ZONE DEVELOPMENT

Integrated Coast & Delta Policy via Building with Nature® & Aquapuncture©

Building with Nature®

$$(\alpha+\beta+\gamma)_{\text{knowledge + action}} \rightarrow \Delta_{\text{sustainable}}$$

Delft University of Technology
Civil Engineering & Applied GeoScience

2020

SUSTAINABLE FUTURE OF INLAND WATERWAYS

AQUAPUNCTURE©

Dr. Ronald E. Waterman MSc
co-author:
Jaap A. Brouwer MUrb

WCC – 2016
Inverness
2019

Dr. Ronald E. Waterman MSc

Senior Consultant
Building with Nature®
Aquapuncture®

www.ronaldwaterman.nl
www.ronaldwaterman.com
www.ronaldwaterman.es

Ing. Jaap A. Brouwer MUrb

Waterways expert
Urban designer
Lecturer Academy of Architure of Amsterdam

www.aquapunctuur.nl

SUSTAINABLE FUTURE OF INLAND WATERWAYS

Stimulating the Blue Green Economy

for

Regional, Socio-Economic &

Spatial Development,

while safeguarding

Safety, Navigability as well as

Environmental Values & Nature

AQUAPUNCTURE©

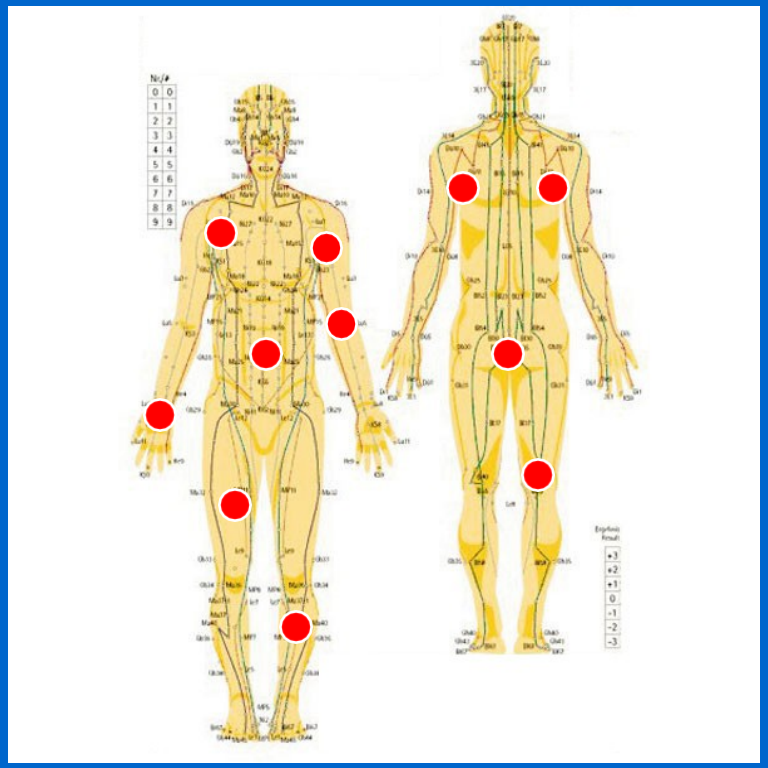
Introduction of AQUAPUNCTURE©

Optimal use, adaptation, experience and management of inland waterways and their waterfronts

for safety against flooding, water storage, water level regulation, water quality, navigability, economy, employment, environment and nature-landscape

ACUPUNCTURE

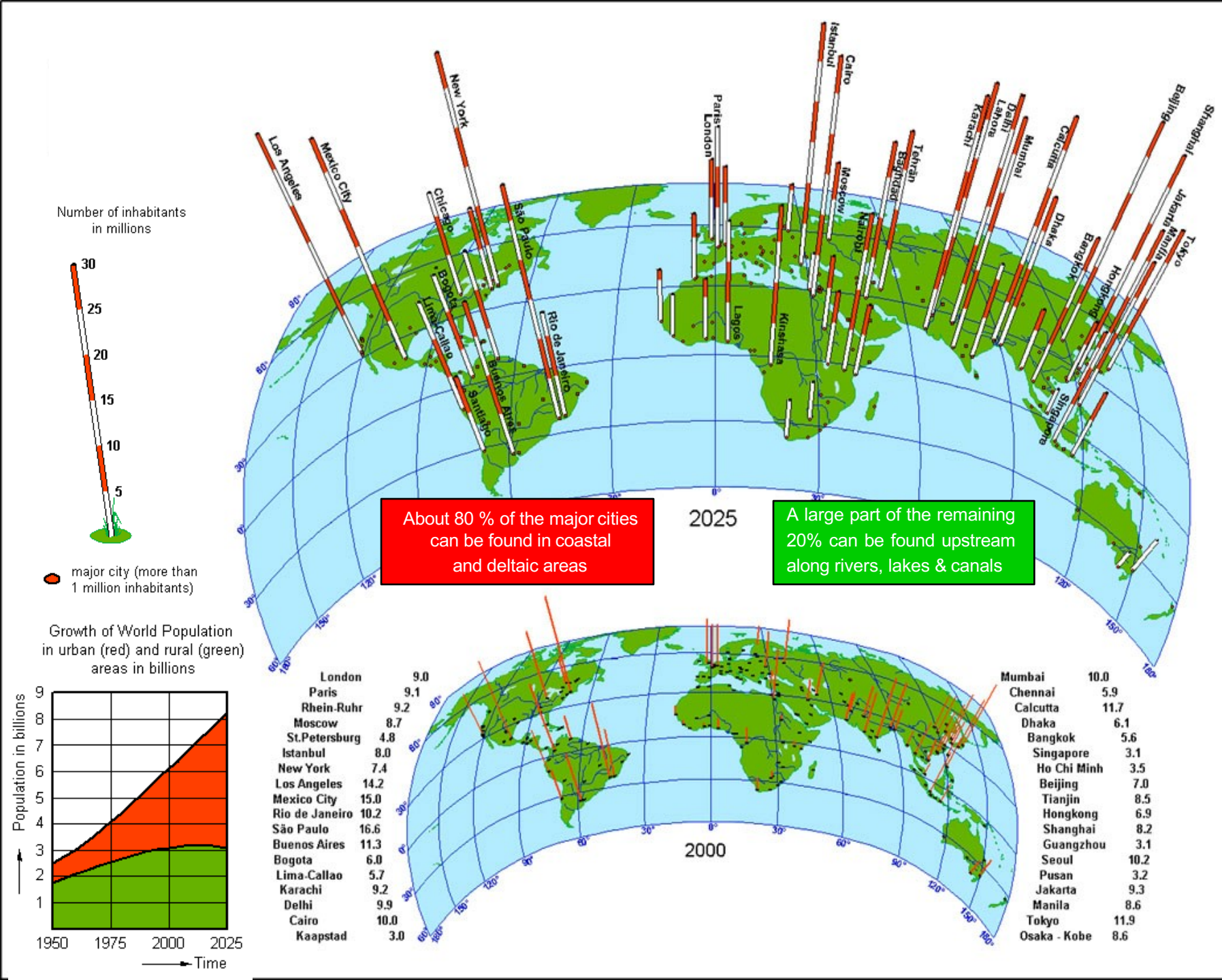
to revitalize
the Nervous System
& Human Organs



AQUAPUNCTURE

to revitalize
the Waterways & their
Water Fronts

DEVELOPMENT OF MAJOR CITIES IN THE WORLD



SUSTAINABLE COASTAL ZONE DEVELOPMENT

About 80% of
the major cities
can be found in
coast and delta areas

A large part of
the remaining 20%
can be found upstream
along rivers, lakes & canals

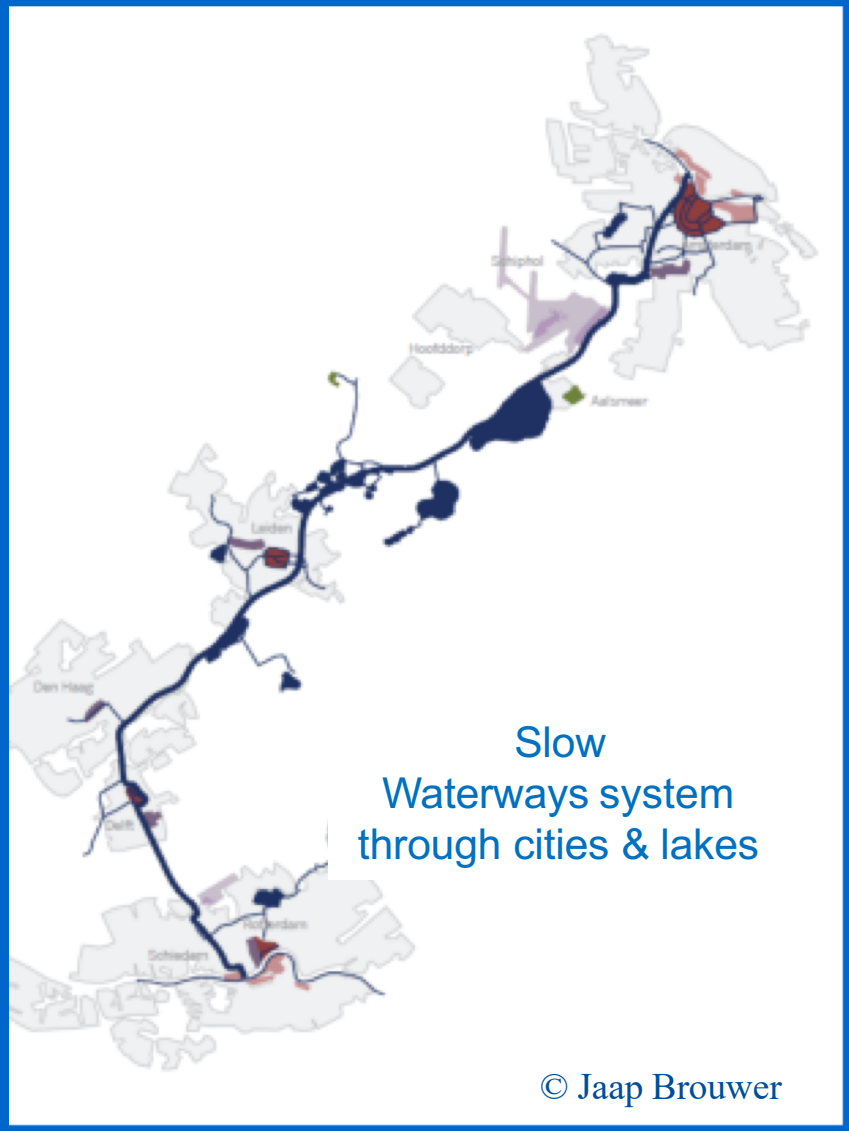
Building with Nature®
Aquapuncture

Aquapuncture©
Building with Nature

In these densely populated areas there is little space available for living, working, infrastructure, recreation & tourism, and at the same time there is the need to preserve or expand valuable environment, nature and landscape.


European
Inland
Waterways

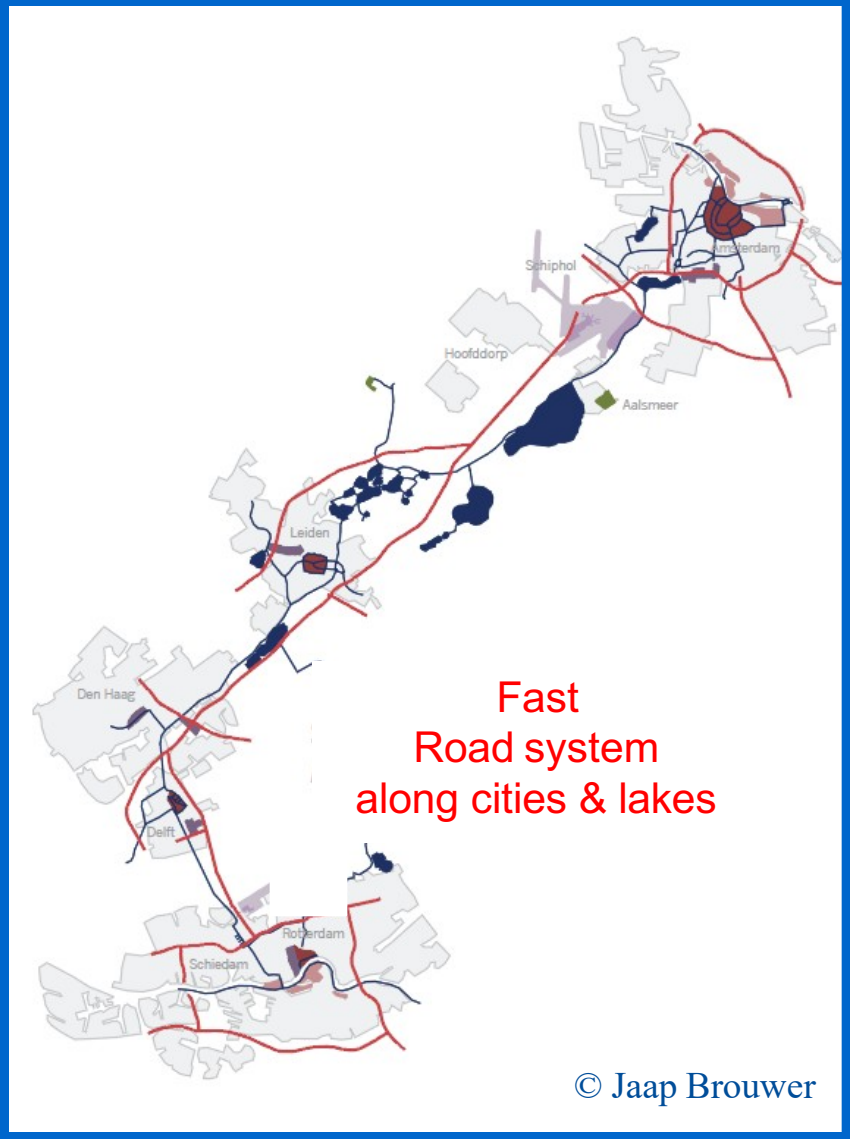
AQUAPUNCTURE OF INLAND WATERWAYS



Waterways were always a focal point for settlements & economic activities.
We used to have the slow waterway system through cities & lakes.

Waterways were used for everything from drinking water supply, beer production, fishing, transport of persons & goods (a.o. coal, oil, peat, straw, sand, gravel, manure, fruit, vegetables, milk), defence, but also as open sewer.

AQUAPUNCTURE OF INLAND WATERWAYS

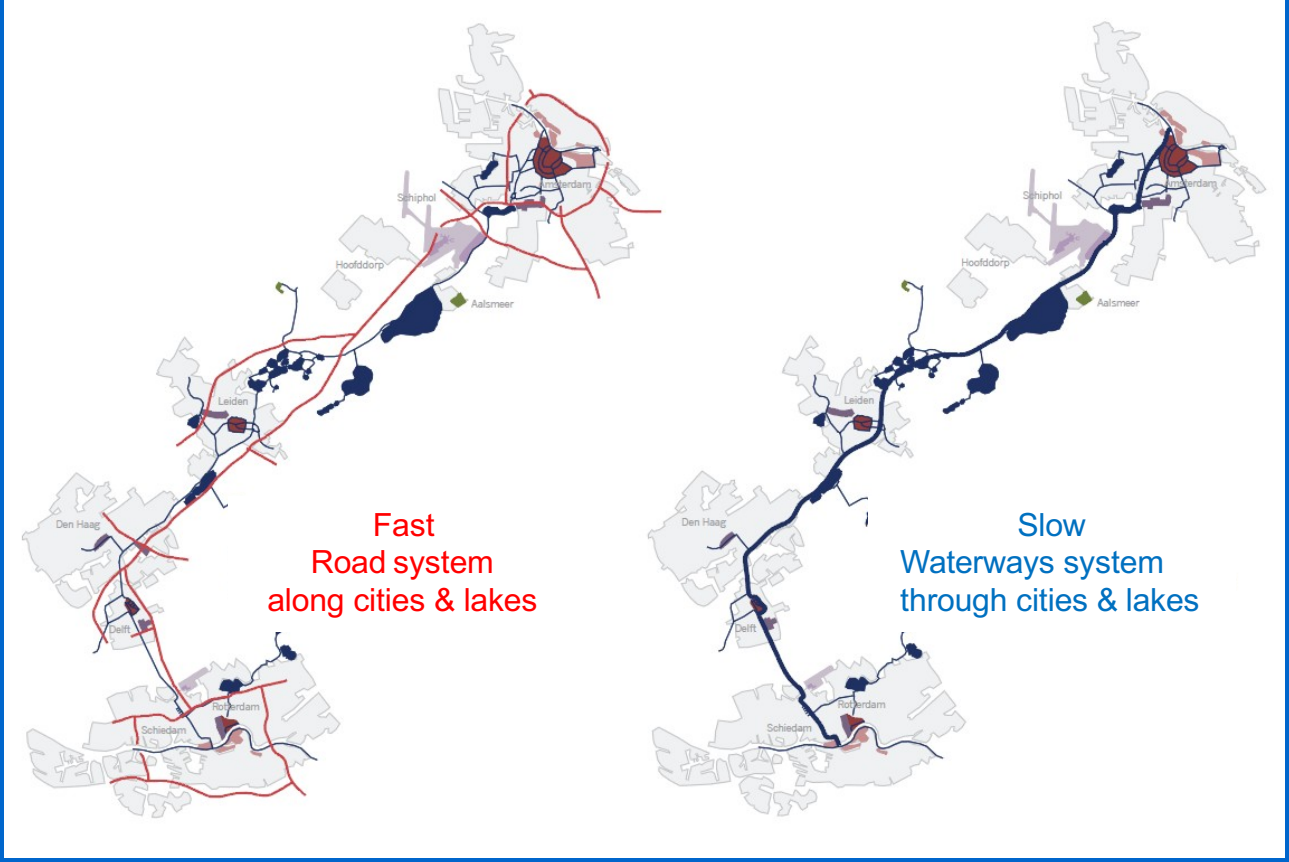


After the fast railway system came the fast road transport system along cities & lakes.

The waterway system became to a certain extent obsolete and its main function was taken over by the faster road system.

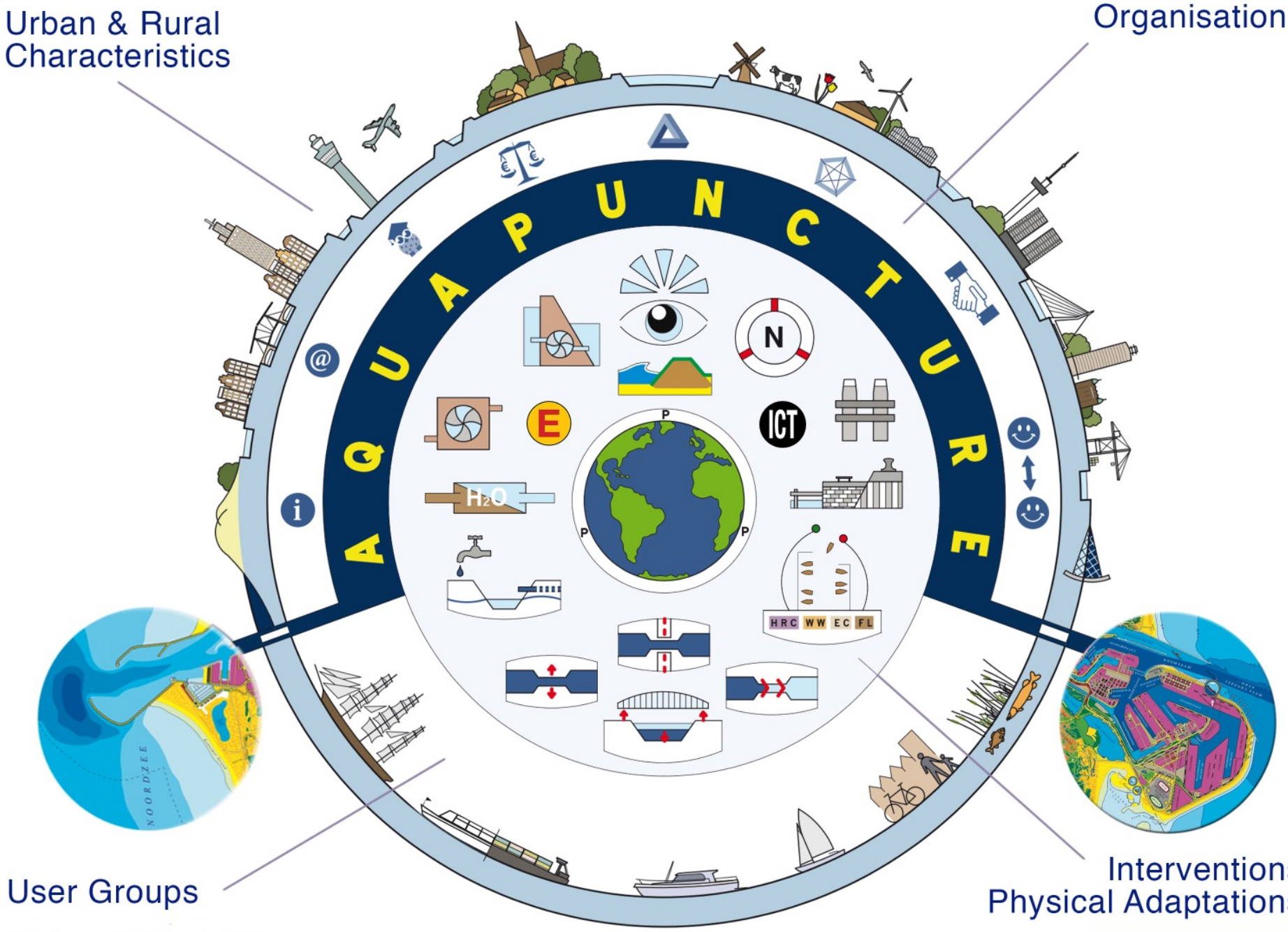
The spatial relation between the waterway and urban development became neglected.

AQUAPUNCTURE OF INLAND WATERWAYS



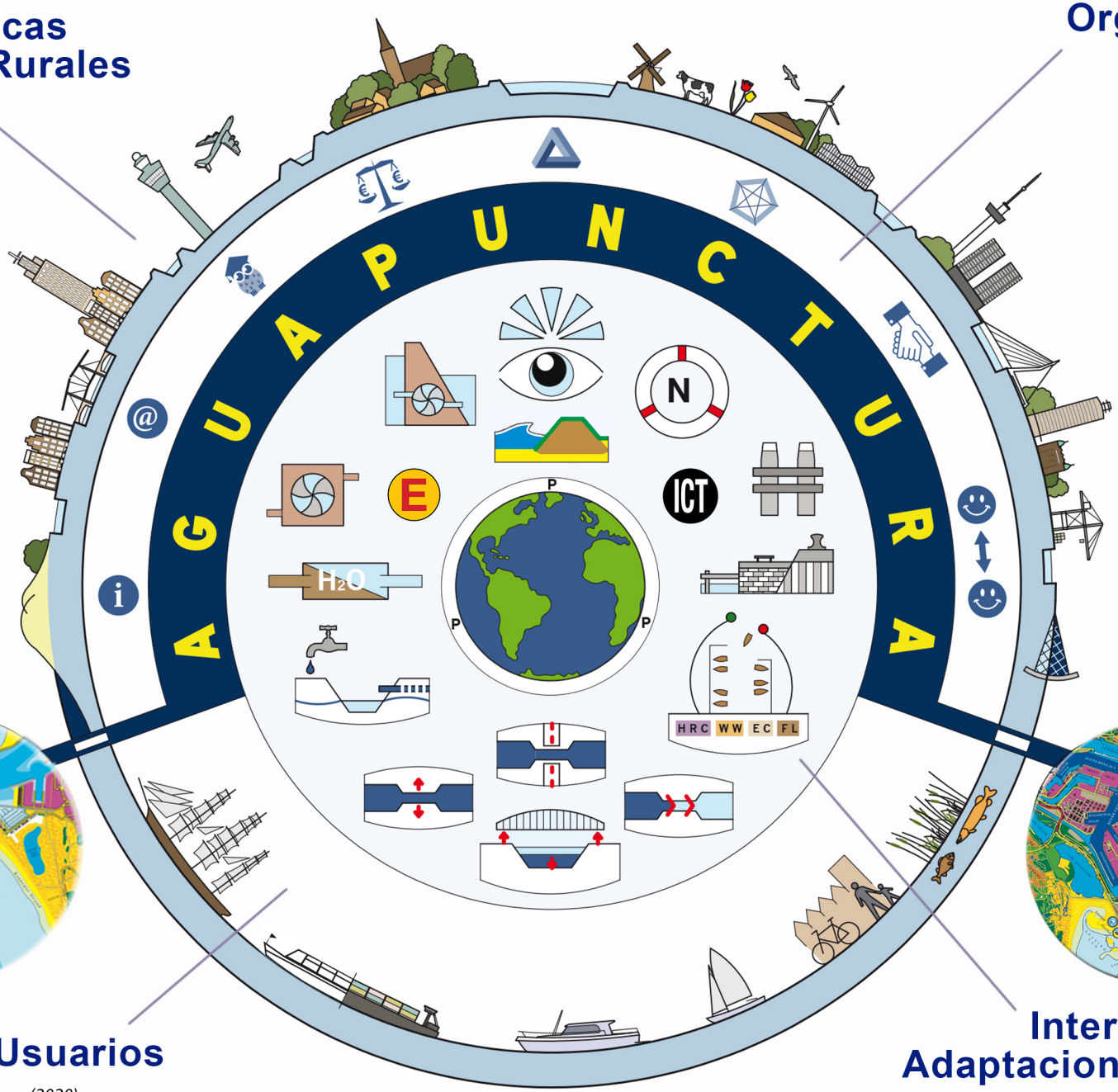
Now we are once again fully aware of the significance of this unique relation between the waterways and the adjacent urban & rural habitats.
Therefore we want to rediscover and revitalise the waterway network through

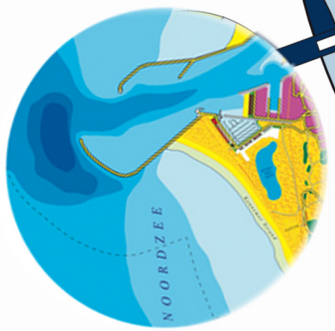
AQUAPUNCTURE©



Caracteristicas
Urbanas y Rurales

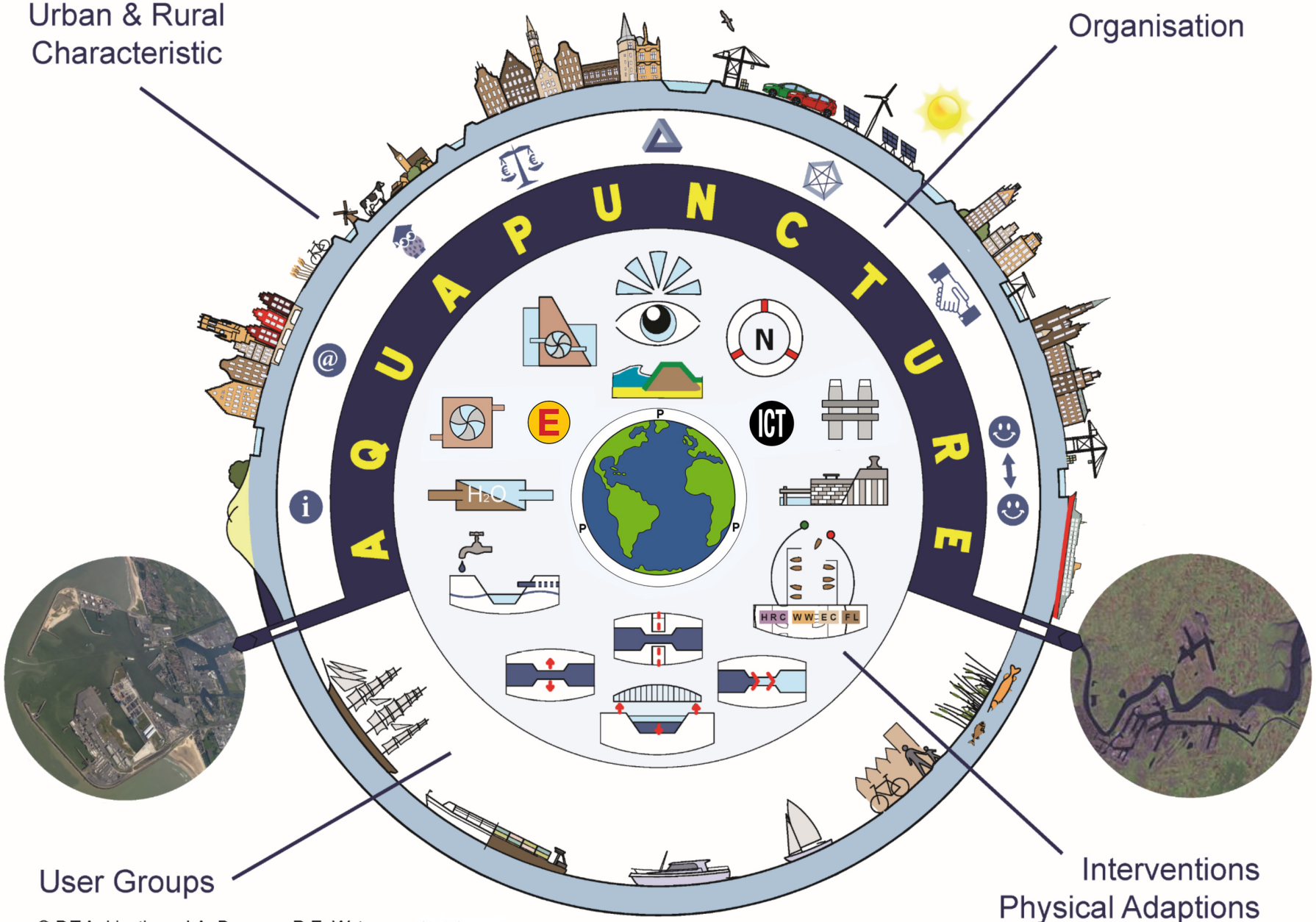
Organización

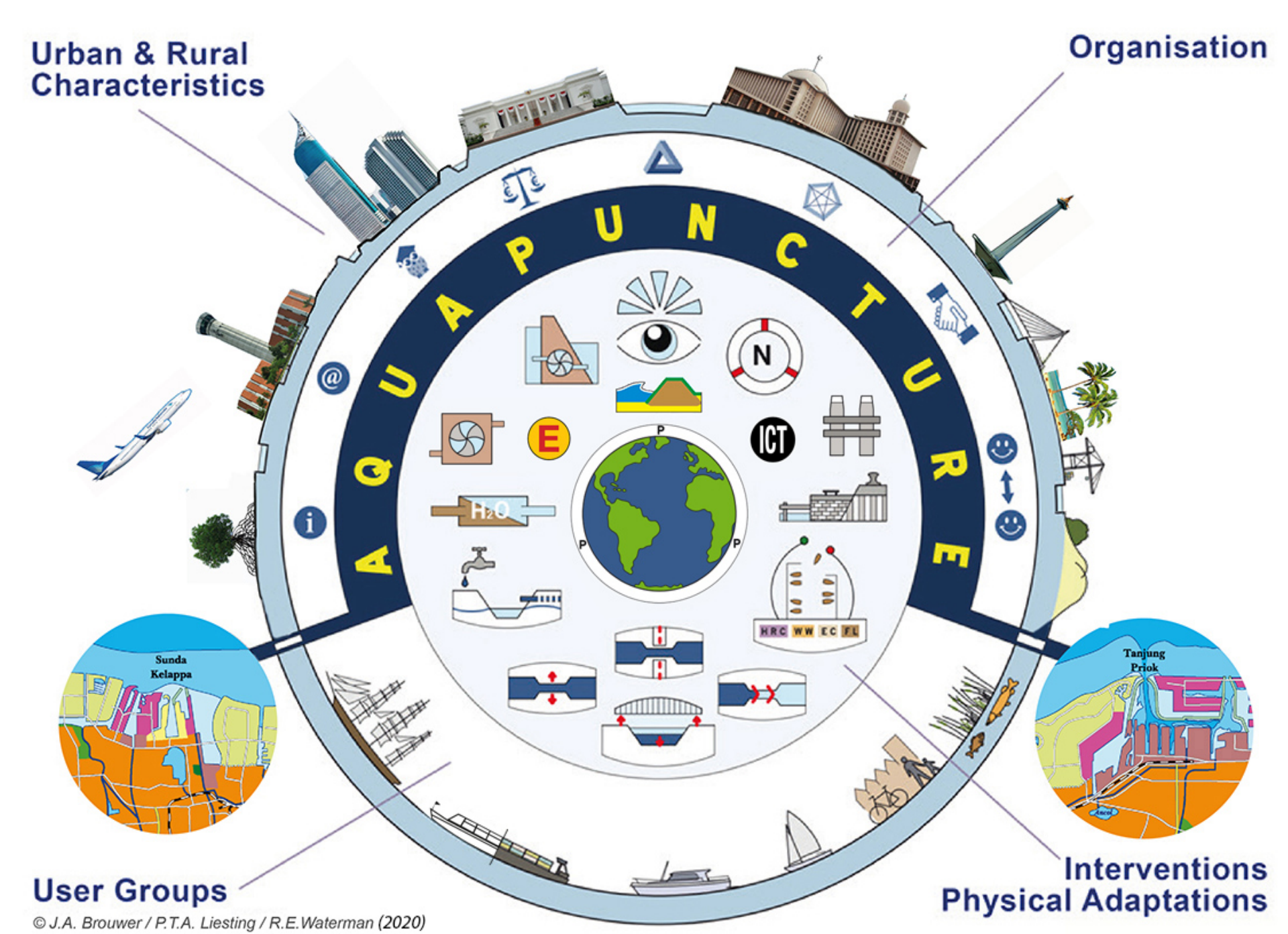




Grupos de Usuarios

Intervenciones
Adaptaciones Fisicas



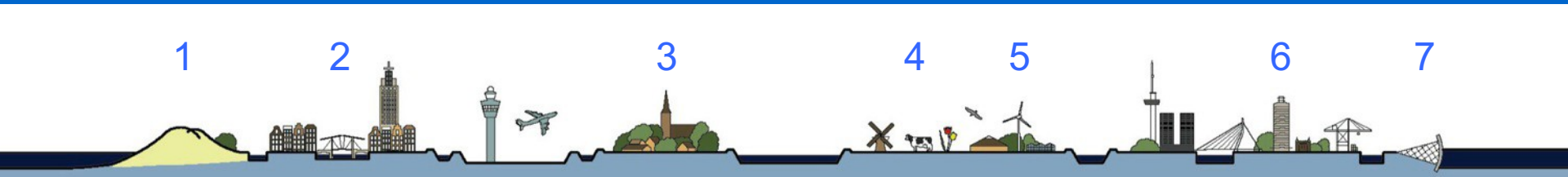


Urban & Rural Characteristics along the Waterways

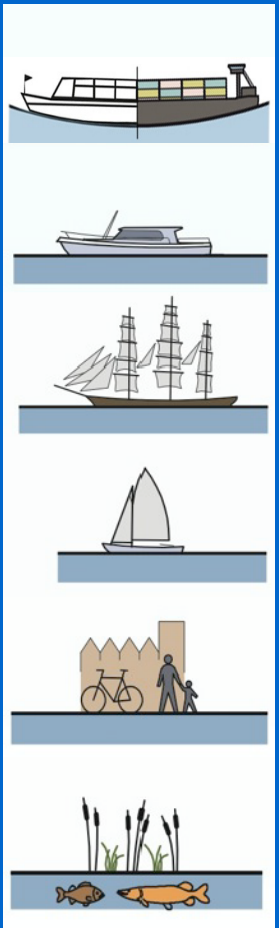
Connection Inland Waterway with Seaport Marina & Nature Reserve Areas via Building with Nature©

1 Soft Coastal Defense
2 City
3 Village
4 Culture & History
5 Farms, Agriculture, Horticulture, Nature
6 Modern City & Port
7 Strong Coastal Defence

Connection Inland Waterway with Mainport Development & Nature Reserve Area via Building with Nature©

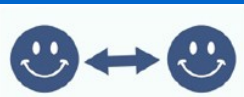


User Groups in and along the Waterways



- Commercial Shipping
- Tourism & Recreation
- Special Nautical Events
- Water Related Sports
- Waterfront Users & Developers
- Aquatic / Terrestrial Flora & Fauna

Organisation for Waterway & Waterfront Development



Stakeholder Participation

Public & Private Partnership

Societal Costs & Benefits

Cooperation with 5 levels of Government

Trias Politica: Legislative / Judicial / Executive Power

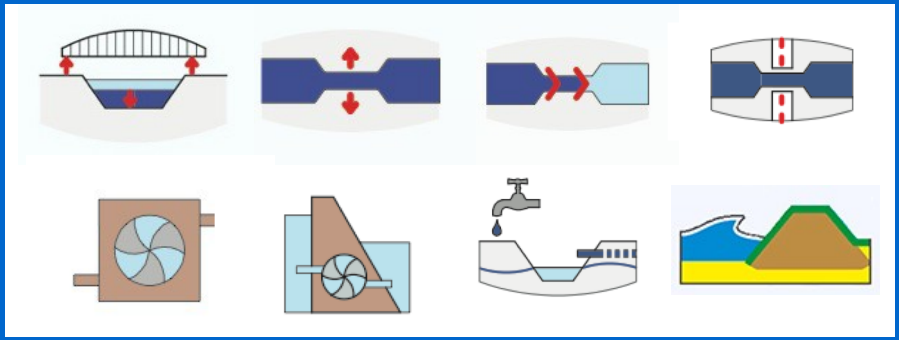
Knowledge & Education

Information, Awareness, Promotion

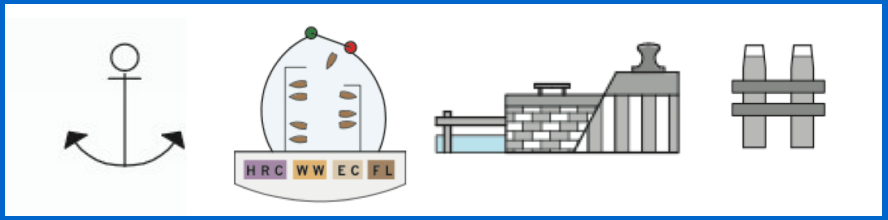
Communication Tools (e.g. Internet & Apps)

Physical Adaptations - Interventions

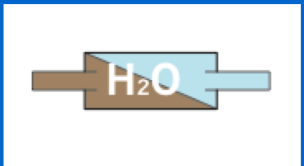
Physical Adaptations



Realisation of Facilities



EU Water Frame Work Directive



for Chemical,
Physical & Biological
Quality

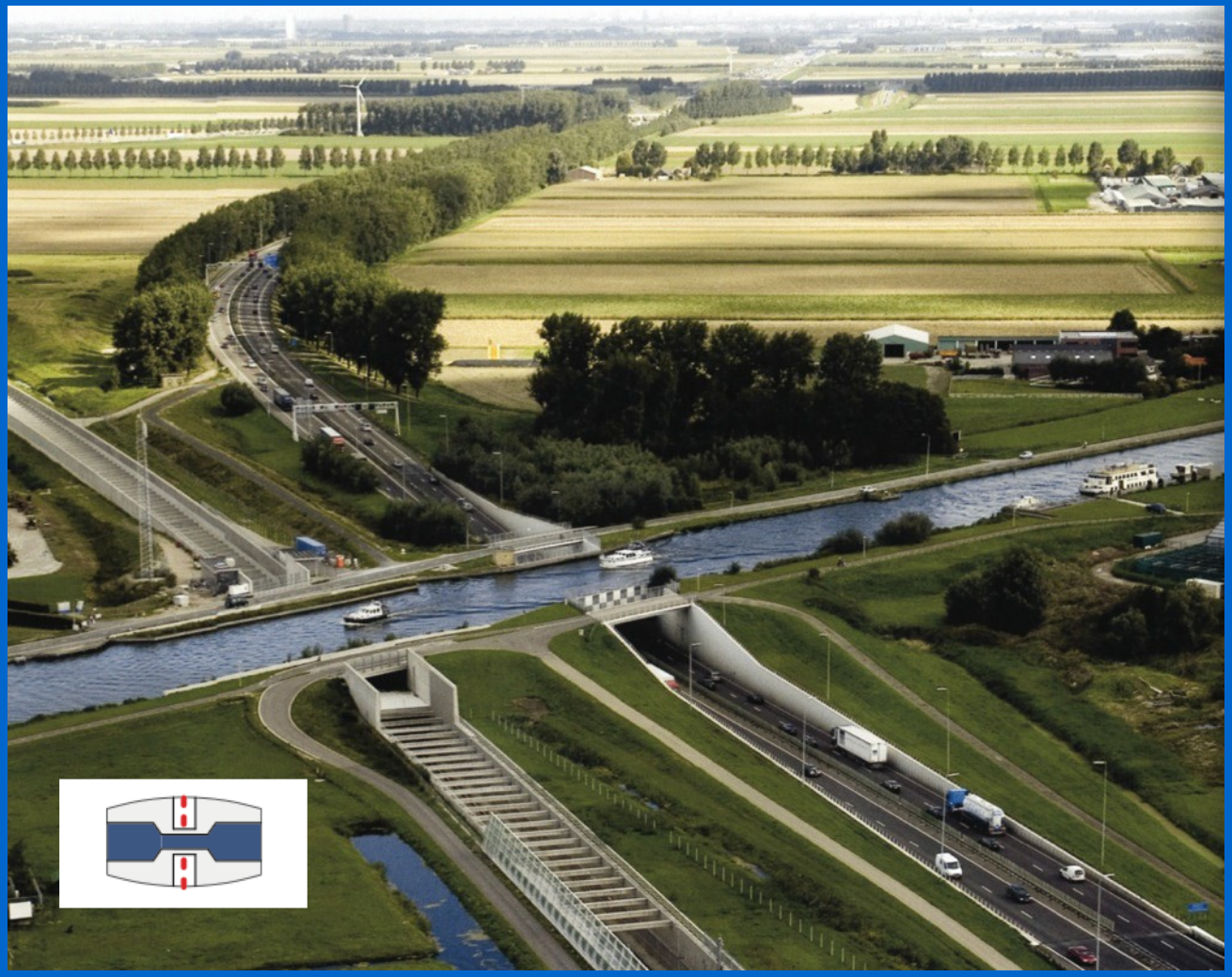
Measures for improving Safety & Environment Mitigating measures with regard to Climate Change

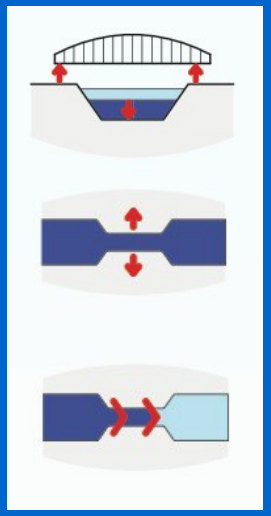
Water use for
Agriculture
Aquaculture
Drinking Water
Cooling & Process Water
Energy
Transport
Water Level Control

Safety including
Nautical Safety

Enhancing Spatial
Qualities

Physical Adaptations - Interventions



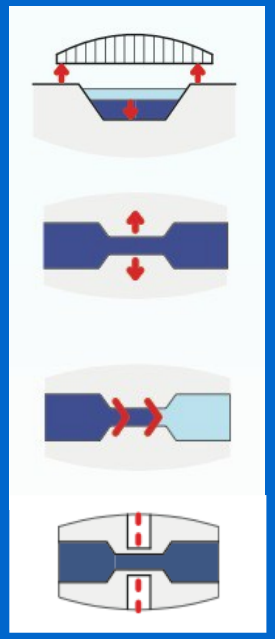


Height bridges above water surface

Depth waterway through environment-friendly dredging

Enlarging sluice /shiplock capacity

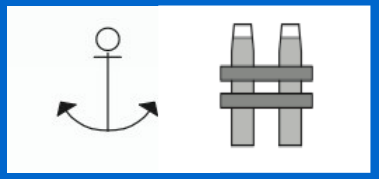
Physical Adaptations - Interventions



Urban development with connecting waterways

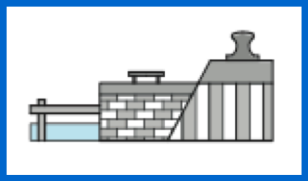
Boat conveyor

Realisation of Facilities

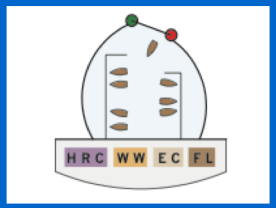


Moorings

Berths with facilities



Jetties, Quay walls, Loading/Unloading Platforms
Container Terminals



Yachting harbour

Safety including Nautical Safety

S

Safety against Flooding

N

Nautical Safety

Enhancing Spatial Qualities

Enhancing blue-green spatial qualities of rural & urban areas

Enhancing Spatial Qualities

▲ Amsterdam

▼Rotterdam

City meets blue-green landscape

Enhancing Transport Qualities

FROM A < -- > B < -- > C

ENERGY:

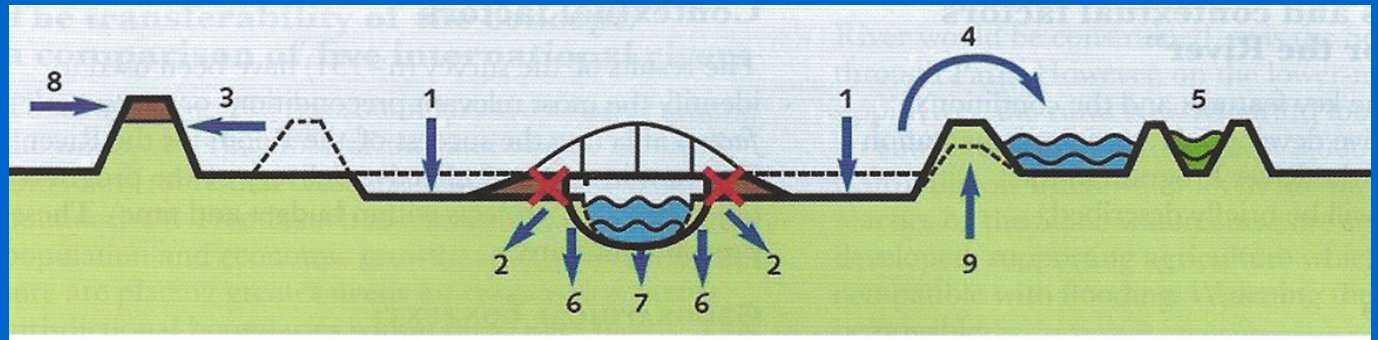
Solar, Wind, Water,
Hydrogen, Methane,
Bio Fuel, E-Power
(Fossile Fuel)

FROM A < -- > B < -- > C

INFORMATION & COMMUNICATION TECHNOLOGY:

Traffic Networks,
Data Networks & Storage,
Simulation,
Artificial Intelligence

Mitigating measures with regard to Climate Change



1 Lowering of floodplains
2 Removal of obstacles
3 Dyke relocation
4 Waterrentention and storage
5 By-pass
6 Height reduction of groynes
7 Deepening of summer bed
8 Heightening of dykes
9 Dyke improvement

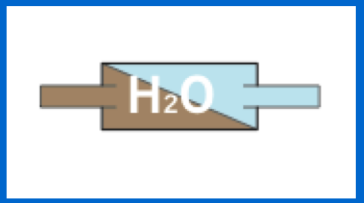
Room for the River

Calamity Storage

Retention Basins

Flood Prevention

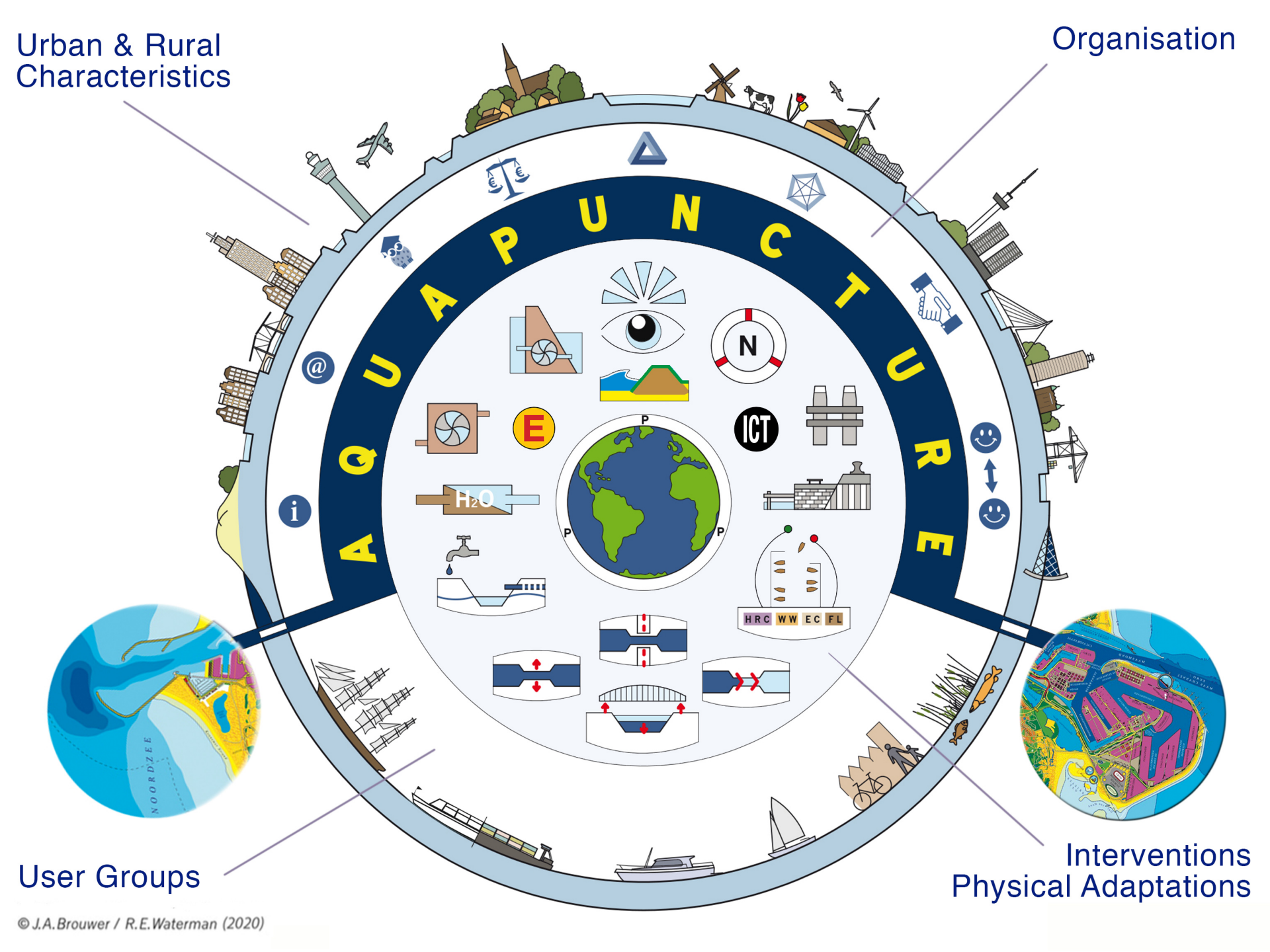
Measures for Improving the Environment



Waste Water Emission Prevention

Waste Water Purification

Water Framework Directive


Urban & Rural Characteristics
Organisation
AQUAPUNCTURE
N
E
ICT
P
P
P
H₂O
HRC WW EC FL
NOORDZEE
User Groups
Interventions Physical Adaptations
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Societal Costs & Benefits Analysis

For the physical adaptations / interventions in and along the waterways initial investments are necessary. These are followed in a later stage by revenues of various types and from various sources.

- **WATER QUANTITY REVENUES**

flood prevention, surface- & ground water regulation, drainage, irrigation for agriculture, drinking water supply, cooling water, process water, water flow, thermal & osmotic energy

- **WATER QUALITY REVENUES**

water quality: beneficial to environment, nature & health

- **NAVIGABILITY REVENUES**

transport of persons and goods, water related sports, tourism & recreation

- **WATERFRONT ATTRACTION REVENUES**

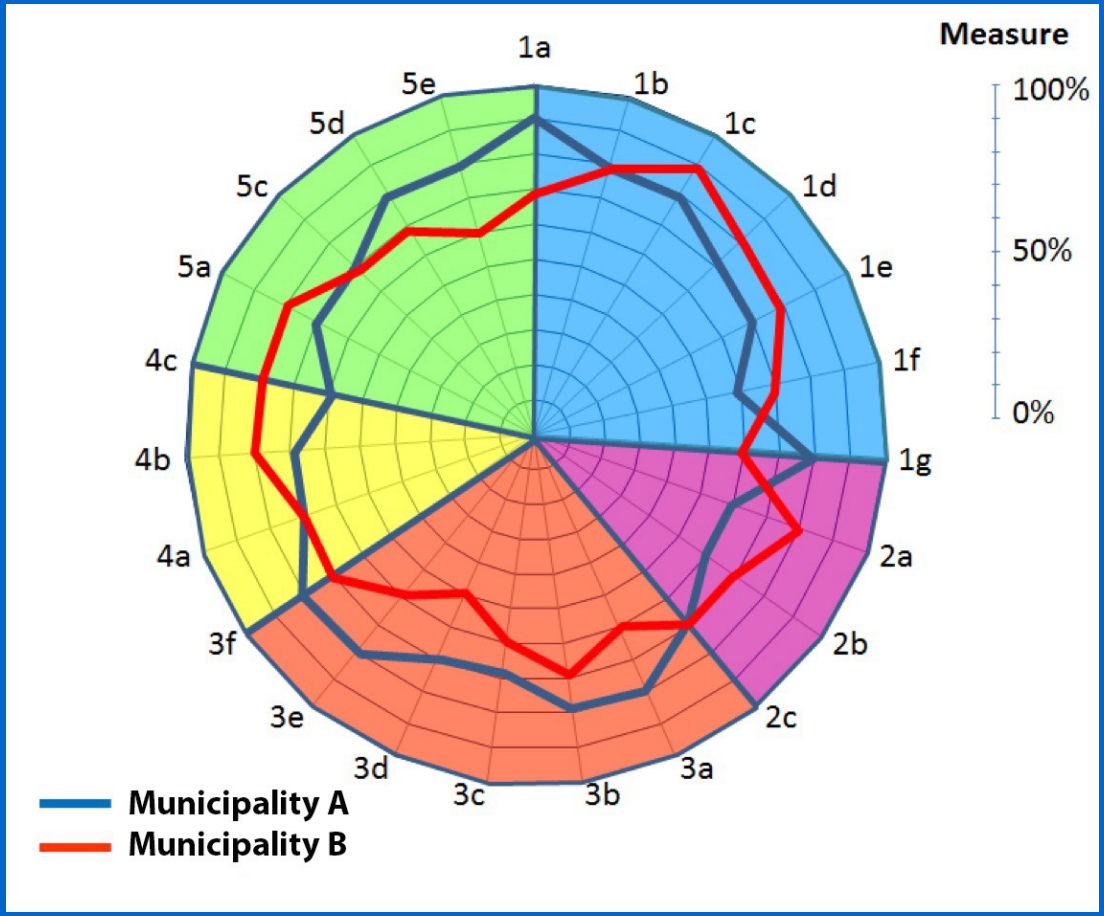
increased liveability, economic activities and increased value of property

- **SPATIAL QUALITY REVENUES**

improved urban & rural environment, preservation & restoration of cultural heritage, attractive residential areas, leisure parks, sustainable industrial parks; overall sustainability also with regard to climate & climate change

Aquapuncture - Shared Value: Societal Costs & Benefits Measurement Model

Values	Objectives
1. **Water quantity**	a) Ensure flood protection b) Surface water & ground water regulation c) Drainage, irrigation for agriculture & aquaculture d) Drinking water supply e) Cooling water f) Process water g) **Water flow, thermal, osmotic energy**
2. **Water quality**	a) Improvement of water quality for environment b) Improvement of water quality for nature c) Improvement of water quality for health
3. **Navigability**	a) Commercial transport of persons b) Commercial transport of goods c) Tourism and recreation d) Special events on/at water e) Water related sports f) Waterway classification & connectivity
4. **Water front revenues**	a) Increased liveability b) Economic activities c) Increased value of property
5. **Spatial quality revenues**	a) Improved urban & rural environment b) Preservation & restoration of cultural heritage c) Attractive residential & business areas d) Leisure parks, sustainable industrial parks e) Overall sustainability, also with regard to climate & climate change



Regional Waterway System

Objective: Sustainable Environment for Living & Working

- Utilization & Improvement Inland Waterways
- Socio-Economic & Spatial Development
- Preservation & Development Enviroment & Nature
- Climate Change Adaptation

Aspects

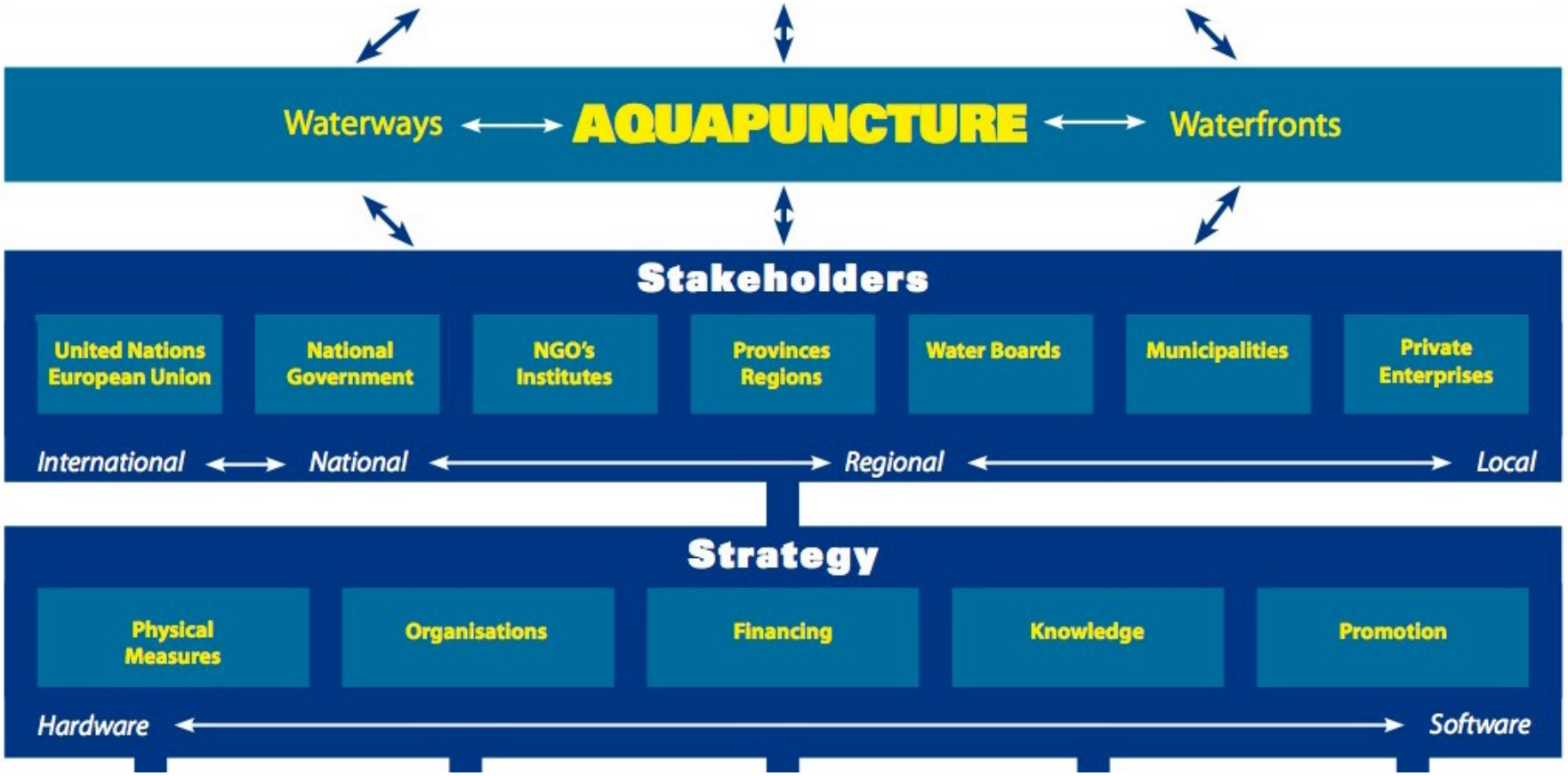
- Navigational Routes *(bottleneck analysis)*
- Waterway Facilities
- Spatial Quality
- Cultural Heritage
- Environment & Nature
- Climate

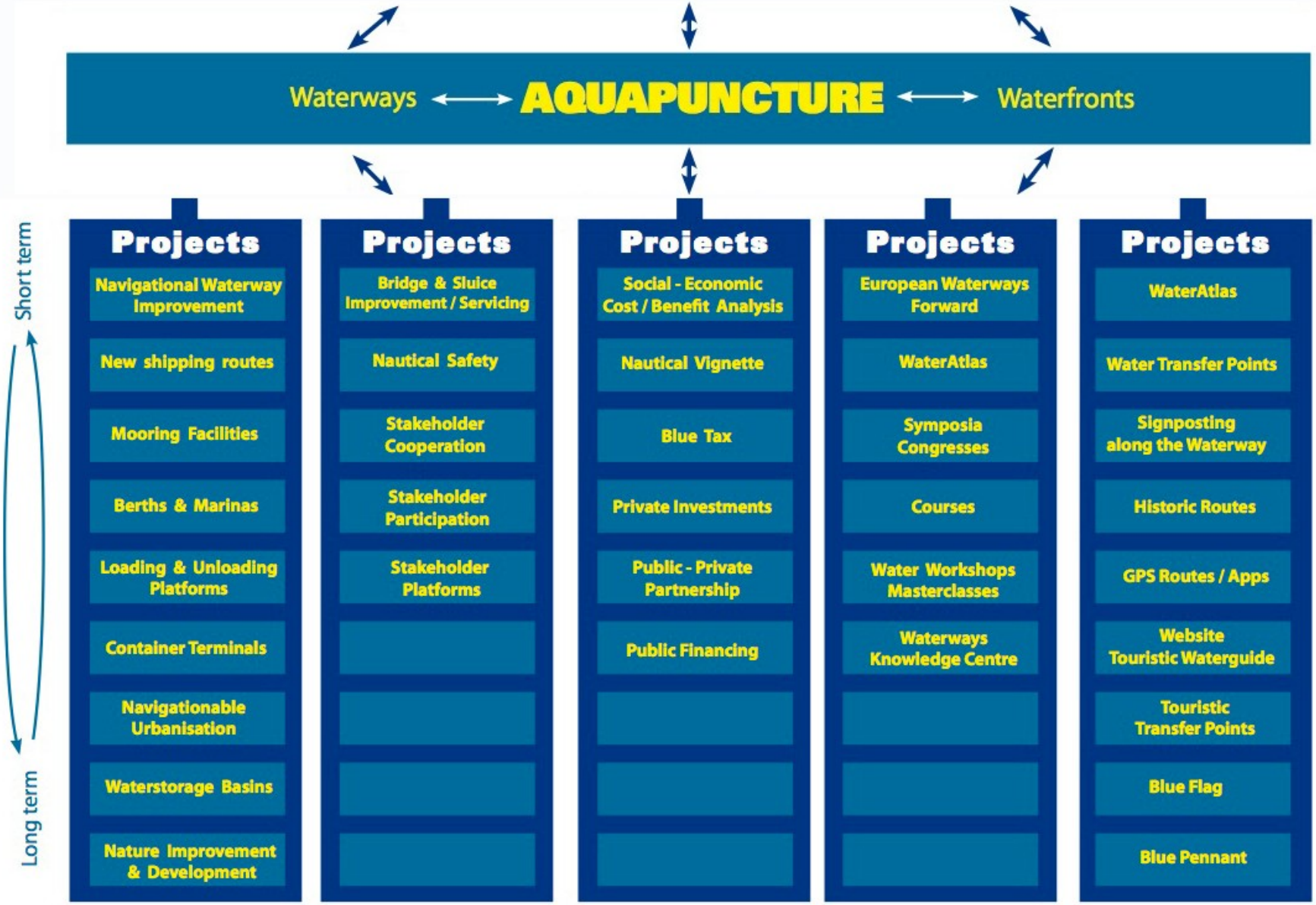
Users

- Commercial Shipping
- Touristic & Recreational Boating
- Watersports
- Waterfront Developers & Users
- Special Nautical Events
- Flora & Fauna Micro-organisms

On water ⟷ *Along / in the water*

Waterways ⟷ **AQUAPUNCTURE** ⟷ Waterfronts

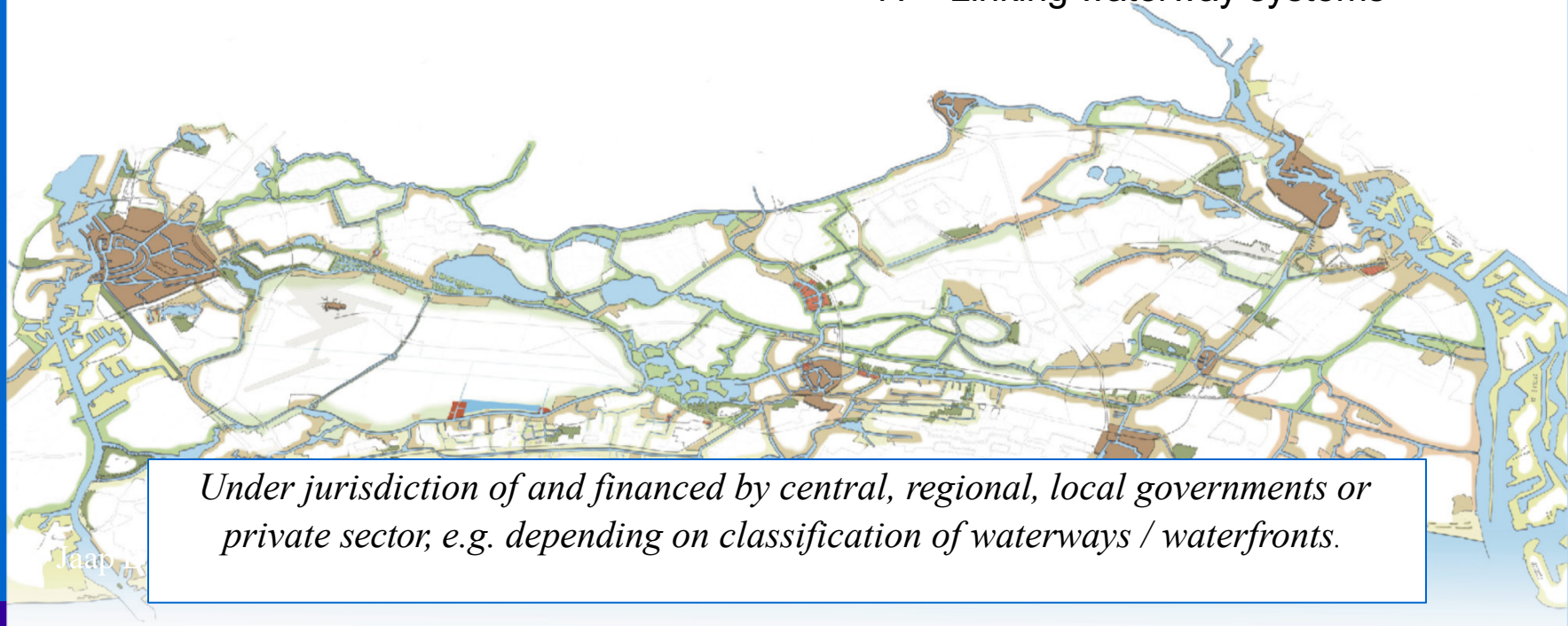

Waterways
AQUAPUNCTURE
Waterfronts
Stakeholders
United Nations
European Union
National
Government
NGO's
Institutes
Provinces
Regions
Water Boards
Municipalities
Private
Enterprises
International
National
Regional
Local
Strategy
Physical
Measures
Organisations
Financing
Knowledge
Promotion
Hardware
Software


Waterways
AQUAPUNCTURE
Waterfronts
Short term
Long term
Projects
Navigational Waterway Improvement
New shipping routes
Mooring Facilities
Berths & Marinas
Loading & Unloading Platforms
Container Terminals
Navigationable Urbanisation
Waterstorage Basins
Nature Improvement & Development
Projects
Bridge & Sluice Improvement / Servicing
Nautical Safety
Stakeholder Cooperation
Stakeholder Participation
Stakeholder Platforms
Projects
Social - Economic Cost / Benefit Analysis
Nautical Vignette
Blue Tax
Private Investments
Public - Private Partnership
Public Financing
Projects
European Waterways Forward
WaterAtlas
Symposia Congresses
Courses
Water Workshops Masterclasses
Waterways Knowledge Centre
Projects
WaterAtlas
Water Transfer Points
Signposting along the Waterway
Historic Routes
GPS Routes / Apps
Website Touristic Waterguide
Touristic Transfer Points
Blue Flag
Blue Pennant

UPGRADING WATERWAY SYSTEMS THROUGH AQUAPUNCTURE

Adaptation of the waterways

1. Adaptation of height under bridges
2. Expanding sluice/shiplock capacity
3. Increasing depth through environment-friendly dredging methods
4. Waterway widening
5. River & canal bank adaptation
6. Waterlevel regulation
7. Linking waterway systems

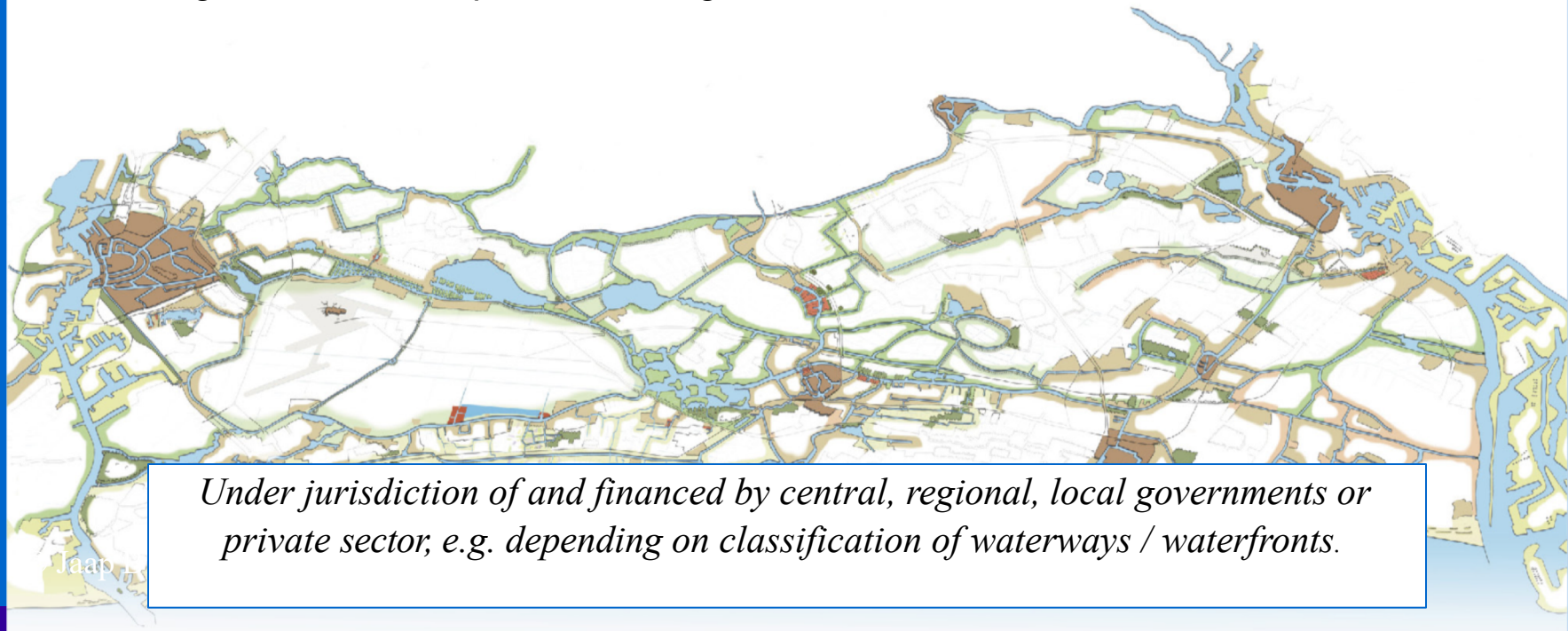


Under jurisdiction of and financed by central, regional, local governments or private sector, e.g. depending on classification of waterways / waterfronts.

UPGRADING WATERWAY SYSTEMS THROUGH AQUAPUNCTURE

Waterway facilities

1. Introduction of berths, marinas with facilities & bollards for mooring
2. Introduction of quay walls, loading/unloading platforms & inland container terminals
3. Bridge and sluice/shiplock servicing

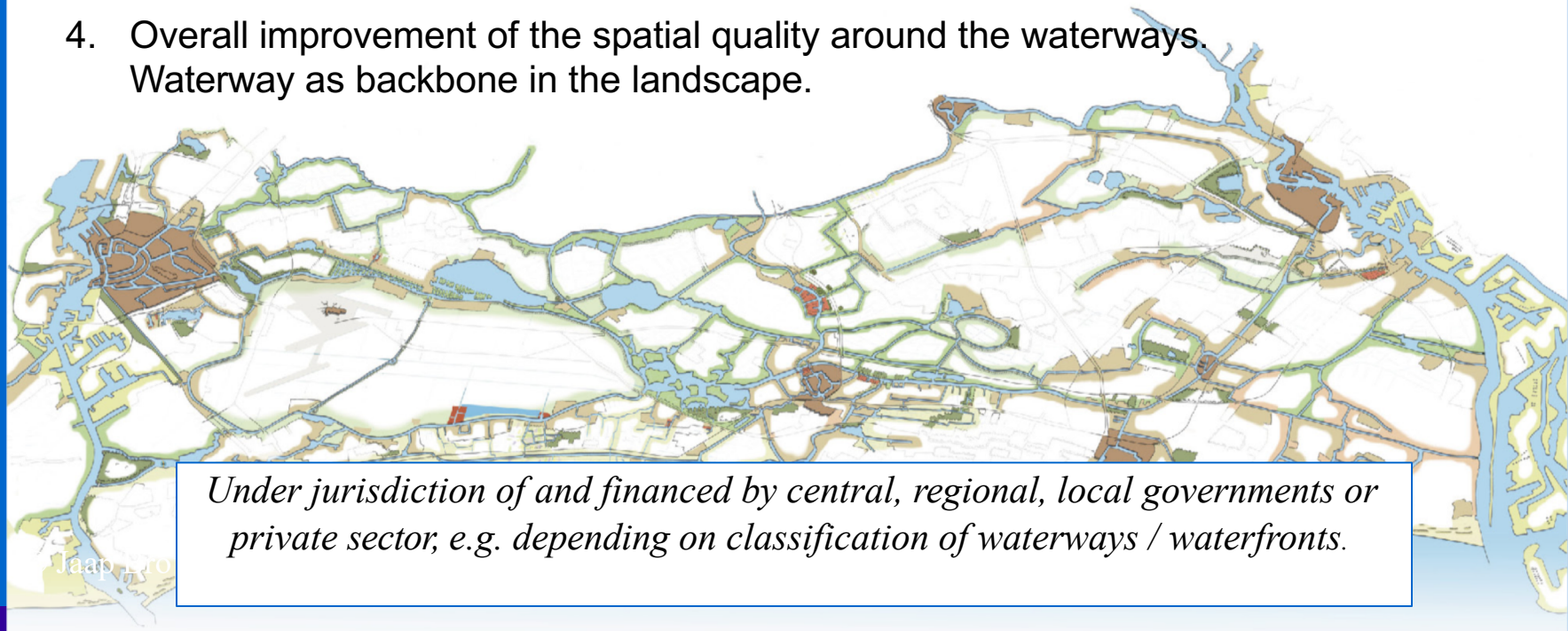


Under jurisdiction of and financed by central, regional, local governments or private sector, e.g. depending on classification of waterways / waterfronts.

UPGRADING WATERWAY SYSTEMS THROUGH AQUAPUNCTURE

Waterfront facilities

1. Cycle- & footpaths, parking space along the waterway
2. Maintaining & restoring & purposeful using cultural heritage values in and along the waterway
3. Introduction of hotel, restaurant, café/pub facilities, museums, water related shops, leisure parks along the waterway
4. Overall improvement of the spatial quality around the waterways. Waterway as backbone in the landscape.



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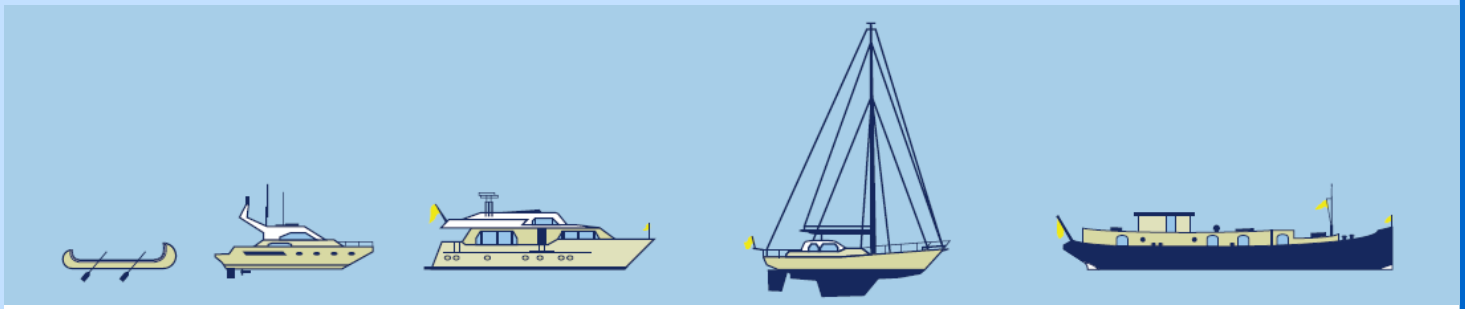
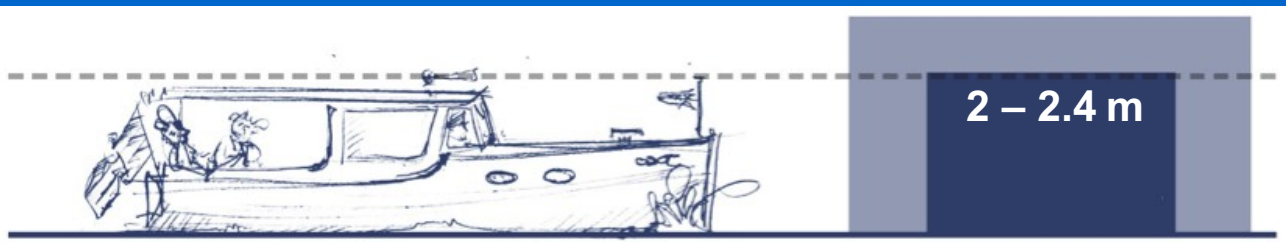
Recreational Navigation Classification



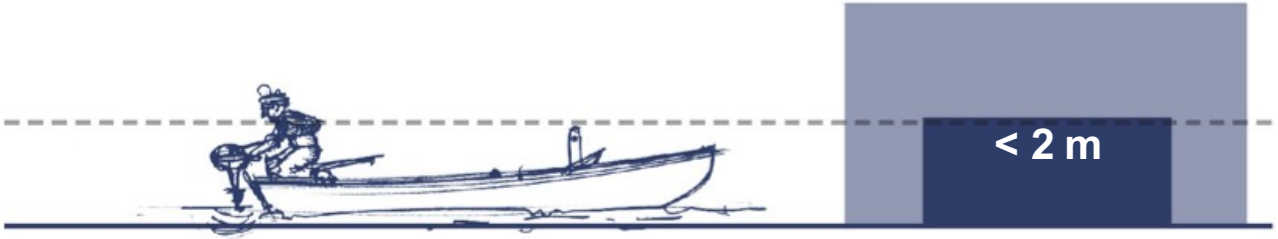
DESIGNATION	OPEN BOAT	CABIN CRUISER	MOTOR YACHT	SAILING BOAT	MOTOR BARGE
CLASS	RA	RB	RC	RD	I
MAX . LENGTH (M)	5.5	9.5	15.0	15.0	38.5
MAX. BEAM (M)	2.0	3.0	4.0	4.0	5.05
DRAUGHT (M)	0.5	1.0	1.5	2.0	1.8 – 2.2
MIN. HEIGHT UNDER BRIDGES (M)	2.0	3.25	4.0	30.0	4.0

AQUAPUNCTURE OF INLAND WATERWAYS



Cruiser

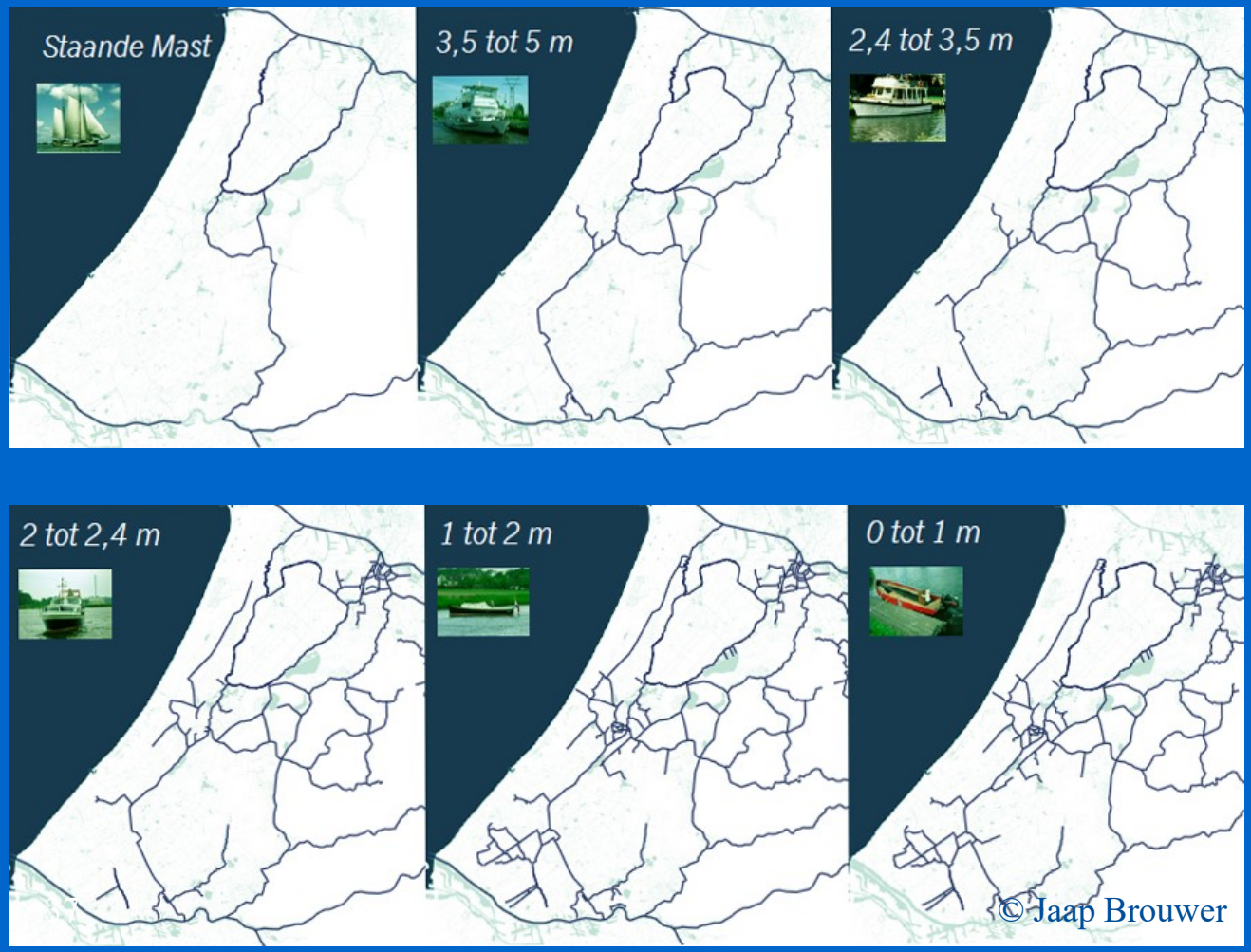
Barge / Boat / Dinghy



BM / Rowing boat / canoe

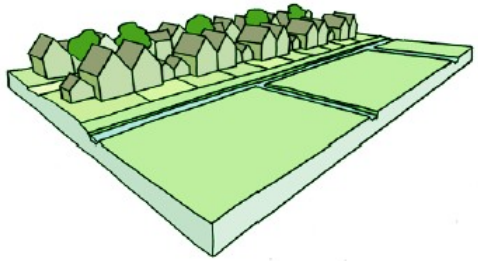
Waterway classification is a.o. depending on the height of the bridges above the water surface and waterway dredging depth

AQUAPUNCTURE OF INLAND WATERWAYS

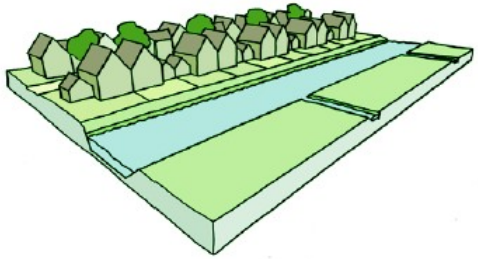


Not only to improve but also to extend the waterway system

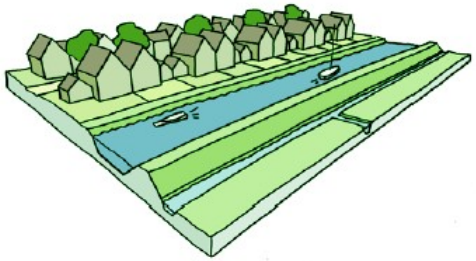
AQUAPUNCTURE OF INLAND WATERWAYS



Revenue = € X



Revenue = € X + 15,000

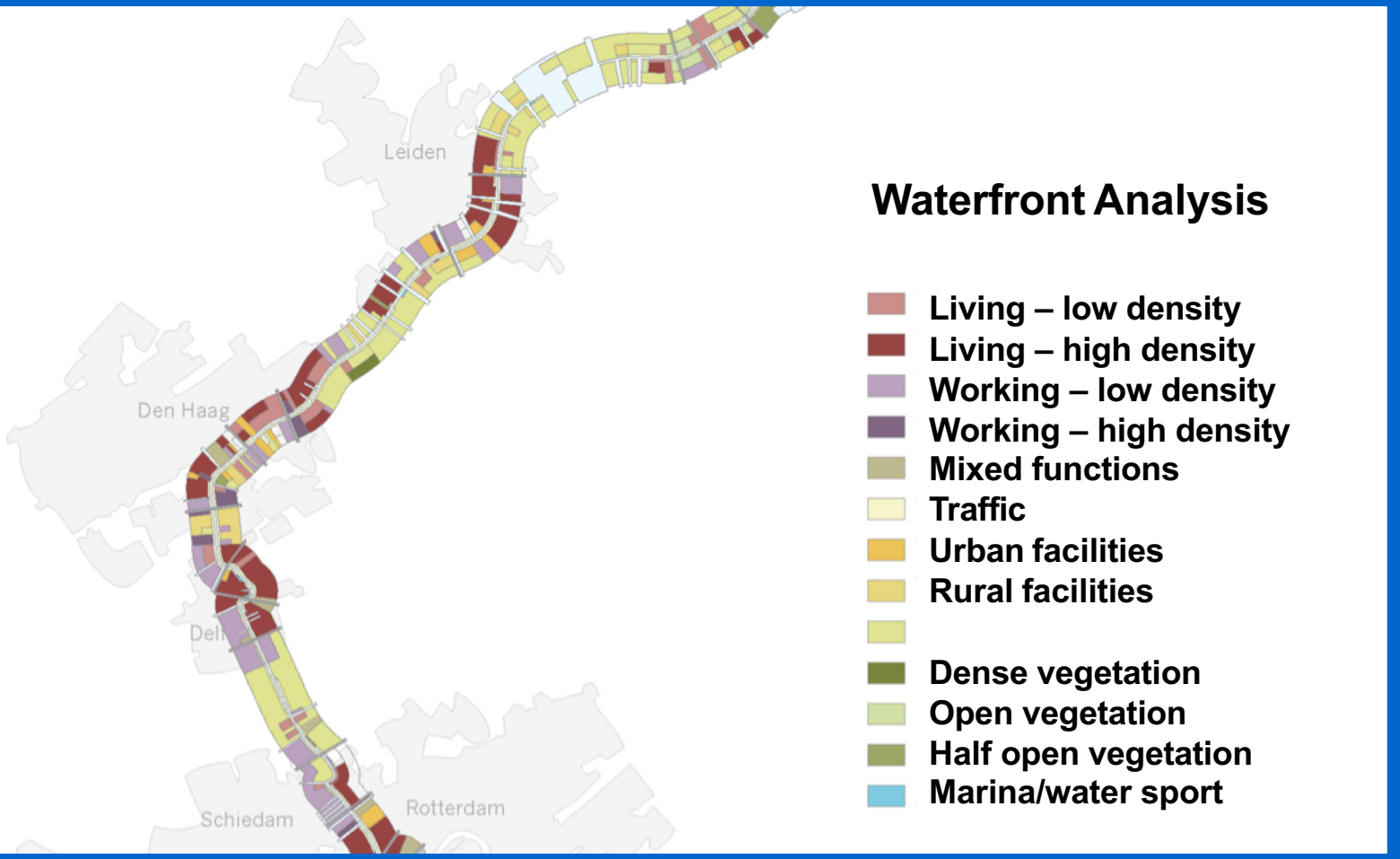


Revenue = € X + 40,000

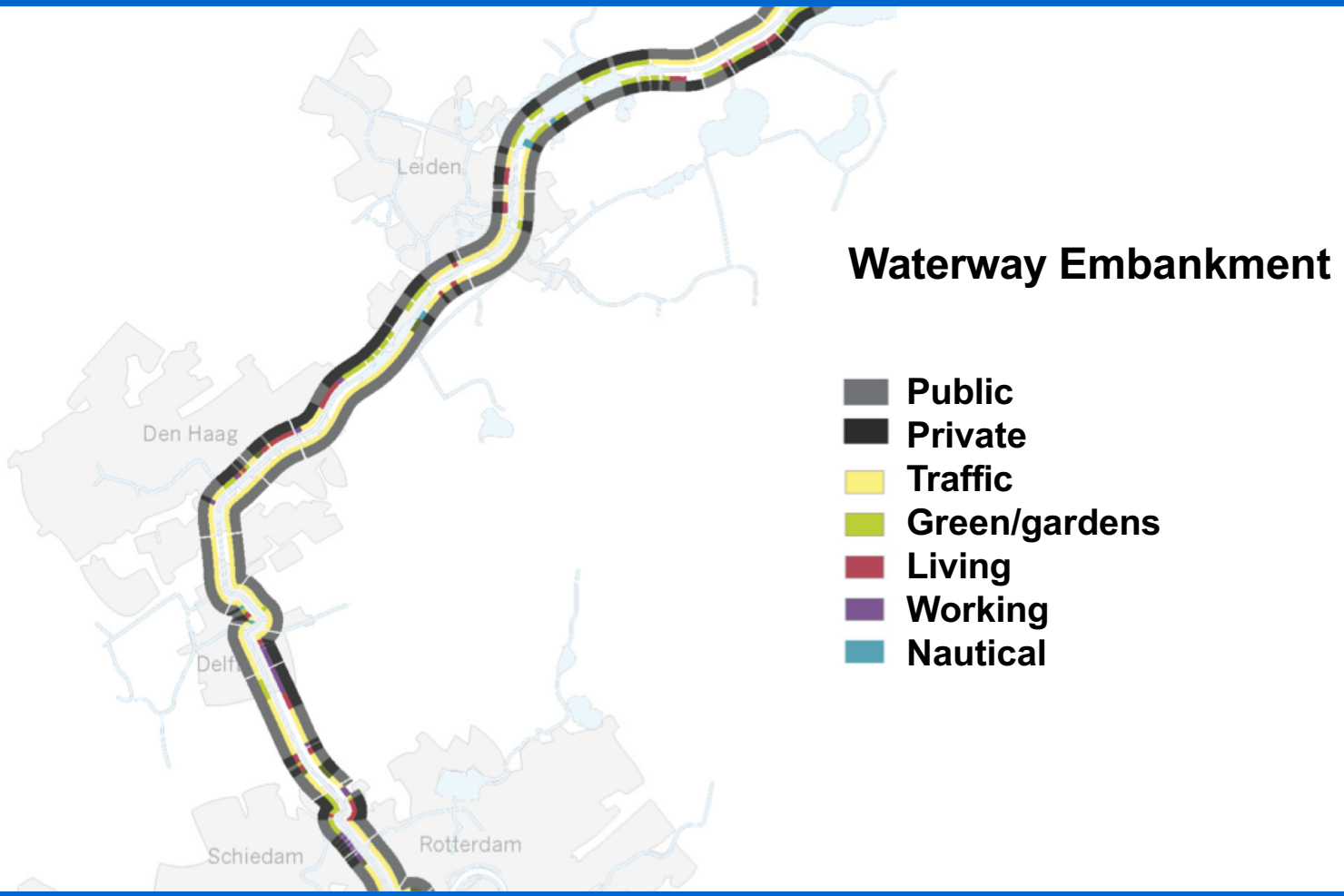
The social-economic significance of water-related tourism / recreation is self-evident and shows in the total revenues and employment figures.

Furthermore waterway improvement leads to higher values of real estate along the waterfront.

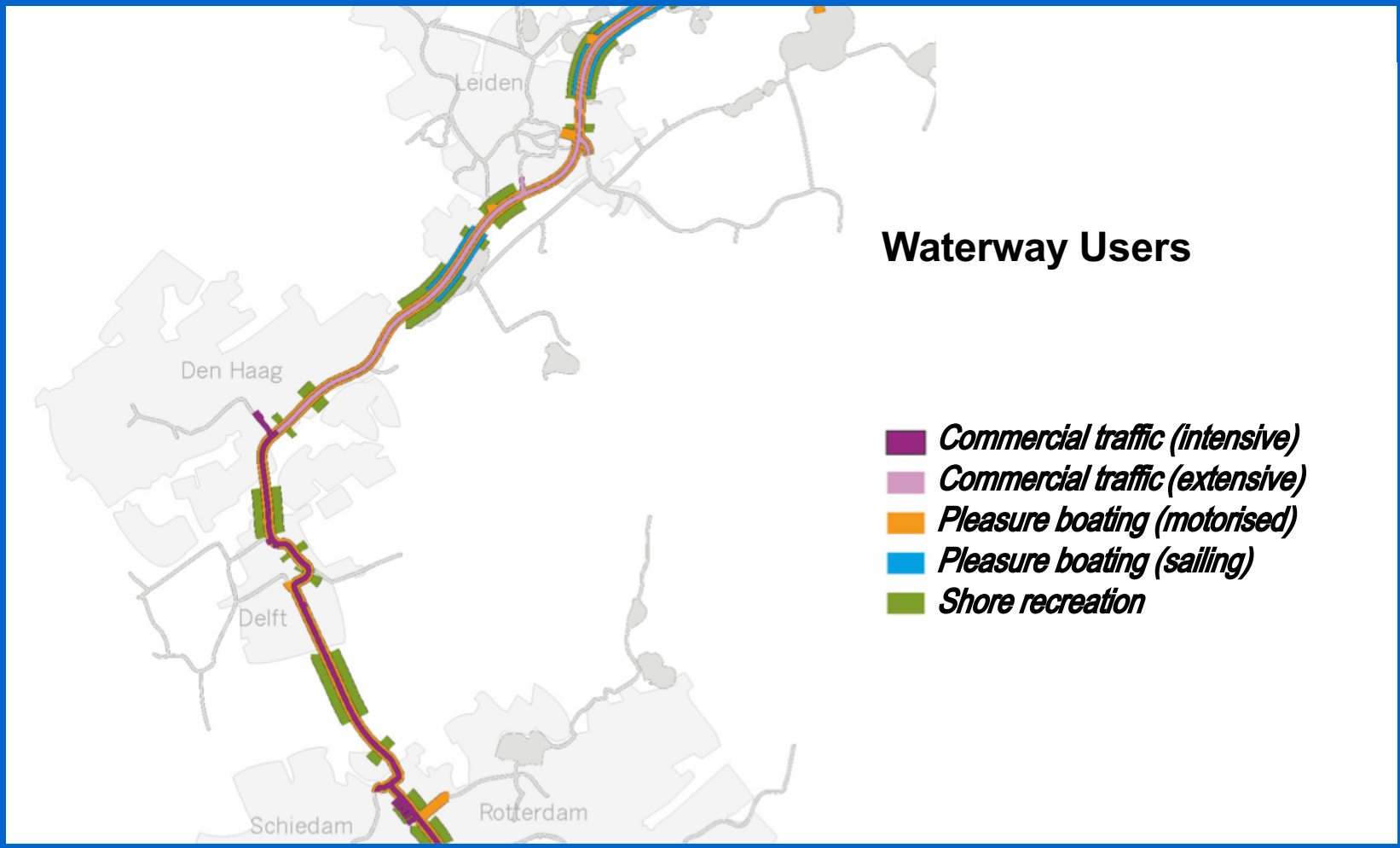
WATERWAY &WATERFRONT CHARACTERISTICS



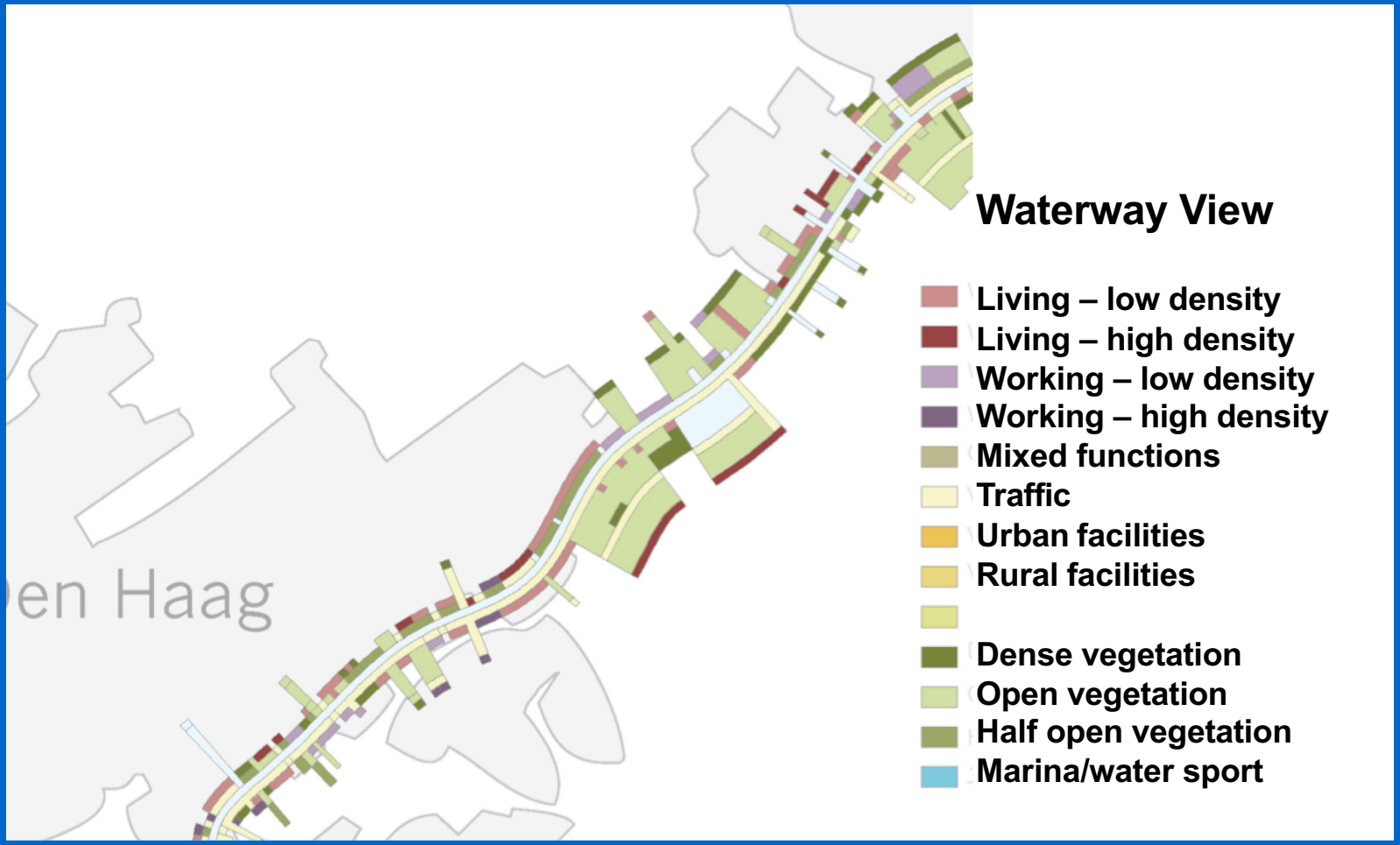
WATERWAY &WATERFRONT CHARACTERISTICS



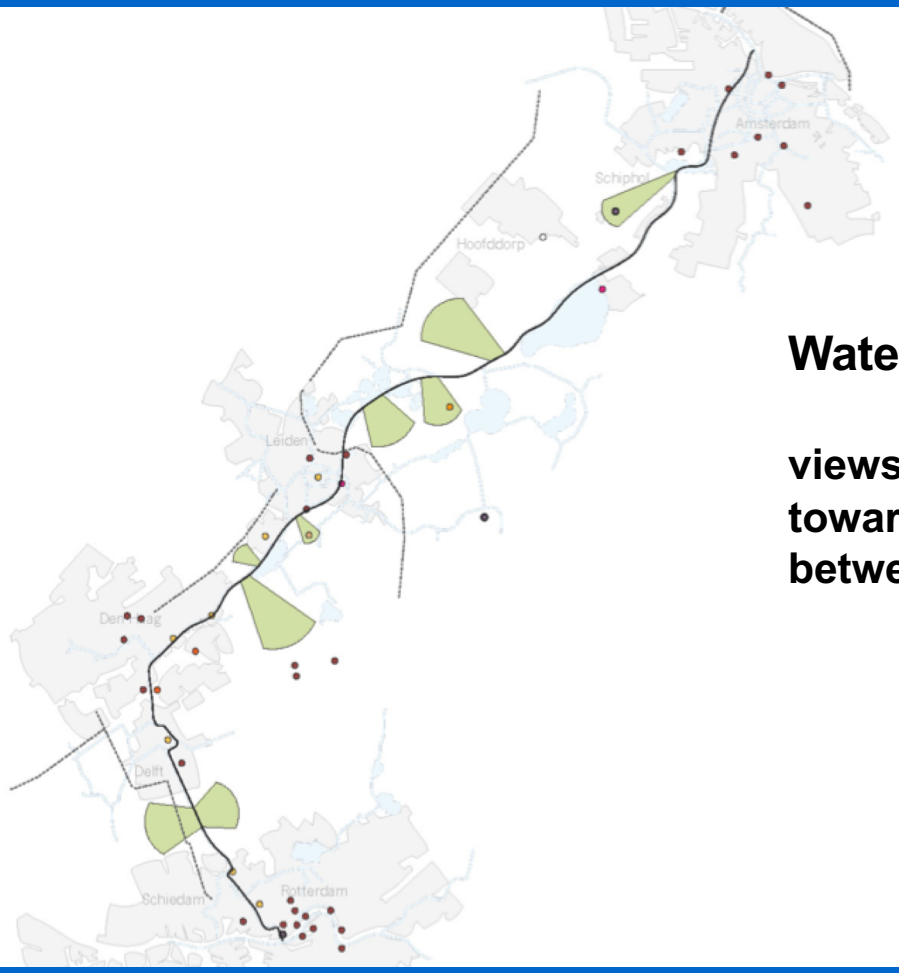
WATERWAY &WATERFRONT CHARACTERISTICS



WATERWAY &WATERFRONT CHARACTERISTICS



WATERWAY &WATERFRONT CHARACTERISTICS



Waterway Panoramas

views from the waterway towards the rural areas between the cities

UPGRADING WATERWAY SYSTEMS THROUGH AQUAPUNCTURE

Environmental measures

1. Introduction of environment-friendly banks / shores
2. Improving overall water quality and aquatic & terrestrial ecosystems
3. Implementation of Water Framework Directive for canals, rivers & lakes
4. Conservation of protected species within Natura 2000 and other designated sites
5. Controlling of invasive flora en fauna species (AIS) in inland waterways, using innovative methods e.g. bio-degradable mats
6. Waterway improvement by cutting overgrowth and by removal of excessive aquatic plants
7. Waterway quality improvement by aeration, a.o. through placing stones in shallow streams and air bubble screens; increasing waterflow
8. Monitoring before, during & after measures for improving water quality
9. Introduction of electrically powered vessels

Under jurisdiction of and financed by central, regional, local governments or private sector, e.g. depending on classification of waterways / waterfronts.

UPGRADING WATERWAY SYSTEMS THROUGH AQUAPUNCTURE

Environmental measures

10. Waste water storage, transport & treatment both on shore as on pleasure crafts
11. Environment-friendly dredging methods to achieve and maintain channel depths
12. Re-introduction of indigenous flora and fauna species
13. Creating conditions for nature development (Building with Nature)
14. Intermodal transition from motorway to waterway transport for freight and persons (boat bus) using Eco-calculator models
15. Measures against eutrification through waste water purification and by reducing use of fertilizers in agriculture
16. Improving environment – nature – landscape through education & active volunteer participation
17. Promotion of eco-tourism in and near Nature 2000 areas / sites
18. Introduction of the Blue Pennant as environmental quality mark for vessels
19. Introduction of the Blue Flag for municipalities to promote good swimming water quality for the public waters

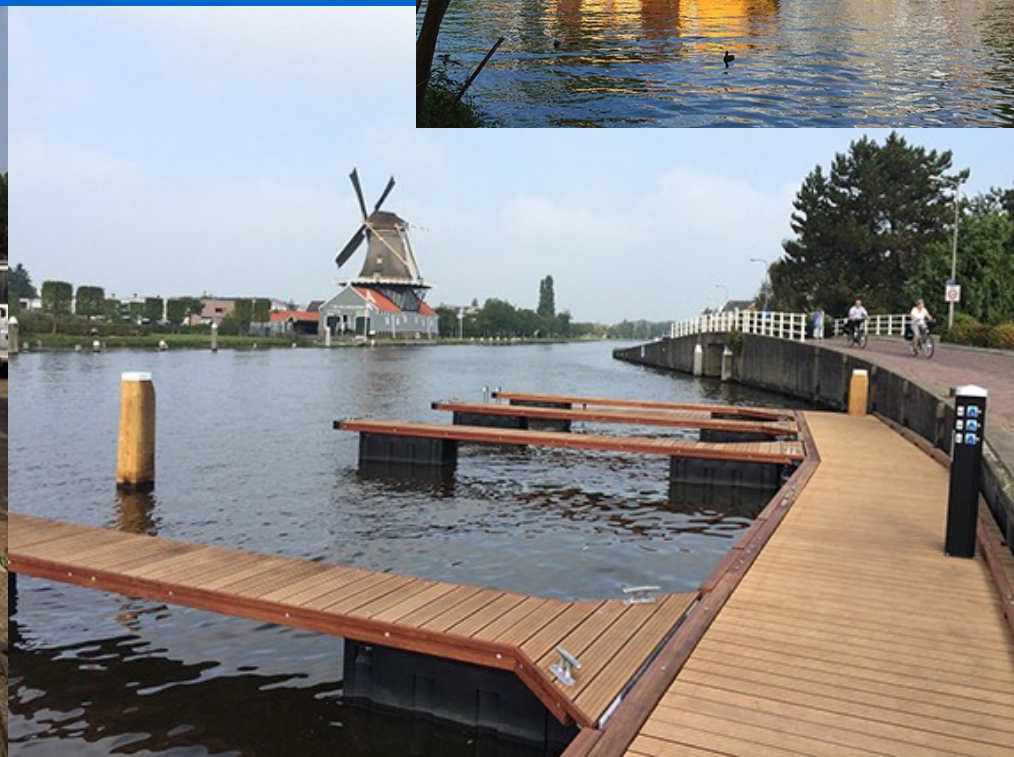
Under jurisdiction of and financed by central, regional, local governments or private sector, e.g. depending on classification of waterways / waterfronts.

SUSTAINABLE FUTURE OF INLAND WATERWAYS

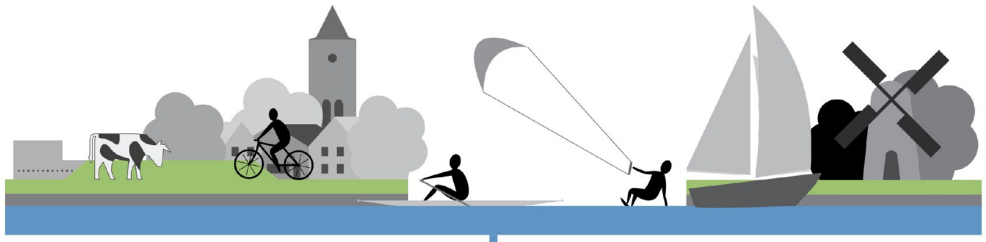
Special berths with facilities

SUSTAINABLE FUTURE OF INLAND WATERWAYS

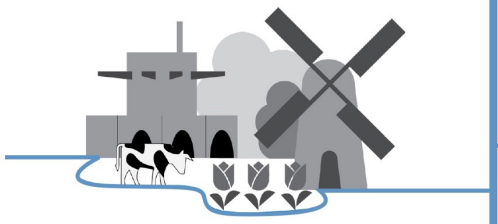
Special berths with facilities



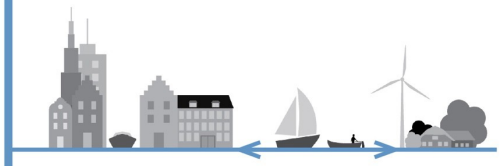
Value of Water Recreation



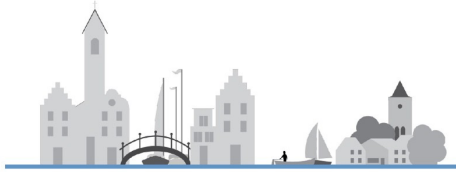
Culture History



Relation Urban - Rural



Residential Quality



Societal & Business Quality

Health

On & Along Water

WATER RECREATION NETHERLANDS

Water Recreation in The Netherlands (2015)

2.600.000 vacationers
507.800 vessels
1.160 yachting harbours
18.690.000 shipping days
20.370 employees
4.200 businesses

Turnover:
€ 4.500.000.000 / year

Source: Waterrecreatie Nederland

GIS MAPS
TOURISM &RECREATION
SOUTH-HOLLAND

Waterways Network

Waterway Physical
Waterway Organisation
Waterway Network Routes

Bridge
Sluice
Aqueduct
Servicing
Blue Wave

Harbours
Passer-by Births
Shopping Jetty
Anchorage
Waiting Station

Trailer Slope
Portage

Nautical Safety

Internet/Apps/Signing

Waterfronts

Horeca
Attractions
Events

Cars
Public Transport
Ferry
Touristic Transfer Point

Walking Path
Cycling Path
Public Space

Arrangements

Environment
Nature
Landscape

Water Quality
Flora & Fauna
Nature Development
Landscape

GIS MAPS
TOURISM &RECREATION
SOUTH-HOLLAND

Usage

River & Canel Cruise
Waterbus / Watertaxi

Sailing Boat
Motorboat
Sloop
Canoe
Swimming
Diving
Fishing
Surfing
Kiting
Speedboating
Rowing
Scouting

Thematic Routes

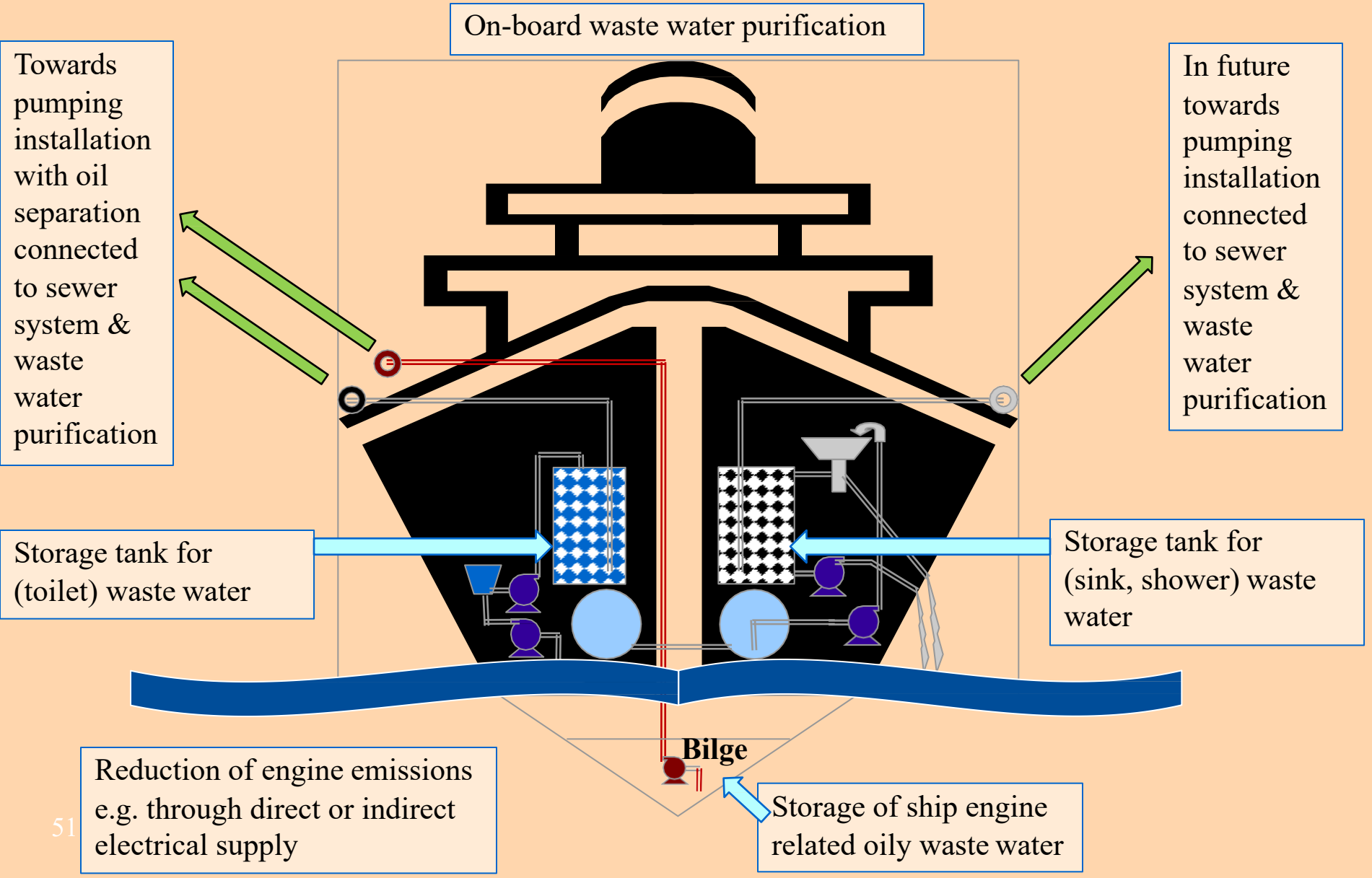
Culture History

Countryside
Urban Site
Nautical Site

Landscape Structure
Urban Structure
Nautical Structure

Landscape Heritage
Industrial Heritage
Water related Heritage
Nautical Heritage
Shipping Heritage
Geopolitical Heritage
Musea

On-board technical provisions starting 2009



SUSTAINABLE FUTURE OF INLAND WATERWAYS

New inland container terminal for brewery

New sluice for shipbuilding

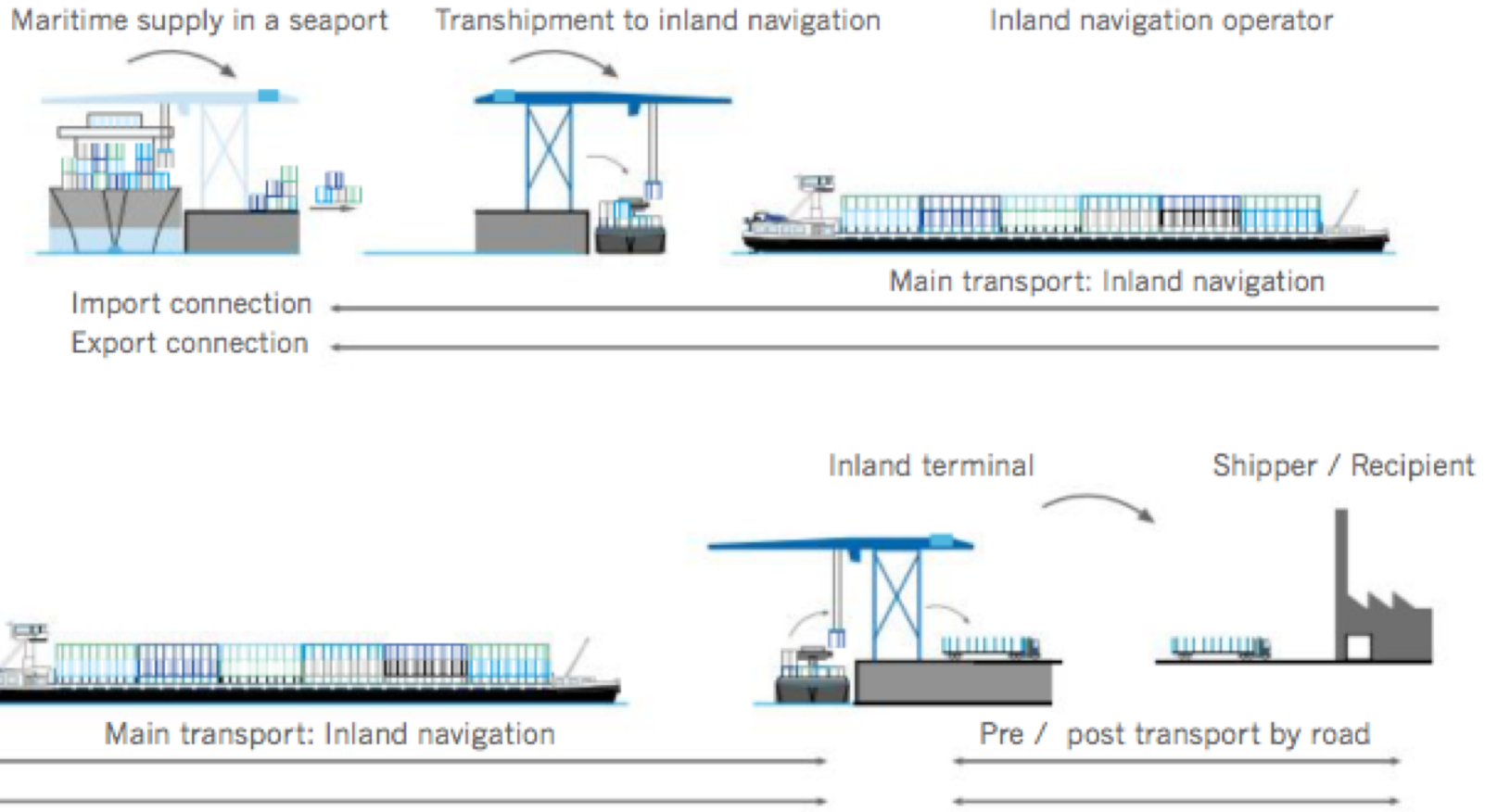
Types of vessels

ECMT Category		
I	Spits  Length 38.50 m - width 5.05 m - draught 2.20 m - cargo capacity 350 t	14X 
II	Campine vessel  Length 55 m - width 6,60 m - draught 2,59 m- cargo capacity 655 t	22X 
III	Dortmund-Eems canal vessel  Length 67 m - width 8.20 m - draught 2.50 m - cargo capacity 1,000 t	40X 
IV	Rhine-Herne canal vessel (Europe vessel)  Length 85 m - width 9.50 m - draught 2.50 m - cargo capacity 1,350 t	54X 
Va	Large Rhine vessel  Length 110 m - width 11.40 m - draught 3.00 m - cargo capacity 2,750 t	120X 
Va	Extended large Rhine vessel  Length 135 m - width 11.40 m - draught 3.5 m - cargo capacity 4,000 t	160X 
Vb	Two lighter pushing unit  Length 172 m - width 11.40 m - draught 4.00 m - cargo capacity 5,500 t	220X 
VIb VIc	Four or six lighter pushing unit  Length 193 m - width 22.80 / 34.20 m - draught 4.00 m - cargo capacity 11,000 / 16,500 t	440/660X 
Va	Standard tank vessel  Length 110 m - width 11.40 m - draught 3.50 m - cargo capacity 3,000 t	120X 

ECMT Category		
Vb	Large tank vessel  Length 135 m - width 21.80 m - draught 4.40 m - cargo capacity 9,500 t	380X 
Va	Car vessel  Length 110 m - width 11.40 m - draught 2.00 m - cargo capacity 530 cars	60X 
III	Container vessel (Campine class)  Length 63 m - width 7 m - draught 2.50 m - cargo capacity 32 TEU	16X 
Va	Standard container vessel  Length 110 m - width 11.40 m - draught 3.00 m - cargo capacity 200 TEU	100X 
Vb	Large container vessel  Length 135 m - width 17 m - draught 3.50 m - cargo capacity 500 TEU	250X 
Va	Ro-ro vessel  Length 110 m - width 11.40 m - draught 2.50 m	72X 
VIb	Coupled formation (vessel with pushed lighter)  Average length 185 m - width 11.40 m - draught 3.50 m - cargo capacity 6,000 t	240X 
VIb	Coupled formation (vessel with pushed vessel)  Average length 185 m - width 11.40 m - draught 3.50 m - cargo capacity 6,000 t	240X 

Designer: ©Stephan le Sage

Hinterland transport by means of inland navigation for maritime transport chains



Container transport via the Dutch inland waterways 2012

Source: RWS, DVS

Main waterways network and planned expansions

Source: BVB, TENtec GIS System - European Commission

SUSTAINABLE FUTURE OF INLAND WATERWAYS

- **Climate change leads to:**

Rise in temperature,
sea level rise,
higher frequency & intensity of storm surges,
more inland: higher frequency & intensity of rainfall
with intermittently periods of drought.
Seasonal varieties of wet and dry periods.
More extremes.

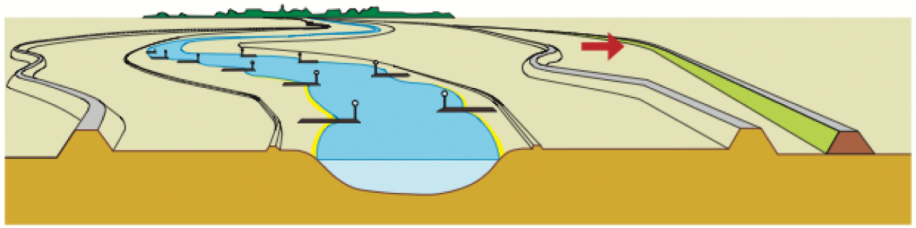
In addition we have to deal with:
land subsidence, salt water intrusion,
a higher % hard surfaces, deforestation,
with a quicker run off towards canals and rivers,
resulting in high water levels,
with in between periods of low water levels
invasive flora & fauna species
bank & shore erosion

UPGRADING WATERWAY SYSTEMS

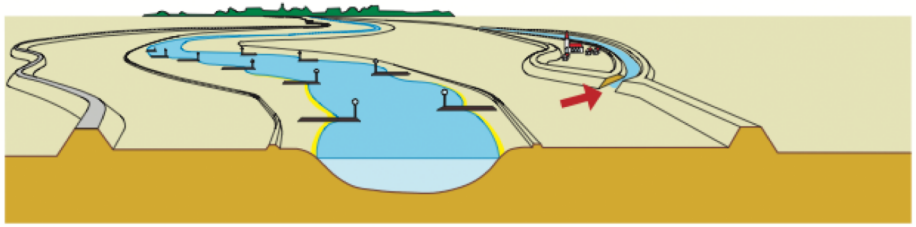
THROUGH AQUAPUNCTURE

Adequate measures for Climate Change:

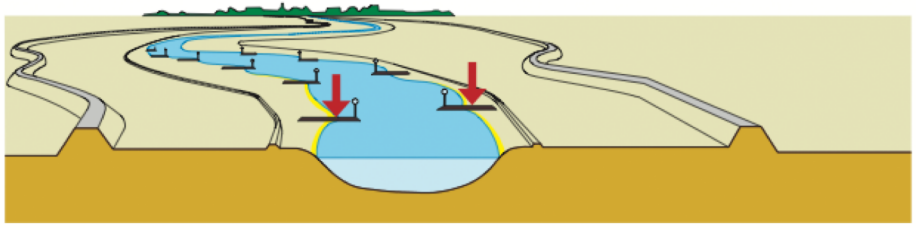
1) Room for the waterway



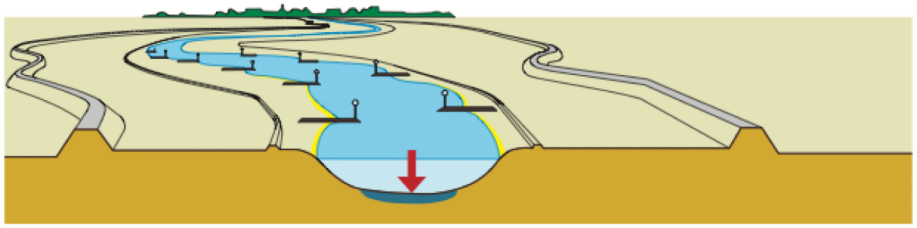
I. Large-scale relocation of the dikes to increase the overflow area between river and dikes



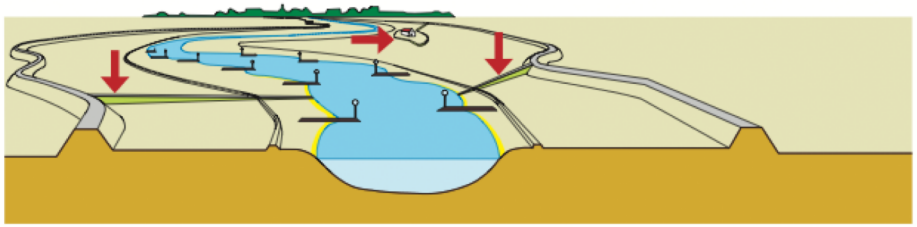
II. River by-pass construction to be used in case of periodic high water levels



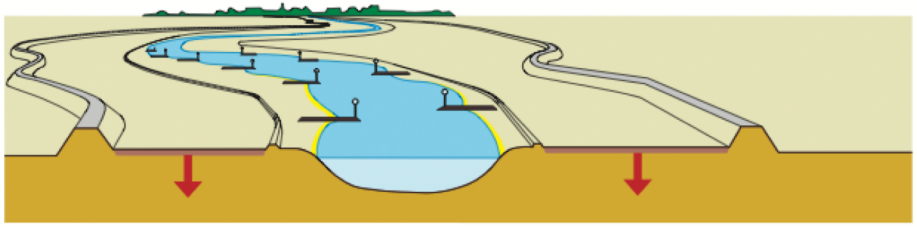
III. Lowering of the groynes



IV. Lowering the riverbed



V. Removal of hydraulic obstacles from the riverbed and the adjacent flood plains



VI. Lowering of the flood plains

UPGRADING WATERWAY SYSTEMS THROUGH AQUAPUNCTURE

Mitigation measures with regard to climate change

Flood prevention through

1. Room for the river
2. River bank protection using as much as possible ‘Building with Nature’ methods
3. Dune/beach widening/heightening along the sea shore through ‘Building with Nature’
4. Introduction of calamity storage basins
5. Adequate drainage pumping systems for water level regulation
6. Creation of storm surge barriers
7. Enlarging coastal wetlands for wave energy dissipation & nature development
8. Reduction of hard surfaces
9. Improving soil permeability & infiltration
   (green roofs, water storage under buildings & infrastructure)
10. Creation of artificial high grounds

Under jurisdiction of and financed by central, regional, local governments or private sector, e.g. depending on classification of waterways / waterfronts.

UPGRADING WATERWAY SYSTEMS THROUGH AQUAPUNCTURE

Mitigation measures with regard to climate change

Flood adaptation through

1. Adaptation of land-water use, spatial planning & zoning
2. Flood proof / dry proof buildings and infrastructure
3. Early warning systems, evacuation plans

Drought prevention

1. Provision of retention basins
2. Adequate choice of vegetation and use of drip irrigation

Fighting salt water intrusion

1. Dune / beach widening / heightening creating larger fresh water lenses
2. Double air bubble screens & fresh water injection; creation of thresholds

Under jurisdiction of and financed by central, regional, local governments or private sector, e.g. depending on classification of waterways / waterfronts.

UPGRADING WATERWAY SYSTEMS

THROUGH AQUAPUNCTURE

To achieve the necessary results cooperation of all the relevant stakeholders is imperative.

Therefore:

- Stakeholder meetings
- Stakeholder involvement
- Stakeholder participation

UPGRADING WATERWAY SYSTEMS

THROUGH AQUAPUNCTURE

To achieve the necessary results cooperation of all the relevant stakeholders is imperative.

In order to achieve:
- Territorial & Social Cohesion
- Raising Awareness
- Community Engagement
- Consensus Approach
- Volunteer Participation

For the necessary improvement of the waterway system, through e.g. physical measures, funding is required. This can be achieved through public and/or private financing.

SUSTAINABLE FUTURE OF INLAND WATERWAYS

Promotion of HERITAGE TOURISM

based on urban & rural cultural heritage values on and near the waterway

ICT, using creative multi-media for interactive map-based websites of the waterway and its surrounding areas

SUSTAINABLE USE OF INLAND WATERWAYS

Promotion of sustainable use of inland waterways and their surrounding areas through:

•Education - stimulating of awareness of terrestrial & aquatic ecosystems starting with the young generation

•Active volunteer participation in achieving sustainable use of the waterways and their waterfronts

•Organising special events

•Marketing through promotion of the multi-facetted significance of the inlands waterways and their surrounding areas.

SUSTAINABLE USE OF INLAND WATERWAYS

In all cases good governance should be ensured on the basis of documents, communication and cooperation between public & private stakeholders.

European and national water & environmental laws, directives, regulations and standards have to be taken into account.

Development of Business Plans and Societal Cost/Benefit Analyses.

Priority sequence should be established with regard to the necessary mitigating measures.

Best practices for each (European) region have to be developed and knowledge transfer has to be ensured.

SUSTAINABLE FUTURE OF INLAND WATERWAYS

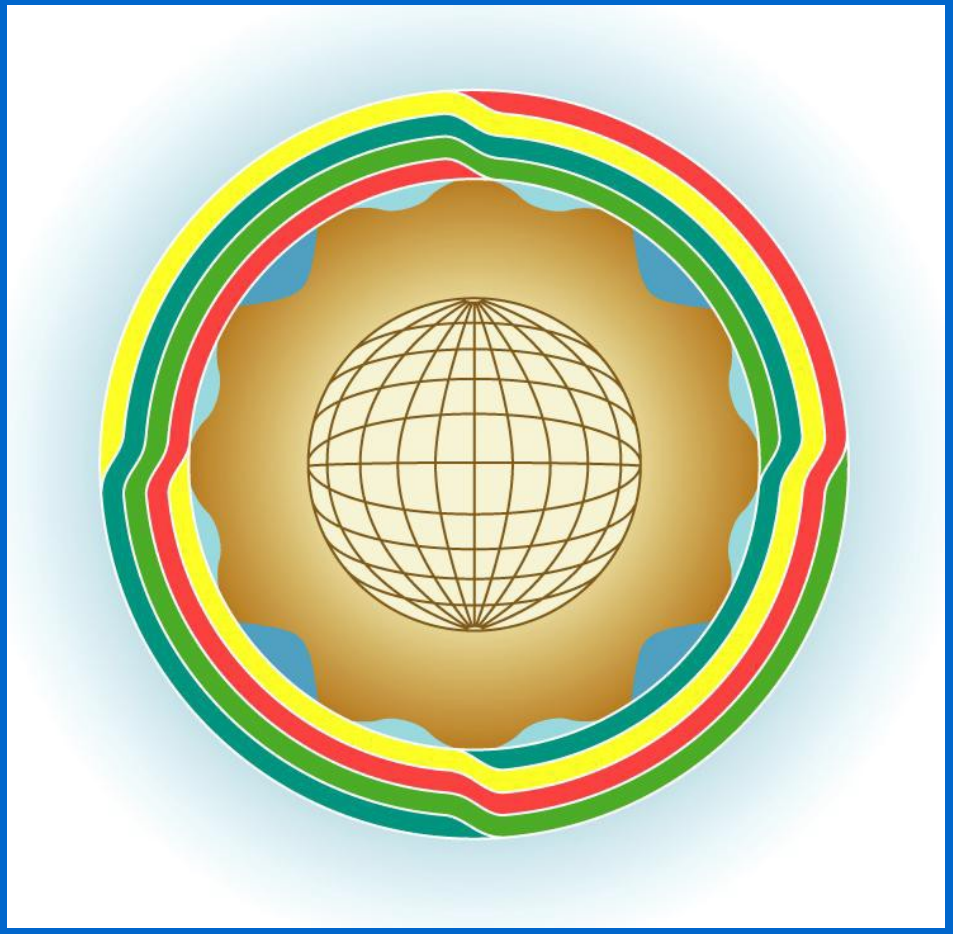
DELIVERABLES

- **A sound basis for more integrated regional policies to boost the socio / economic development of inland waterways and adjacent areas in a balanced way, while respecting environment, nature & landscape.**

- **Improved governance by creating better structures and models to: streamline national and regional regulations to organize a more integrated approach between the various policy sectors to have a balanced structure of responsibilities for the management of waterways, resulting in a jointly defined best governance model for regional waterways**

- **Strengthening the multi-functional use of regional inland waterways, while reducing negative effects on environment, nature & landscape, taking into account: WFD policies for river basins & effects of climate change on these waters. Ensuring in all cases safety.**

Spatial plan based on a six layer system



Atmosphere Layer

Occupation Layer

Infrastructure Layer

Agriculture &
Aquaculture Layer

Terrestrial &
Aquatic Nature Layer

Soil / Subsoil /
Hydrosphere Layer

Spatial plan based on a six layer system

1. Underground Layer (Soil / Hydrosphere)

The underground layer with its composition and structure and all its natural resources serves a whole series of natural functions. In addition to these natural functions, it fulfils and can fulfil a series of human-initiated and humanmade functions in and on the underground layer, which are and have to be based on its soil, sub-soil and hydrosphere characteristics.

This underground layer serves as a basis for:

- *landscape & seascape*
- *agriculture, fishery, aquaculture*
- *exploitation of composite minerals, ores*
- *foundation for building sites and infrastructure*
- *storage for waste products, energy, water and CO2*
- *terrestrial & aquatic nature values*
- *extraction groundwater & surface water*
- *geothermal energy, water energy, fossil energy*
- *tunnels, cables, pipelines, geodetic domes*
- *preservation historic and archaeological sites.*

The composition and structure of the underground layer are of vital importance for the following layers.

Spatial plan based on a six layer system

2. Green-Blue Layer

This layer contains all valuable terrestrial & aquatic nature values, including landscape and seascape, rivers, lakes, ponds and waterways that are in constant need of conservation.

3. Agriculture – Fishery – Aquaculture Layer

This production layer contains all forms of agriculture (greenhouse horticulture, forestry, cattle & poultry breeding, dairy farming); fishery & aquaculture (including mariculture); the production of microorganisms and their metabolic products.

This layer has a clear overlap and interaction with the green-blue layer, especially since production and nature protection are increasingly combined.

Spatial plan based on a six layer system

4. Occupation Layer

The occupation layer contains all building sites for living, working and recreation with all additional facilities amongst others related to education, health care & welfare, religion, shopping, sports and culture.

5. Infrastructure Layer

This layer contains all forms of infrastructure: waterways, roads (including motorways, cycle paths, and footpaths), railroads, pipe / tube / cable, air lanes, electronic highway. In this infrastructure layer, are also present all construction / engineering / structural works such as bridges, tunnels, viaducts, aqueducts, sluices, weirs, railroad stations, metro stations and bus stations, airports, pumping stations, transformers, transceiver stations, sensors, electronic signalling and control equipment. This infrastructure layer serves to link cities, ports and urban, rural & sea areas.

Spatial plan based on a six layer system

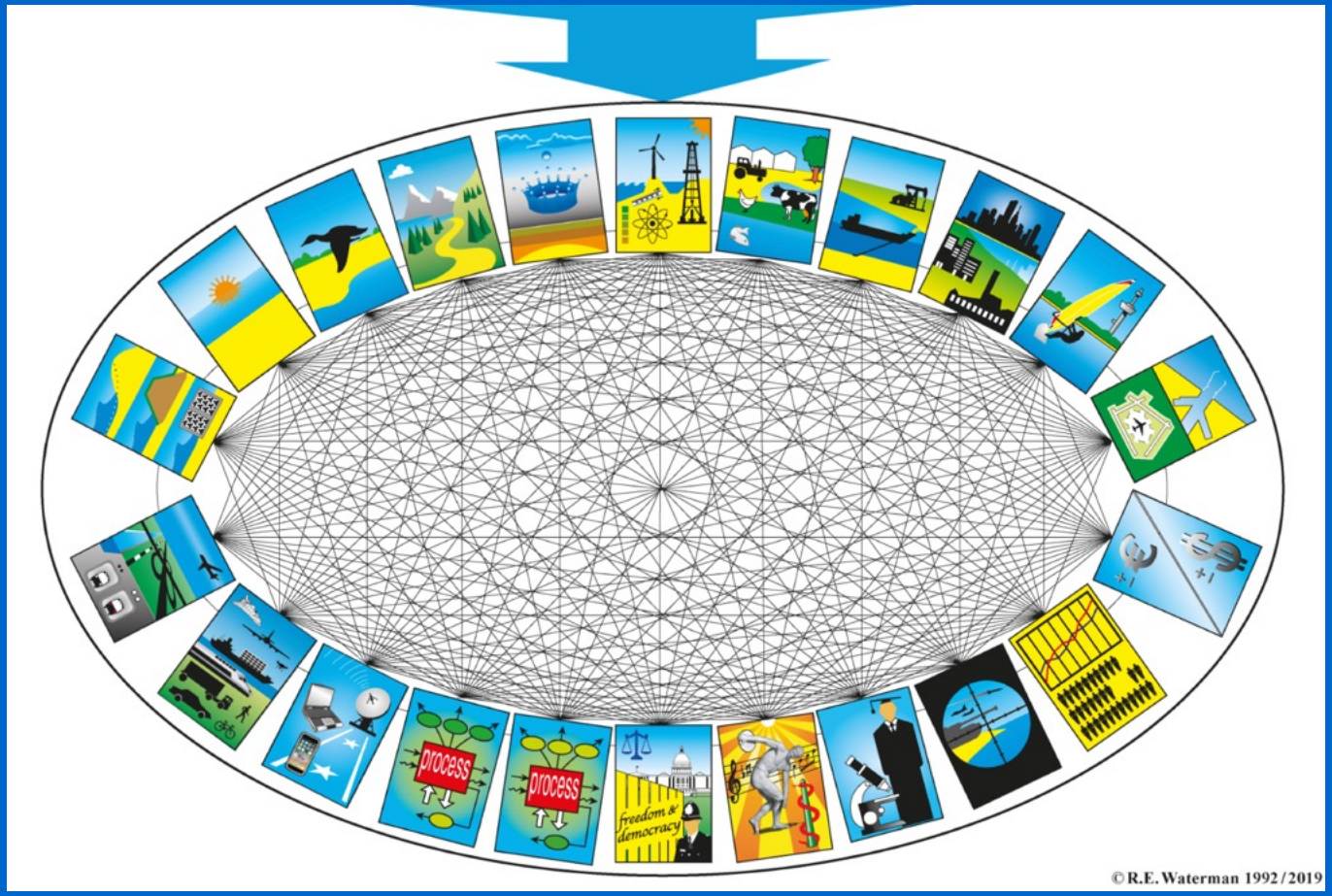
6. Atmosphere Layer

This umbrella layer is essential for the climate cycle, hydrological cycle as well as other cycles. It is also an important medium for transportation of electromagnetic waves, sound waves and matter in all its diversity.

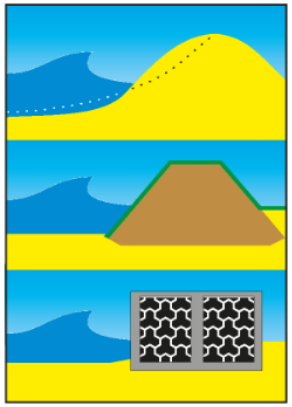
Although these six layers are separately defined, which in itself is very useful, clearly the six layers are strongly interrelated and partly overlapping each other.

In the spatial planning process with regard to the separate and interrelated layers, special attention must be given to the composition of the underground layer and thereby in general to the third dimension.

SUSTAINABLE USE OF INLAND WATERWAYS



**For Sustainable Use of Inland Waterways in their specific regions,
it is necessary to take into account
all possible functions in all their intricate relationships.**



SAFETY with regard to:

- flooding
  (including effects:
  sea level & river level rise)
- drought
- coastal erosion
- land subsidence
- salt water intrusion
- natural disasters
- human activities

01

ENVIRONMENT
(IN GENERAL)

environmental
compartments:

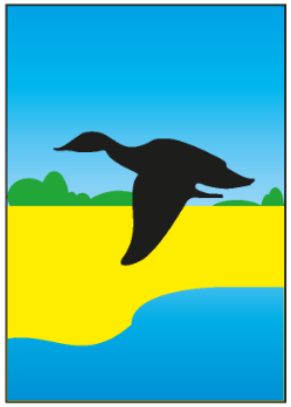
- air
- water
- land

02

NATURE

- micro-organisms, flora,
  fauna (incl. people)
- eco-systems
- nature conservation
- nature development
- bio-diversity
- bio-diversification

03



LANDSCAPE

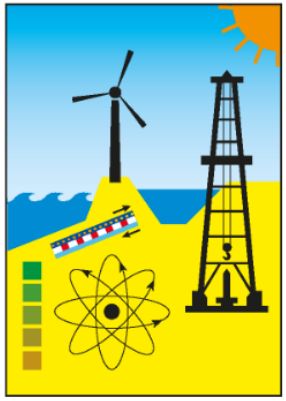
- landscape conservation
- landscape development

SEASCAPE

04

WATER RESOURCES MANAGEMENT
- water quantity
- water quality
- groundwater
- surface water
- dune infiltrated water
- (desalinated) sea-water
- sewer systems
- waste water purification

05



ENERGY
- natural gas, oil, coal, etc.
- biomass (wood, etc.); organic wastes
- nuclear energy
- solar-, wind-, water-, geo-energy
- combined cycle, isolation, etc.

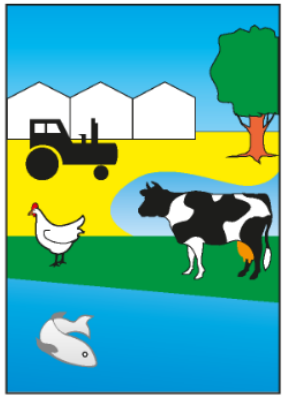
06

AGRICULTURE
horticulture, forestry, cattle & poultry breeding

FISHERY

AQUACULTURE

07



MINING / EXTRACTION & STORAGE

in / on

Land / Sea-bed / Sea / Air

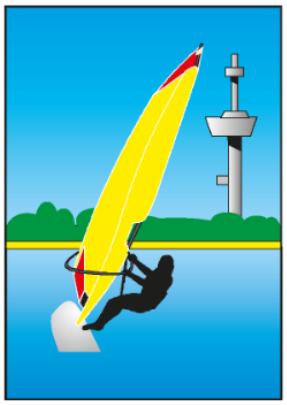
08

Functions 01 / 08

BUILDING SITES FOR LIVING & WORKING

- houses & apartments
  + facilities
- industries & offices
  + facilities
- urban development

09



RECRATION & TOURISM

10

TRANSFER / DISTRIBUTION CENTRES & RELATED ACTIVITIES

- seaport
- riverport,
- lake port
- airport,
- landport

11

INFRASTRUCTURE

- roads
- railroads
- waterways
- underground systems
- airlanes
- electronic highway

12

TRANSPORT MODULES

- bicycle, motor-car, bus, tram, train, maglev (magnetic levitation train),
- metro
- ship,
- container
- drone, airplane, rocket, satellite

13

INFORMATION COMMUNICATION TECHNOLOGY

DATA ACQUISITION
DATA STORAGE
DATA TRANSMISSION
DATA PROCESSING

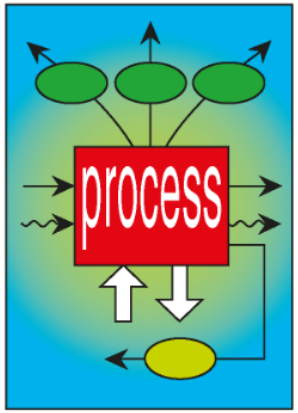
A.I.

14

ENVIRONMENT (IN PARTICULAR)

Air- / Water- / Soil-quality by improvement of conversion processes and by end of pipe purification

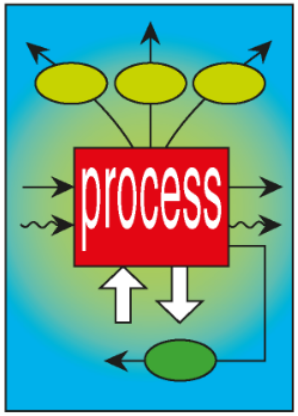
15



ENVIRONMENT (IN PARTICULAR)

solid waste reduction by improvement of conversion processes and by environmental friendly collection - transport - storage - processing - recycling - usage

16



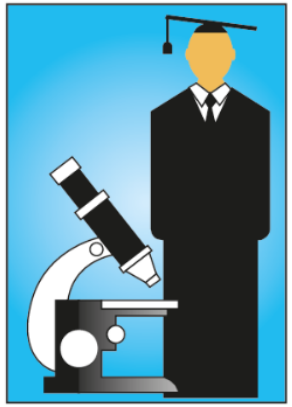
GOVERNMENTAL
INSTITUTIONS
NON-GOVERNMENTAL
INSTITUTIONS
CITIZEN GROUPS
INDIVIDUAL CITIZENS
PEOPLE'S
PARTICIPATION
LAW - JUSTICE - ORDER

17

HEALTH & WELFARE
SPORT / PLAYGROUND
HISTORY & CULTURE
RELIGION
PHILOSOPHY OF LIFE
VALUES & STANDARDS
SOCIOSPHERE

18

EDUCATION
&
RESEARCH



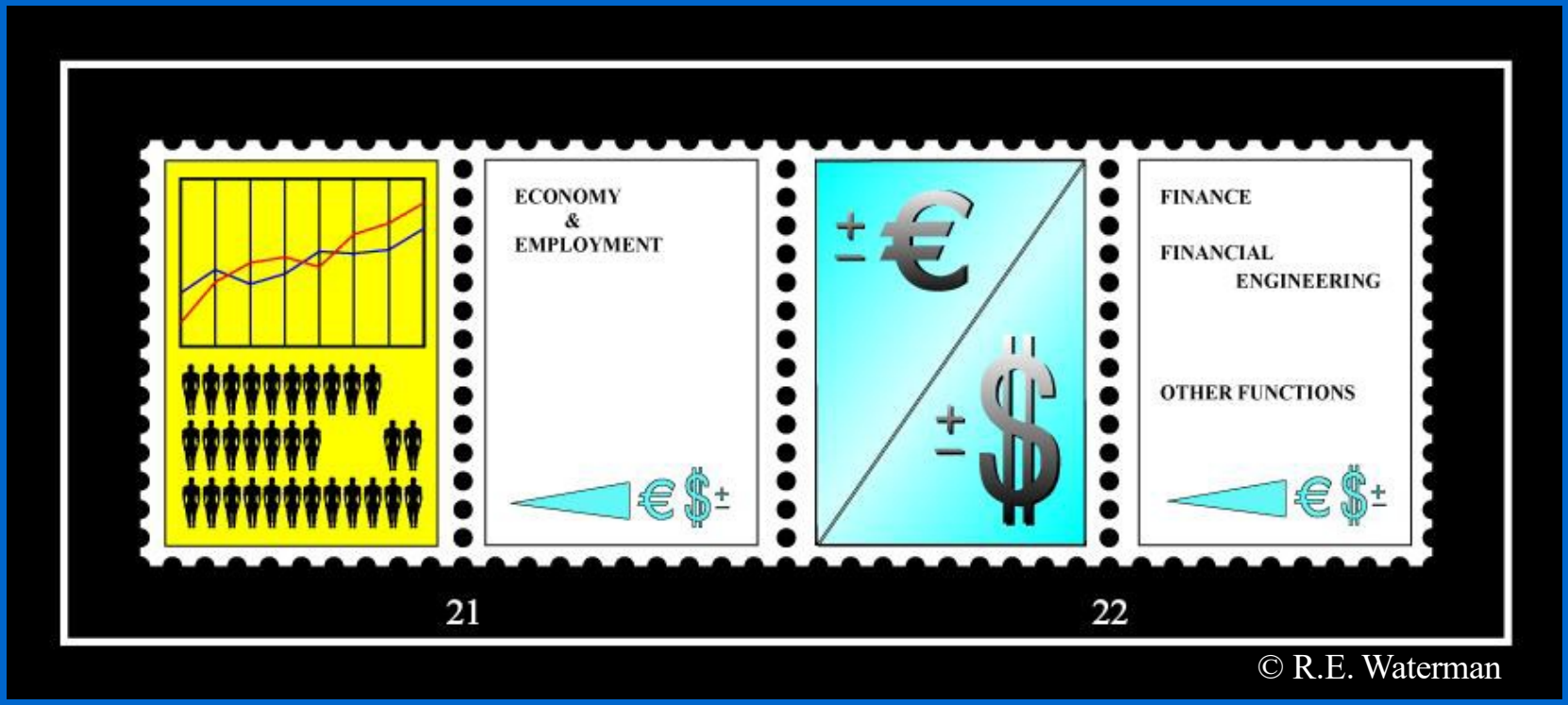
DEFENCE
&
RISK MANAGEMENT

SAFETY & SECURITY

19

20

FUNCTIONS



The great challenge of the 21st century

Introduction and implementation of methods that simultaneously Strengthen the Economy and Improve the Environment to achieve Sustainability.


European
Inland
Waterways

SUSTAINABLE USE OF INLAND WATERWAYS

- **Considering the various themes we have to take into account the differences and similarities between the regions.**

Differences with regard to:

1) Type & capacity of the waterways: river, lake or canal

2) Functions & use of the waterway

3) Direct connection with the sea or not

4) Terrain conditions (high/lowland, type of soil, nature reserve areas)

5) Water level differences along the length of a canal or river
(a.o. number of sluices, ship elevators, aqueducts)

6) Domination of urbanised or rural territory

7) Population density and visitor potential

8) Climate with regard to yearly & seasonal temperature, rainfall, drought

SUSTAINABLE USE OF INLAND WATERWAYS

- **Considering the various themes we have to take into account the differences and similarities between the regions.**
  Similarities with regard to:

  1) Necessity of improving environment, nature, landscape
  2) Necessity of water management (quantity & quality)
  3) Necessity of mitigating measures with regard to negative effects of climate change
  4) Necessity of socio-economic development
  5) Necessity of nautical safety and ensuring overall safety
  6) Necessity of safeguarding / restoring &using heritage values

SUSTAINABLE USE OF INLAND WATERWAYS

UK WALES (British Waterways)

UK NORTHERN IRELAND (Waterways Ireland)

REPUBLIC OF IRELAND (Waterways Ireland &South Tipperary County Council)

THE NETHERLANDS (SRN/VRW)

FRANCE (French Waterways)

NORWAY (Telemark County Council)

SWEDEN (County Adm. Board of Värmland)

FINLAND (Savonlinna Region)

ITALY (Navigli Lombardi)

ITALY (Province of Ferrara)

SPAIN (Ass. Riverside Towns of the Castilla Channel)

LATVIA (Vidzeme Planning Region)

POLAND (Municipality of Brzeg Dolny)

HUNGARY (Municipality of Dunaujvaros / Central Dir. of Water & Environment)

SERBIA (Vode Vojvodine Executive Council)

UK WALES
British Waterways

Montgomery Canal

Monmouthshire & Brecon Canal

SUSTAINABLE USE OF INLAND WATERWAYS

Montgomery Canal

SUSTAINABLE USE OF INLAND WATERWAYS

Falkirk Wheel

REPUBLIC OF IRELAND

Waterways Ireland
South Tipperary County Council

Royal Canal &Grand Canal with connection from Dublin to Shannon-Erne Waterway and via Barrow River / Canal to Waterford.

River Suir from Tipperary to Waterford

UK NORTHERN IRELAND

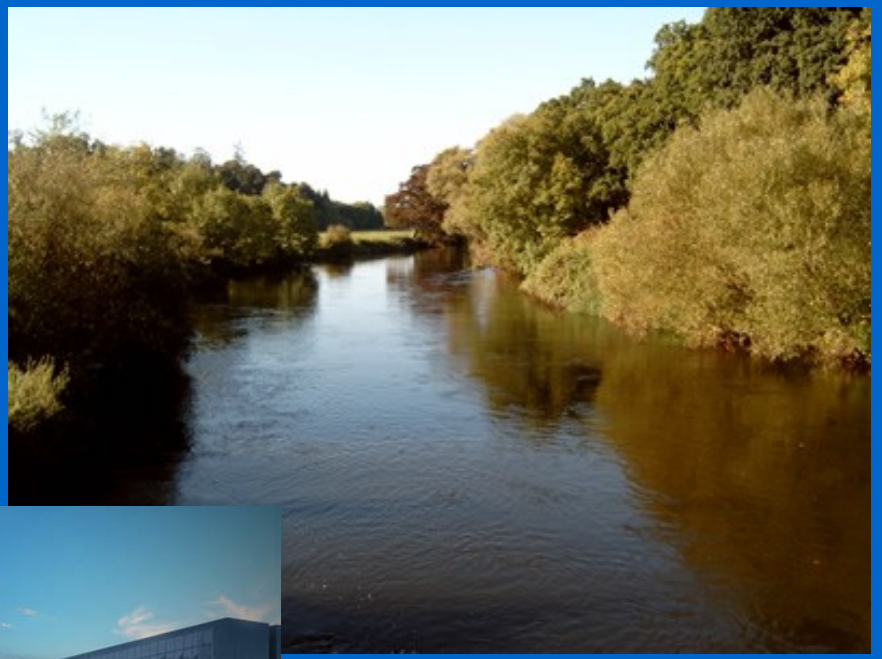
Waterways Ireland

Ulster Canal from Lough Neagh to Shannon-Erne Waterway

SUSTAINABLE USE OF INLAND WATERWAYS

Ulster Canal

River Suir 184 km 3rd longest river



Royal Canal Dublin

Heritage Boats on the Grand Canal, Dublin

The Cutts, Lower Bann

Dromineer, Shannon Navigation

Rowing on the Bann

Kayaking in Carrick-on-Shannon


World Pike Fishing Competition

NETHERLANDS

Dutch Recreational Waterways (SRN)

Association Region Water (VRW)

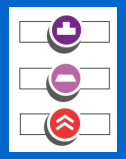
Rhine-Schie Canal with adjacent waterways

Randstad Waterway System

Ministry of Infrastructure & Environment

Map of Water System of Randstad Holland

Basic Grid

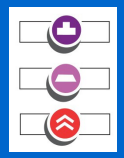


Pumping station
Obstacle
Sluice

Ministry of Infrastructure & Environment

Map of Water System of Randstad Holland

Water Levels & Sluices & Pumping Stations



Pumping station
Obstacle
Sluice

Ministry of Infrastructure & Environment

Map of Water System of Randstad Holland

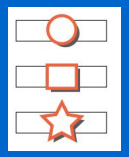
Recreation

Yachting Harbours in Waterway System

Ministry of Infrastructure & Environment

Map of Water System of Randstad Holland

Inventory of Plans



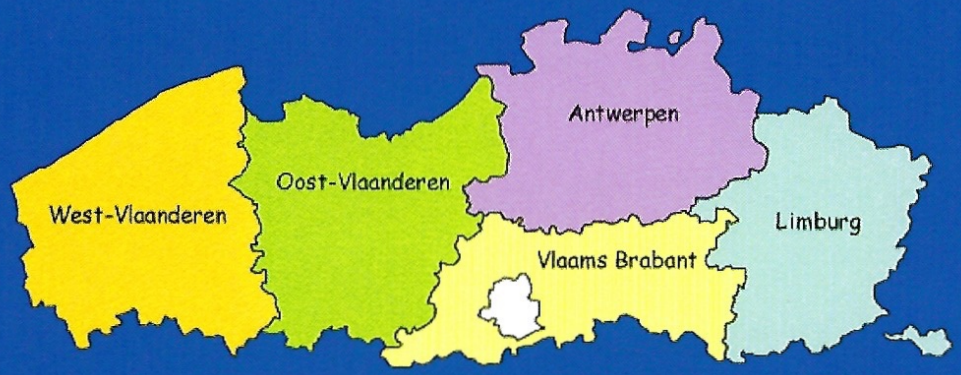
Policy Plan
Missing Links
Stimulating Measures

FLANDERS CLIMATE RESILIENT & WATER PROOF

SUSTAINABLE COAST & DELTA ZONE DEVELOPMENT

through

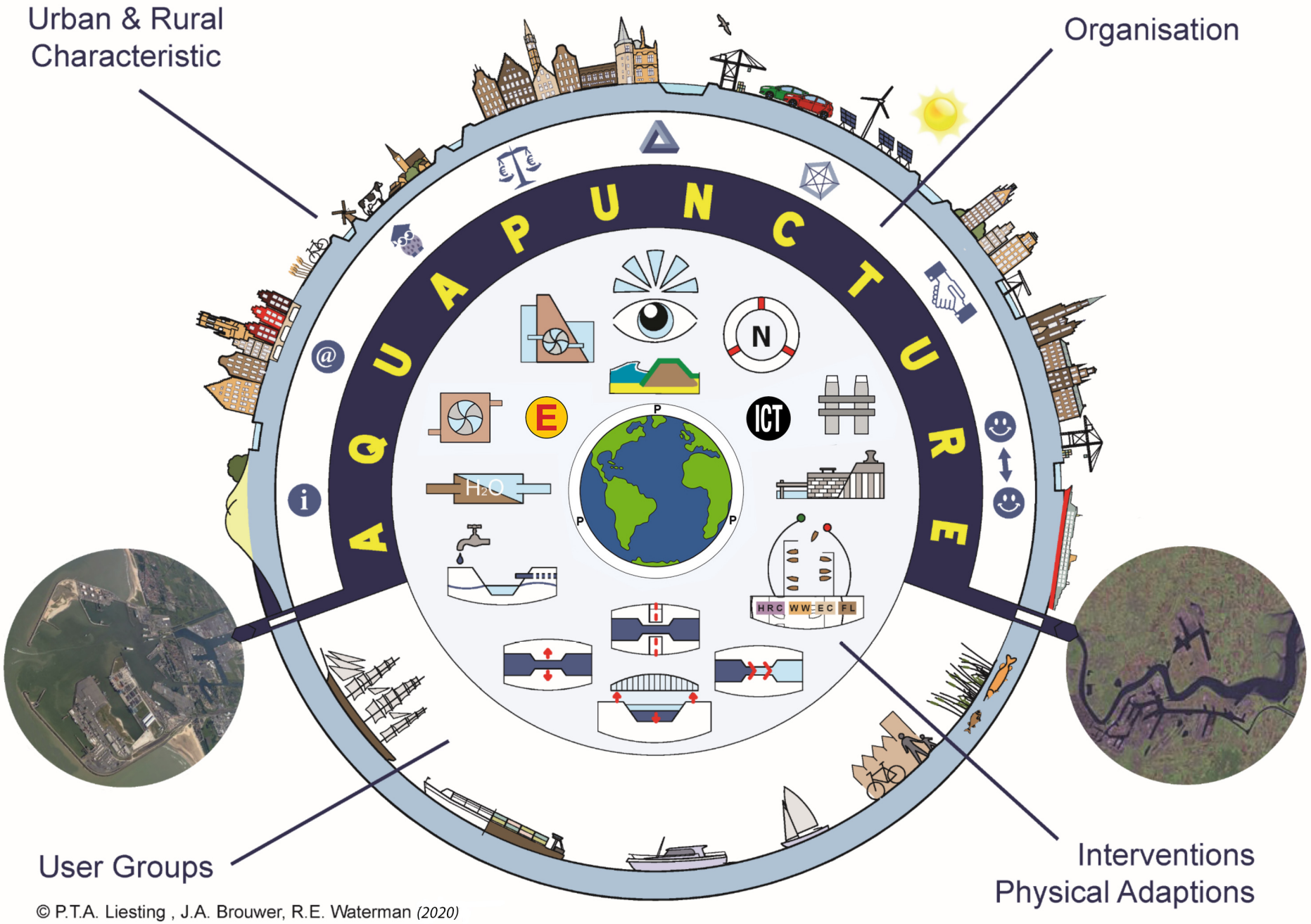
BUILDING WITH NATURE® & AQUAPUNCTURE©



Prof. Dr. R.E. Waterman MSc

OP WEG NAAR EEN KLIMAATBESTENDIG, WATERVEILIG & WELVAREND VLAANDEREN

KVAB 21 maart 2018 Paleis der Academiën




NOORDZEE
NEDERLAND
VLAANDEREN
WALLONIE
FRANCE
DEUTSCHLAND
LUXEMBOURG
BREDA
EINDHOVEN
ZEEBRUGGE
BLANKENBERGE
SLUIS
Boudewijnkanaal
TERNEUZEN
OOSTENDE
Kl. Gent-Oostende
BRUGGE
EEKLO
ANTWERPEN
ZELZATE
Beneden-Zeeschelde
Kanaal Dessel-Turnhout-Schoten
SCHOTEN
TURNHOUT
DESSEL
Kl. Bocholt-Herentals
HERENTALS
VIERSEL
ROERMOND
BOCHOLT
Zuid-Willemsvaart
LEOPOLDSBURG
KWAADMECHELEN
Kl. Dessel-Kwaadmechelen
Kl. Beverlo
Albertkanaal
Netekanaal
LIER
BOOM
DUFFEL
Rupel
RUPELMONDE
TEMSE
Moer-vaart
Durme
LOKEREN
GENT
Ring-vaart
Kl. Gent-Terneuzen
Kl. Plassendale-Nieuwpoort
PLASSENDALE
NIEUWPOORT
VEURNE
Kl. Nieuwpoort-Duinkerke
BEERNEM
AALTER
Kl. Gent-Oostende
Afleidingskl.
Beneden-Nete
Beneden-Dijle
MECHELEN
Bassins-Schiphe
Zeekanaal
Kanaal Leuven-Dijle
LEUVEN
DIKSMUIDE
IJzer
Lokenaal
ROESELARE
Kl. Roeselare-Leie
Leie
DEINZE
Boven-Zeeschelde
DENDERMONDE
AALST
Kl. Ieper-IJzer
IEPER
OOIGEM
OUDENAARDE
Boven-Schelde
KORTRIJK
Kl. Bossuit-Kortrijk
MENEN
BOSSUIT
Cl. De L'Espierres
Dender
LEMBEEK
Kl. Brussel-Charleroi
BRUSSEL
BRUSSELS HOOFDSTEDELIJK GEWEST
HASSELT
MAASMECHELEN
Kl. Briegden-Neerharen
BRIEGDEN
Juliana kanaal
MAASTRICHT
LIEGE
Cl. Nimy-Blaton
Cl. Du Centre
Péronnes
MONS
CHARLEROI
Basse-Sambre
NAMUR
Meuse
Marinas and Sanitary stations
WATERWAYS IN FLANDERS
(Situation September 2013)© Promotie Binnenvaart Vlaanderen
PROMOTIE BINNENVAART VLAANDEREN
Passage forbidden
Lock
Marina/Mooring place
Sanitary station

Waterways West- Vlaanderen

Schelde
Dijle
Leie
Dender
Rupel
IJzer
Grote & Kleine Nete
Zenne
Molenbeek

Albertkanaal
Boudewijnkanaal
Leopoldkanaal
Kanaal Gent – Terneuzen
Kanaal Gent – Oostende
Zeekanaal Brussel – Schelde
Kanaal Leuven Dijle

Upgrading waterways through Aquapuncture©

FRANCE

(French Waterways)

Sambre

Canal de la Sambre à l'Oise.

Noyon - Ribemont - Vadencourt -Maubeuge - Charleroi

NORWAY (Telemark County Council) Telemark Kanal

NORWAY (Telemark County Council) Telemark Kanal

SWEDEN (Värmland)

Göta Ålv –

Trollhättan Kanal –

Vänern – Klarälven

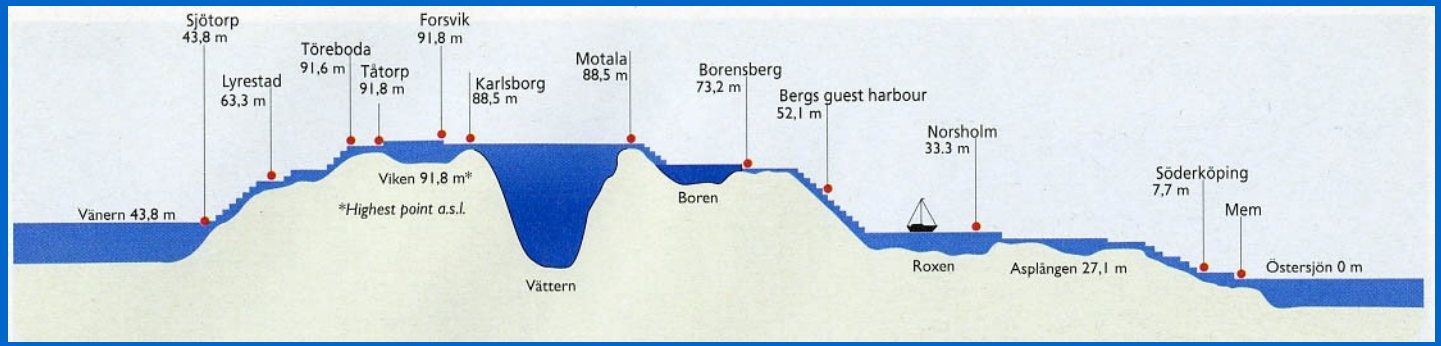
Göta Kanal –

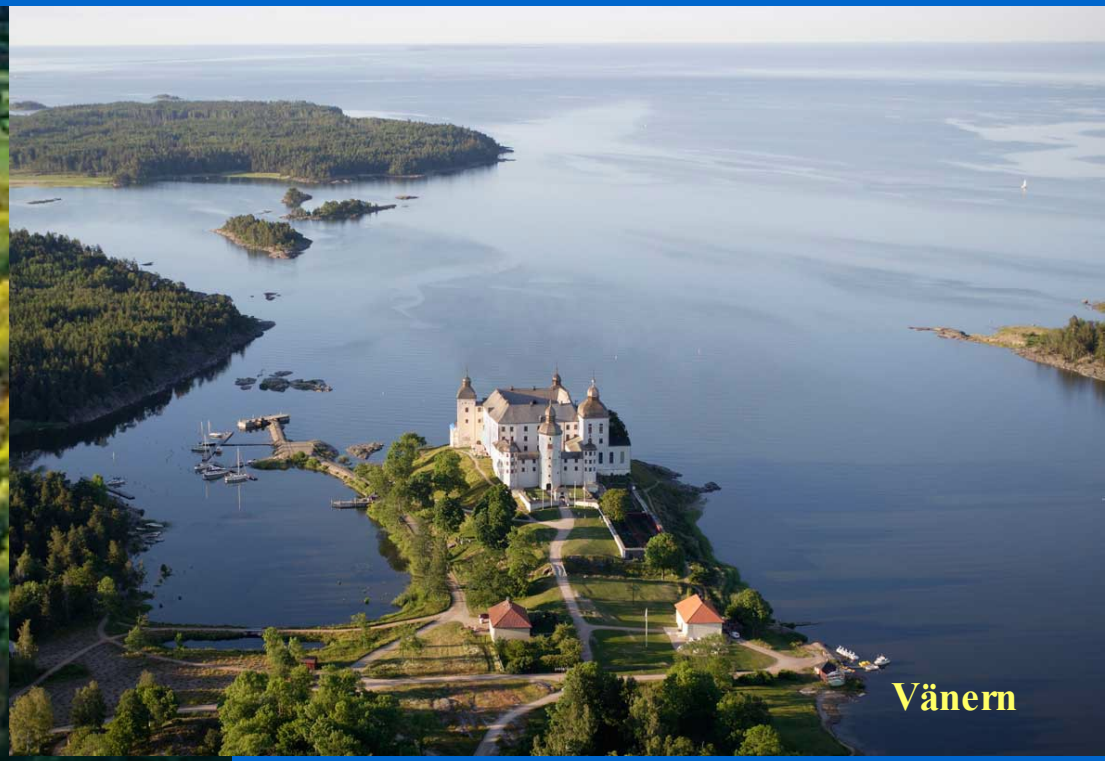
Vättern Kanal –

Göta Kanal

Waterway between

Kattegat &Baltic Sea





Vänern

Göta Kanal

FINLAND

(Savonlinna Region)

Saimaa River system

Saimaa Canal

Mäntyharju Canal

SUSTAINABLE FUTURE OF INLAND WATERWAYS

AQUAPUNCTURE©

Dr. Ronald E. Waterman MSc
co-author:
Jaap A. Brouwer MUrb

Città Metropolitana di Milano

2017-2018-2019

ITALIA

Città metropolitana di Milano

ITALY

Navigli Lombardi s.c.a.r.l.

Milano Province

Lombardi Region:

canal system 250 km in an area of 1,800 km²

Lombardi Canals / da Vinci Canals between Milano – Lago Maggiore Lago di Como Ticino River – Po River – Adda River

ITALY

Ferrara Province

Po River system

Region Castilla y León (SIRGA)

Association of Riverside Towns along Canal de Castilla

Canal de Castilla (207 km) from Palencia to Valladolid with connection towards Duero River, from Palencia to Medina de Rioseco, from Palencia to Alar del Rey.

SPAIN

Computerised system within restored building for water control catchment area Duero River

SPAIN

(Association of Riverside Towns along Castille Channel, Region Castille et León)

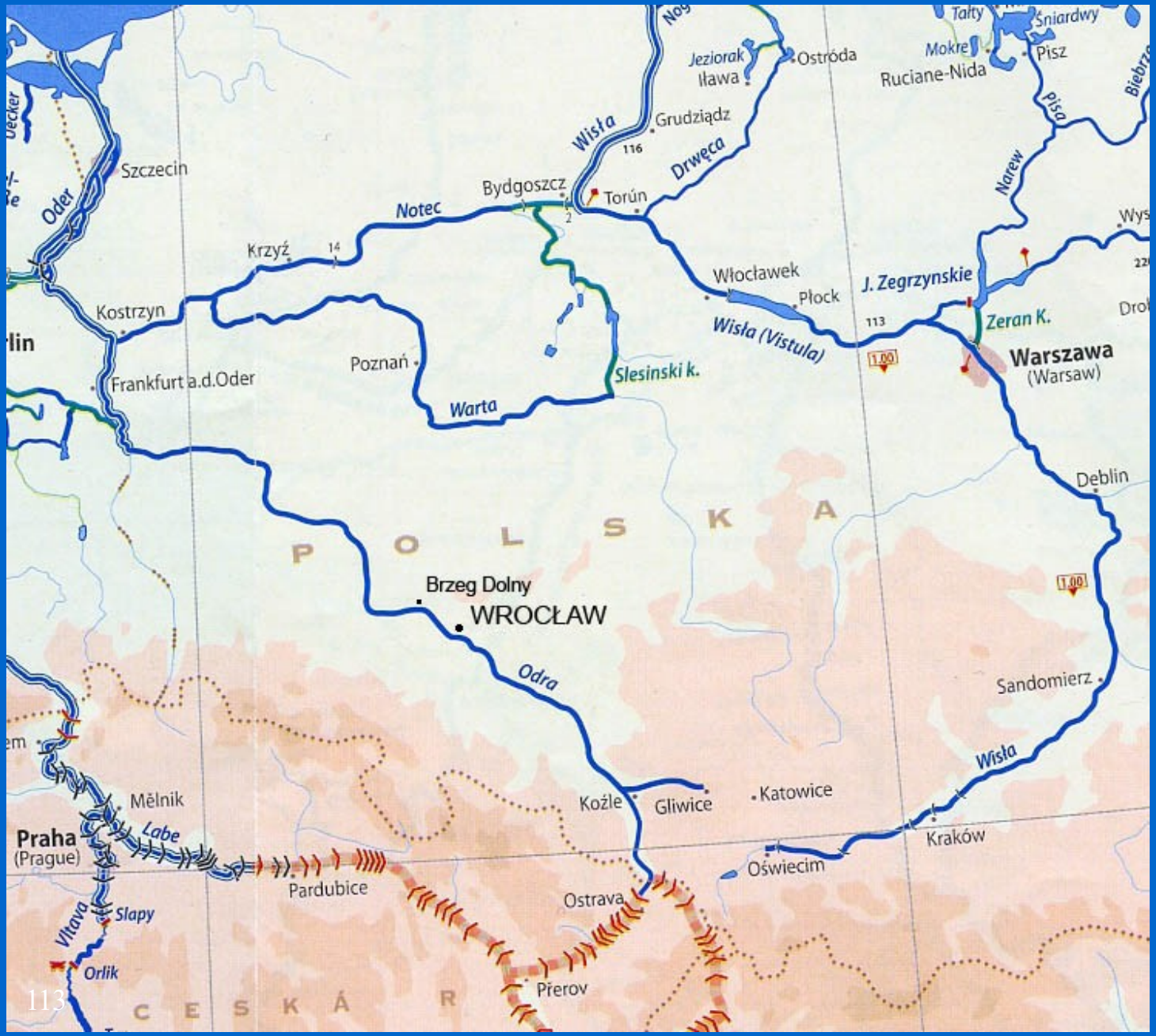
Canal de Castille (207 km) from Palencia to Valladolid with connection towards Duero River, from Palencia to Medina de Rioseco, from Palencia to Allar del Rey.

LATVIA - Vidzeme Planning Region
235,000 inhabitants; 15,257 km²

4 rivers: Gauja, Salaca, Pededze, Aiviekste.

3 lakes: Aluksne, Burtnieks, Lubans.

Aeration with oxygen of rivers & canals by placing stones in the water
Removal of excess beaver dams
Removal overgrowth by trees and bushes of river banks
River bank maintenance
Eco-education and volunteer participation



POLSKA

Brzeg Dolny

Municipality

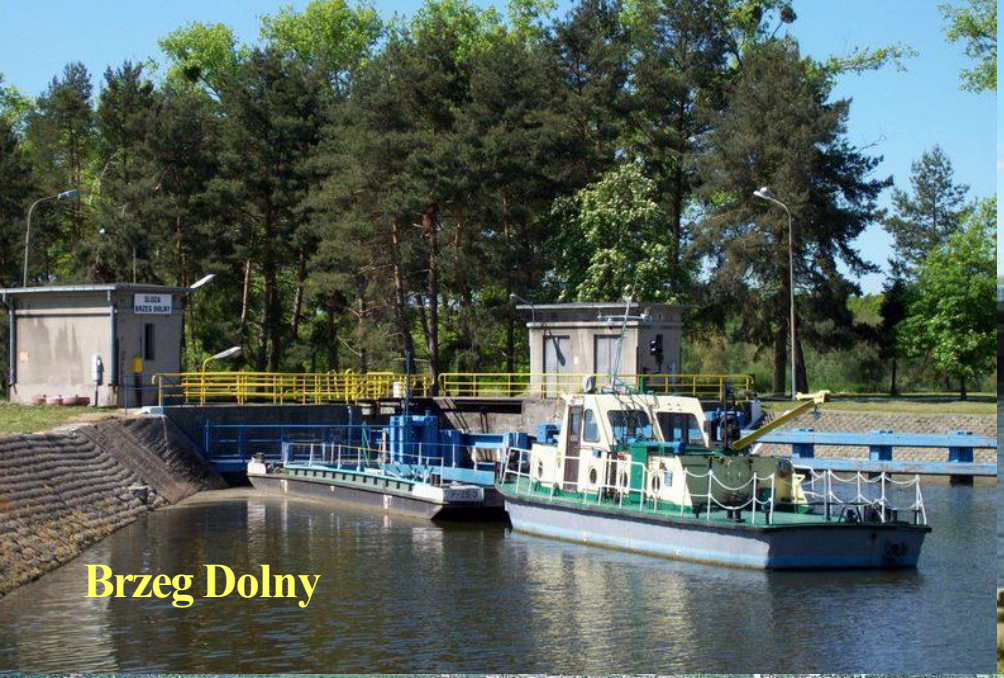
Odra River

From Kozle to

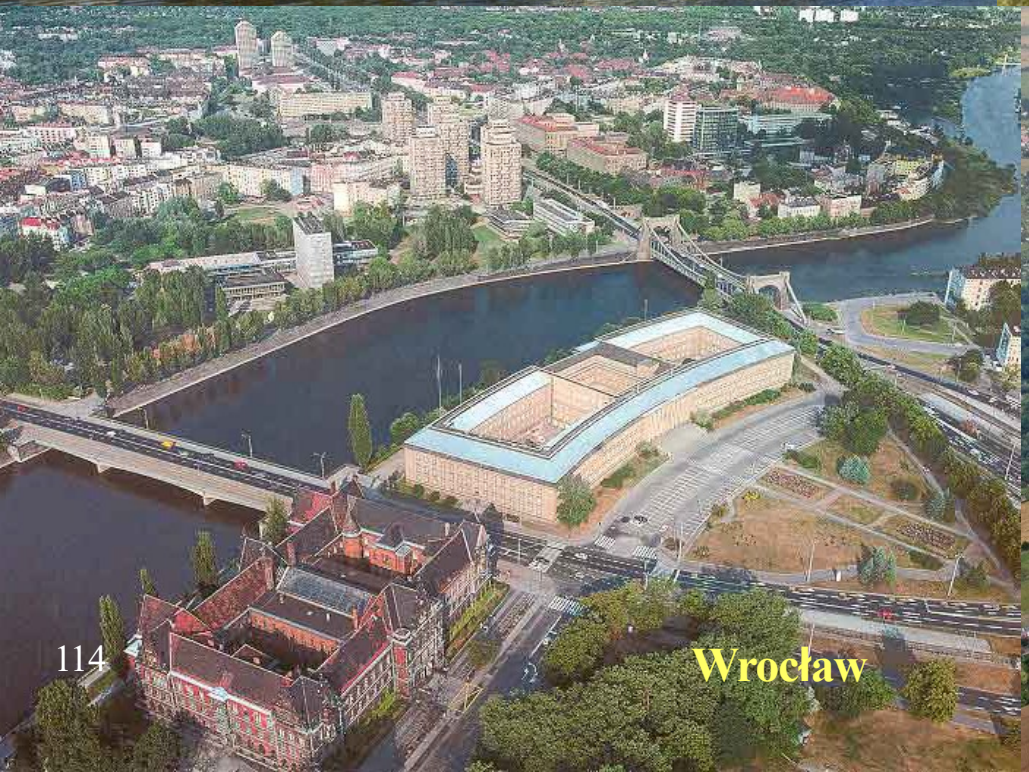
Brzeg Dolny

the first 186 km

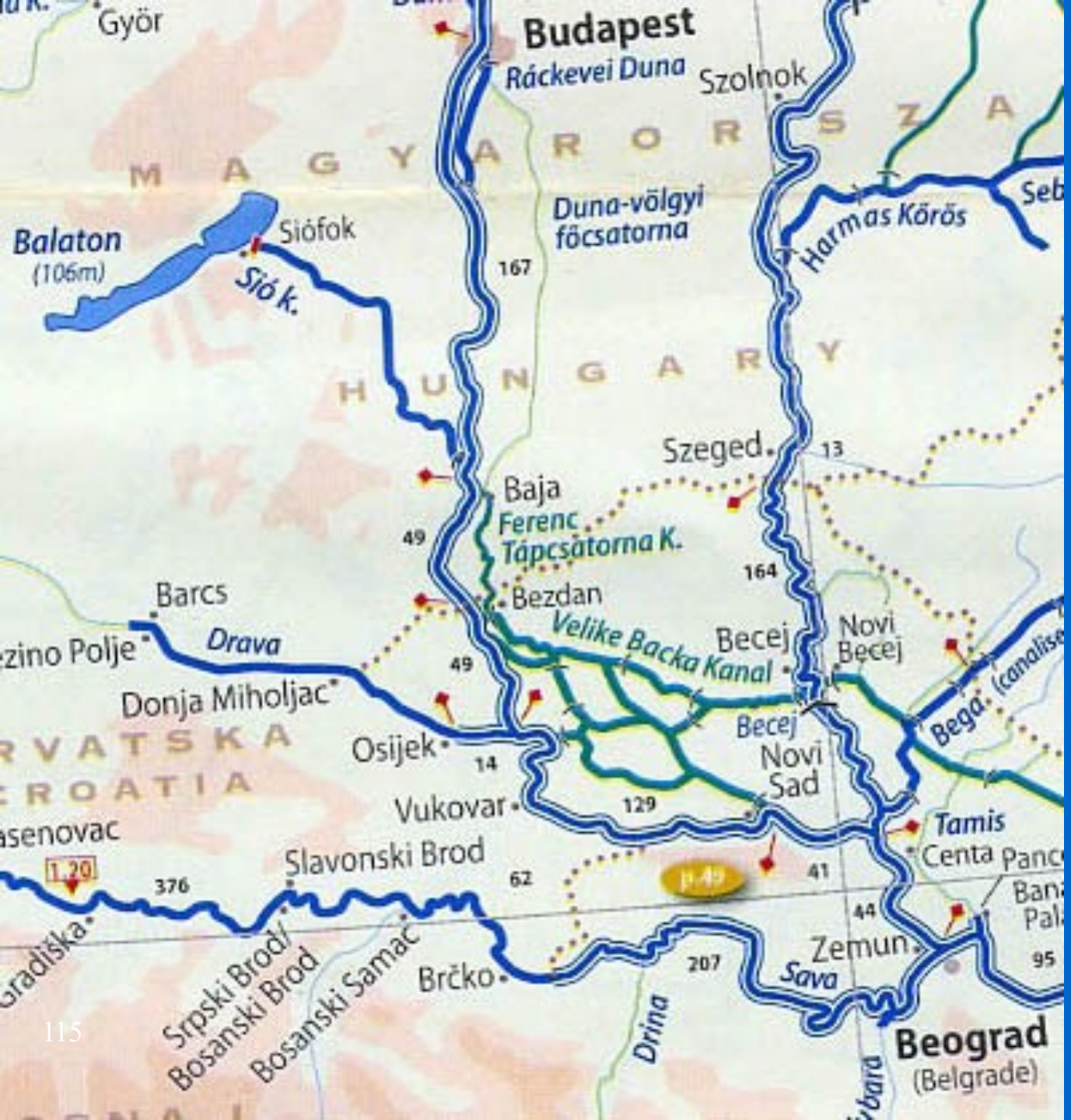
is canalised


Brzeg Dolny


Brzeg Dolny


Wrocław


Kozle



HUNGARY

Dunaujvaros Municipality / Central Directorate Water & Environment

Hungary:
10 million inhabitants
Dunaujvaros:
60,000 inhabitants
Duna - Tisza - Balaton

Dunaujvaros specific problems:

- **deterioration water quality caused by industry.**

Therefore improvement of industrial conversion processes & waste water purification and implementation of laws, regulations & standards.

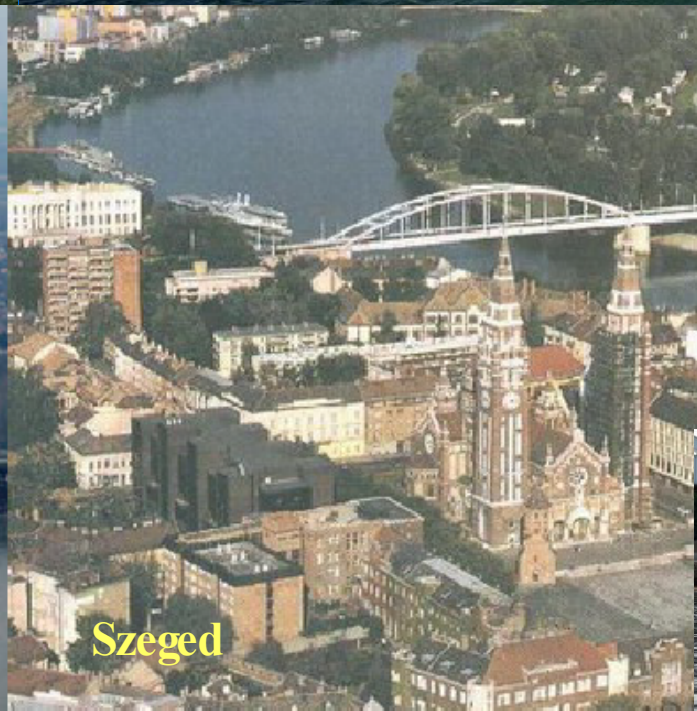
- **instability / erosion löss wall.**

Therefore necessity adequate löss wall protection.

Budapest

Balaton

Dunaujvaros



Szeged

SERBIA
Vode Vojvodine
Executive Council

Canal system linked to Danube and Tisza.

SUSTAINABLE USE OF INLAND WATERWAYS

SINGAPORE
Transformation of rivers & canals into blue-green artiries

Kallang River Transformation

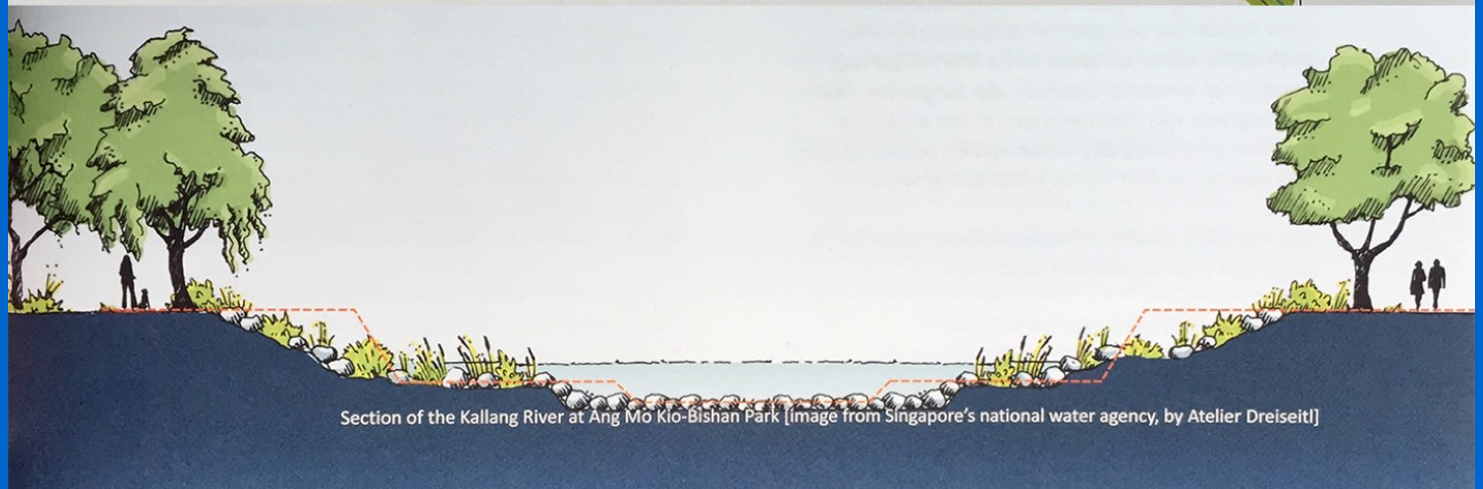
INDONESIA
Jakarta land reclamation combined with Aquapuncture

MEXICO
Mexico City back to the future through Aquapuncture

COLOMBIA
Recuperación del Canal del Dique
Revitalisación Rio Medellin, Rio Bogota, Rio Cauca & Rio Cali via Aquapuncture

SUSTAINABLE USE OF INLAND WATERWAYS

SINGAPORE - Transformation of rivers & canals into blue-green artiries

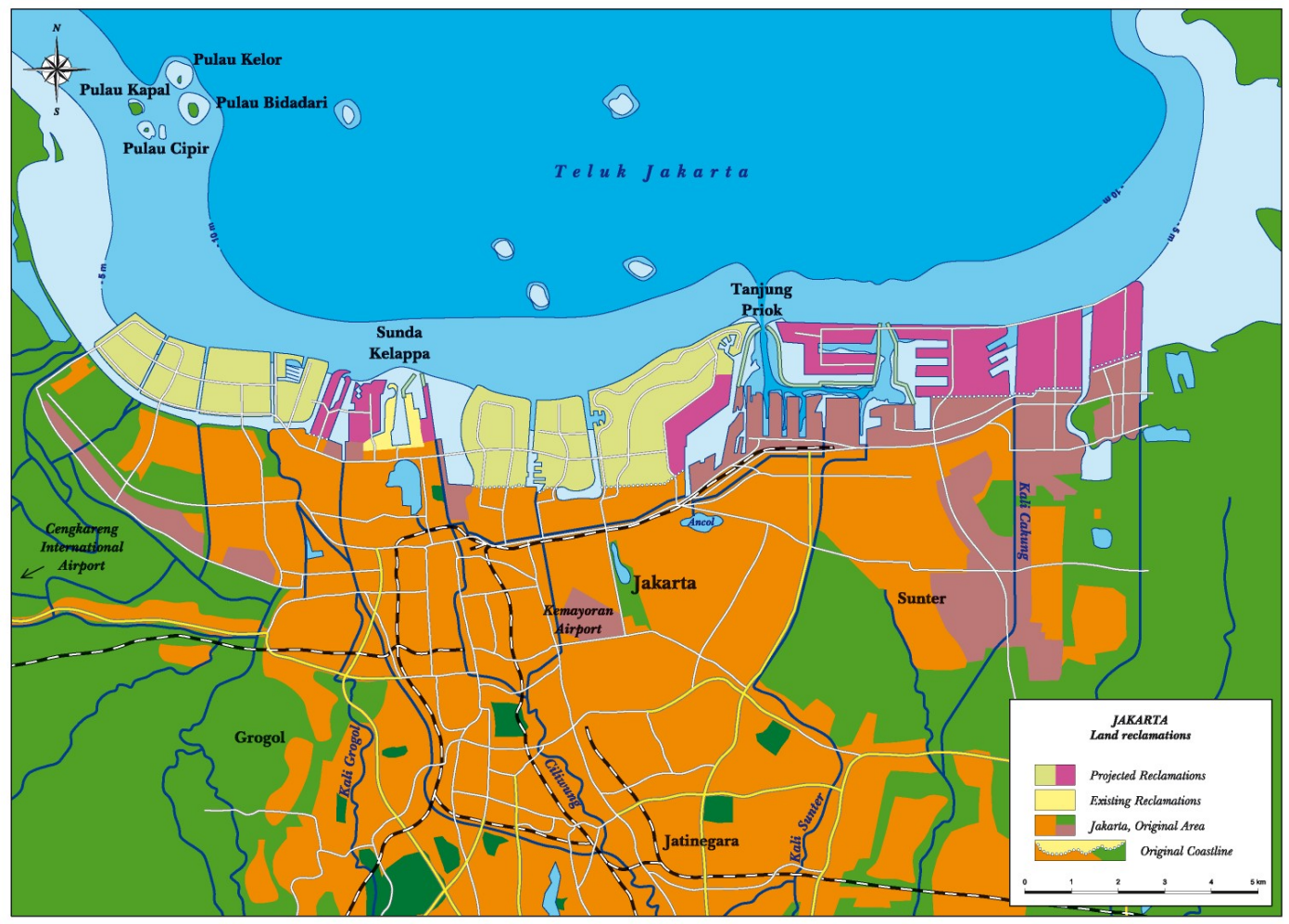


Section of the Kallang River at Ang Mo Kio-Bishan Park [image from Singapore's national water agency, by Atelier Dreiseitl]

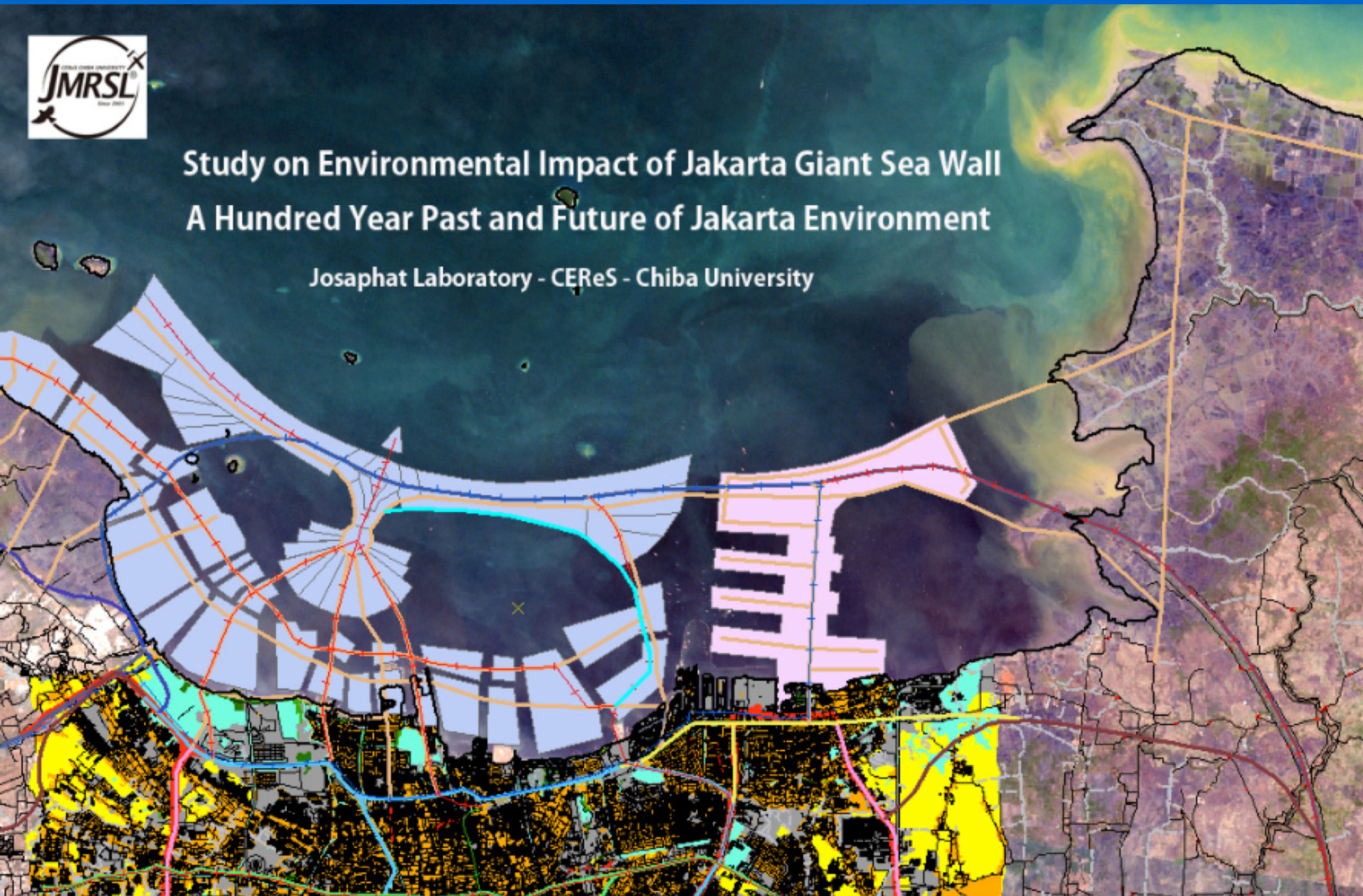
SINGAPORE – Kallang River before and after transformation

SUSTAINABLE USE OF INLAND WATERWAYS

INDONESIA - Jakarta land reclamation combined with Aquapuncture

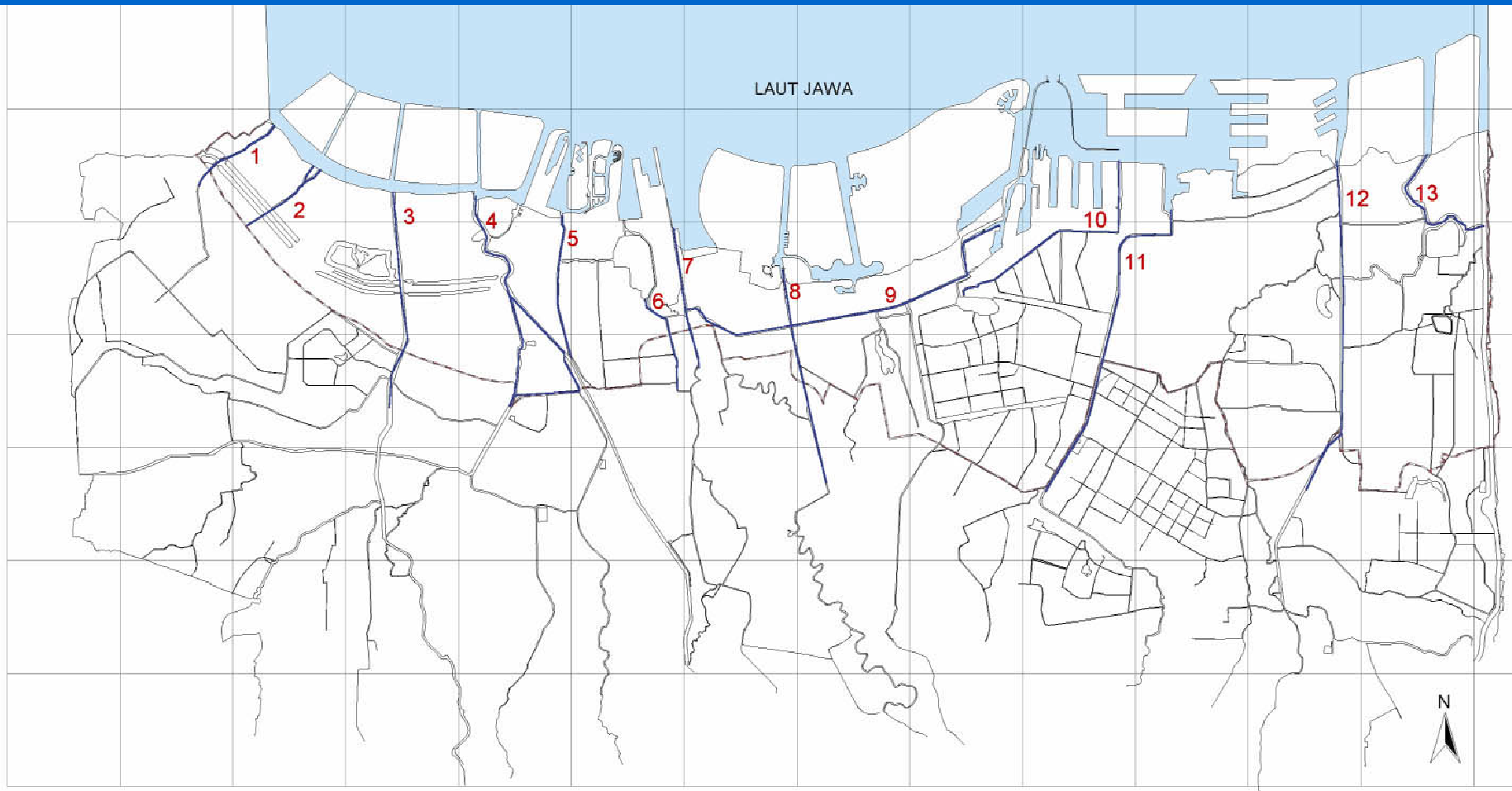


INDONESIA - Jakarta land reclamation combined with Aquapuncture
Land reclamation in Teluk Jakarta: Great Garuda + Extension Tanjung Priok



LOCATION OF 11 RIVERS &2 DRAINAGE CANALS IN PANTURA ZONE OF JAKARTA

Necessity of upgrading waterway system through Aquapuncture



PETA LOKASI 13 SUNGAI DI KAWASAN PANTURA JAKARTA

KETERANGAN :

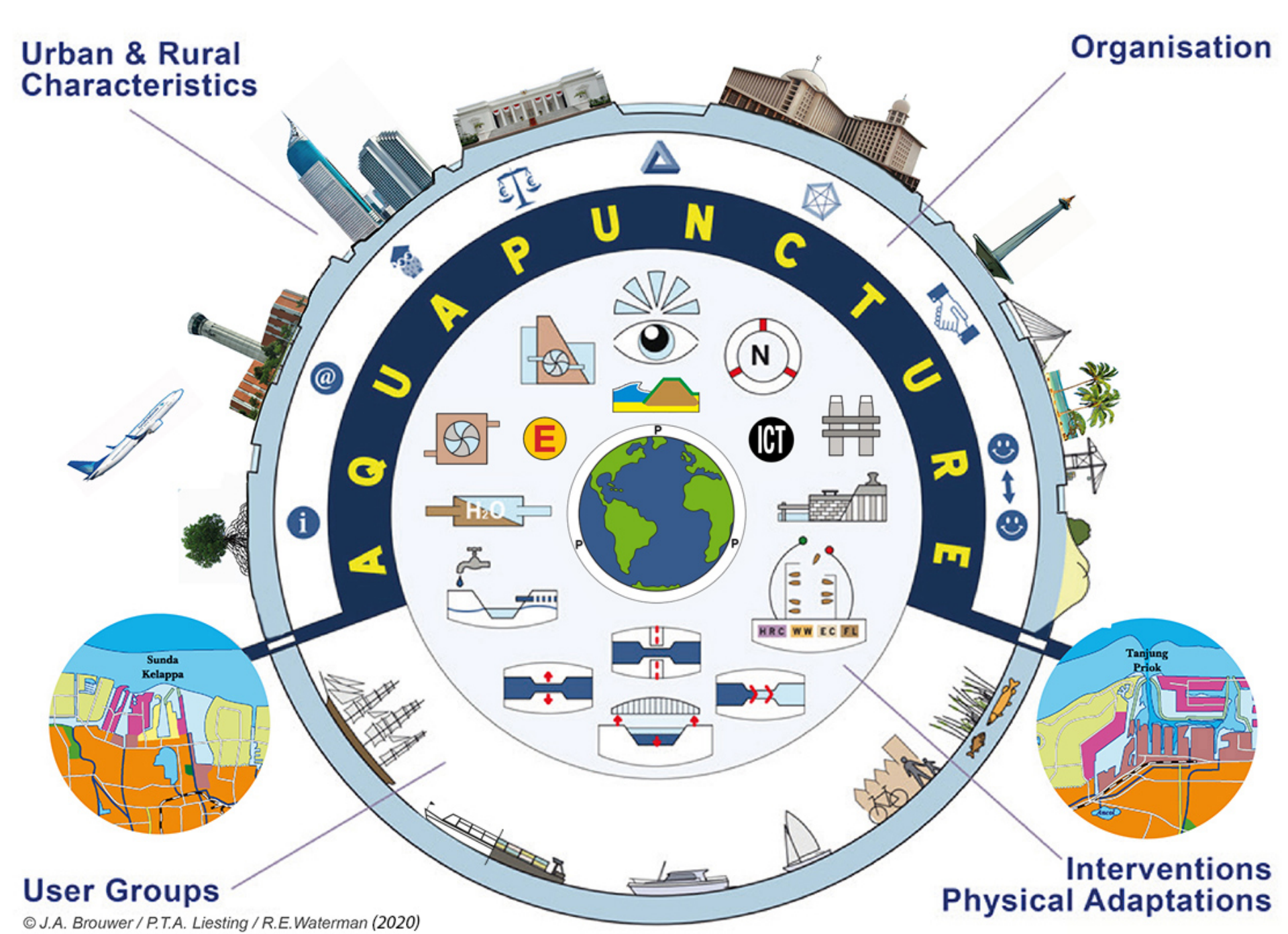
1. KALI KAMAL
2. KALI TUNJUNGAN
3. CENGKARENG DRAIN
4. KALI MUARA ANGKE
5. KALI DURI LEDENG
6. KALI OPAK
7. KALI ANAK CILIWUNG I
8. KALI CILIWUNG/MARINA
9. KALI ANCOL
10. KALI LAGOA
11. KALI SUNTER
12. CAKUNG DRAIN
13. KALI BLENCONG

PEMERINTAH DAERAH KHUSUS IBUKOTA JAKARTA
BADAN PELAKSANA REKLAMASI
PANTAI UTARA JAKARTA
JAKARTA WATERFRONT DEVELOPMENT

Upgrading river & drainage canals and waterfronts through Aquapuncture

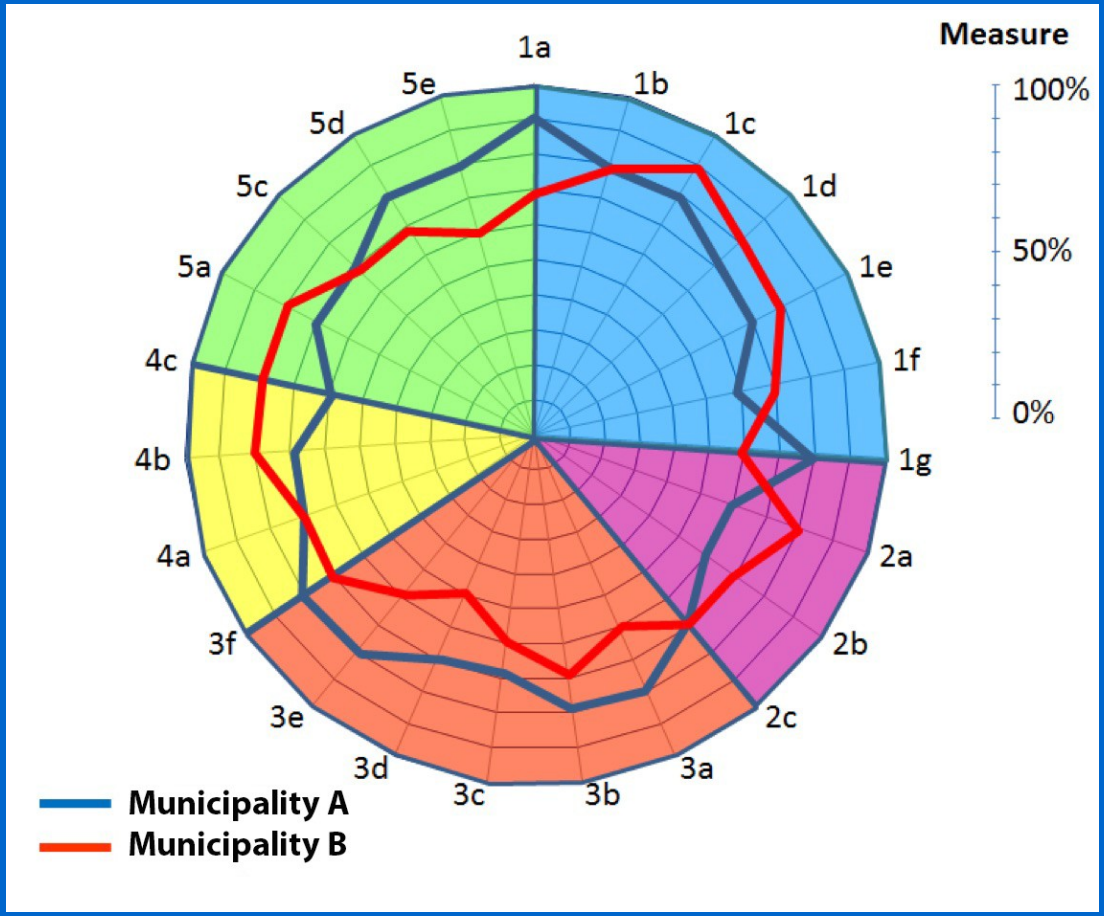
- dredging of water system
- prevention of garbage & waste dropping in water system
- waste water treatment
- waste collection, transport, storage & treatment
- elevation of bridges for navigability
- clearing water fronts for accessibility
- social resettlement inshore and offshore
- stopping of ground water extraction
- fresh water supply through piping from upstream water reservoirs

Long term mobilisation of double workforce of each 10,000 men to achieve this



Aquapuncture - Shared Value: Societal Costs & Benefits Measurement Model

Values	Objectives
1. **Water quantity**	a) Ensure flood protection b) Surface water & ground water regulation c) Drainage, irrigation for agriculture & aquaculture d) Drinking water supply e) Cooling water f) Process water g) **Water flow, thermal, osmotic energy**
2. **Water quality**	a) Improvement of water quality for environment b) Improvement of water quality for nature c) Improvement of water quality for health
3. **Navigability**	a) Commercial transport of persons b) Commercial transport of goods c) Tourism and recreation d) Special events on/at water e) Water related sports f) Waterway classification & connectivity
4. **Water front revenues**	a) Increased liveability b) Economic activities c) Increased value of property
5. **Spatial quality revenues**	a) Improved urban & rural environment b) Preservation & restoration of cultural heritage c) Attractive residential & business areas d) Leisure parks, sustainable industrial parks e) Overall sustainability, also with regard to climate & climate change



Jaipur

Capital of Rajasthan
6 million inhabitants

INDIA

DRAVYAVATI RIVER REJUVENATION PROJECT

To transfer Jaipur into a Clean Smart City

INVESTMENT:
+/- 210 Mln EUROS

CONSTRUCTION (3 YEARS):
170 Mln

MAINTENANCE (10 YEAR):
30 Mln

DRAVYAVATI River Rejuvenation Project:

- 47.5 km River Front
- 18,000 Trees
- 65,000 sqm Green Area

Pollution Reduction
Rain Water Harvesting
Sewage Water Treatment
(5 Plants – 170 mln l / day)
Flood Control
Green Spaces
Social Spaces

Cleaner Air
Better Public Health
Improved Quality of Life
100% LED light
Attract Investments
a.o.

DRAVYAVATI River Rejuvenation Project

DRAVYAVATI River Rejuvenation Project

Project Benefits

Experience Centre

Recreational Zones

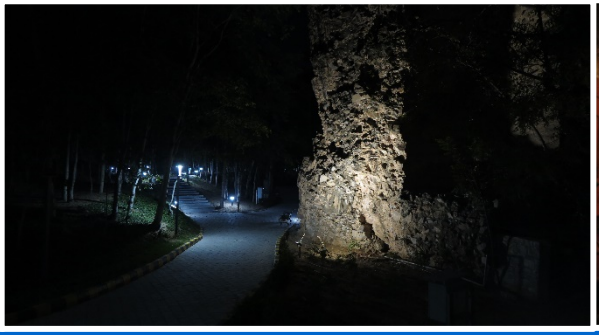
WIFI Hotspots / VCS

Botanical Garden

Landscape Park (leisure)

Heritage Waterworks Museum

Walking, Cycle & Jogging Tracks



Bird Park

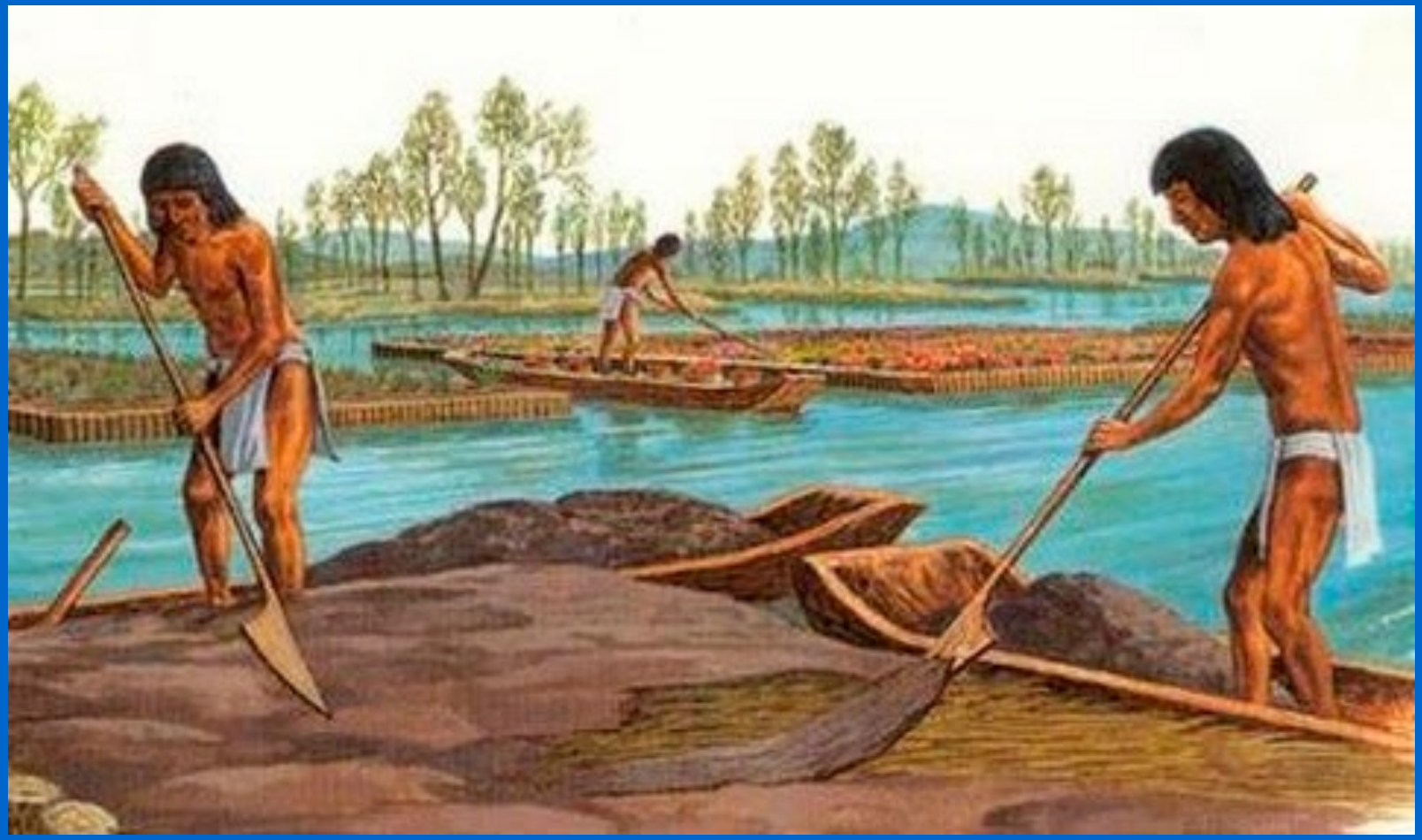
Food Plazas

SUSTAINABLE USE OF INLAND WATERWAYS

MEXICO - Mexico City back to the future through Aquapuncture
Aztec period > Tenochtitlan > Mexico City

Xochimilco – Chinampas – World Heritage Site

Xochimilco – Chinampas – World Heritage Site



Xochimilco – Chinampas – World Heritage Site

SUSTAINABLE USE OF INLAND WATERWAYS

COLOMBIA - Recuperación del Canal del Dique

Length 120 km, from Catagena to Rio Magdalena & Calamar

Recuperation complete with dikes, new locks & marsh improvements

AGUAPUNTURA©
for the optimal use &adaptation of the waterway and the waterfronts for economy, employment, environment, nature & landscape




Revitalisation Rio Medellin, Rio Bogota, Rio Cauca & Rio Cali via Aquapuncture

Rio Magdalena

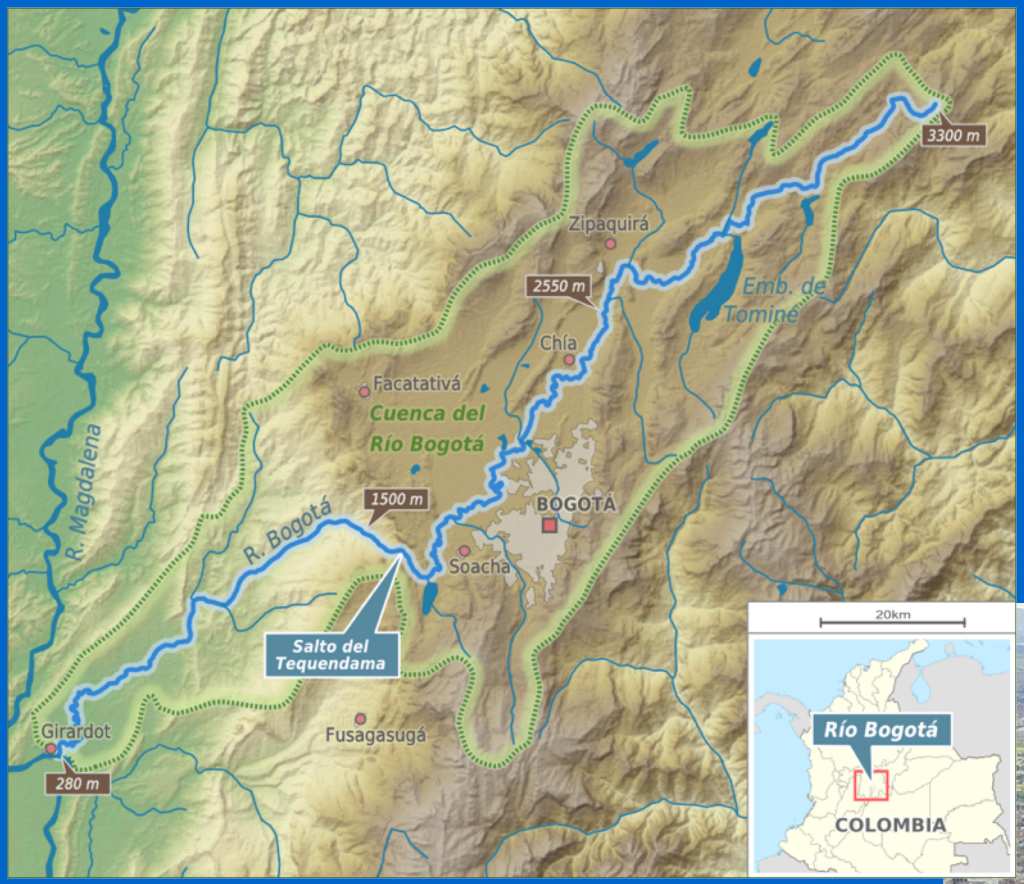
Rio Magdalena –
Length 1540 km

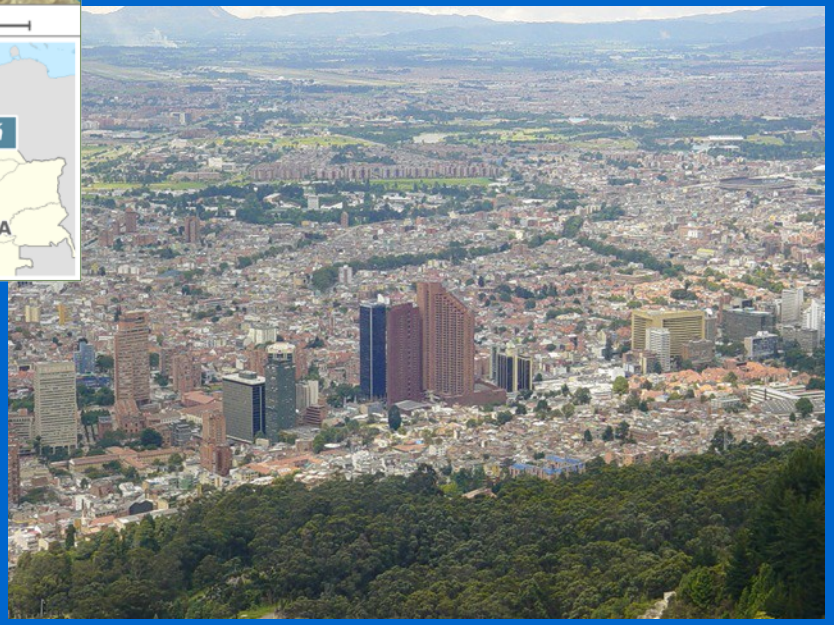
AGUAPUNTURA©
for the optimal use &adaptation of the waterway and the waterfronts for economy, employment, environment, nature &landscape

Rio Bogotá

The relation between Bogotá and the Rio Bogotá should be improved through AGUAPUNTURA©

AGUAPUNTURA©
for the optimal use &adaptation of the waterway
and the waterfronts for economy, employment, environment, nature & landscape

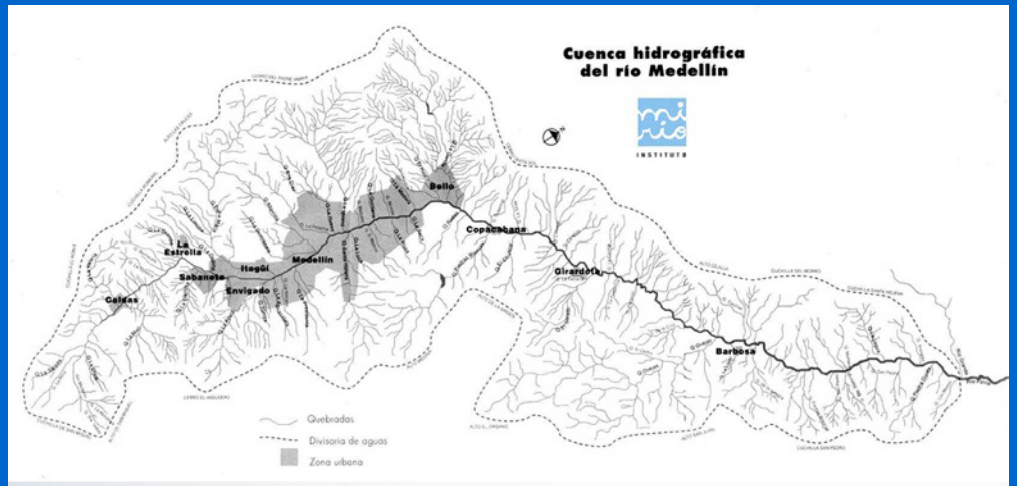




Bogotá

7.3 million inhabitants

Rio Medellin



Medellin - 2.2 million inhabitants

Rio Medellin - Length 100 km
(60 km Medellin & 40 km Porce)

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Rio Cauca

Rio Cauca –
Length 965 km

AGUAPUNTURA©
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and the waterfronts for economy, employment, environment, nature & landscape

Rio Cali

Santiago de Cali –
2.0 million inhabitants

Rio Cali

AGUAPUNTURA©
for the optimal use &adaptation of the waterway and their waterfronts for economy, employment, environment, nature & landscape

THE NETHERLANDS

WATER MAP OF THE NETHERLANDS

Network Recreational Waterways

4714 km in various navigational classes

1005 fixed bridges

1107 open bridges

258 ship locks

1100 marinas with 178,000 berths
40,000 berths outside marinas

Employment Water Recreation

30,000 jobs

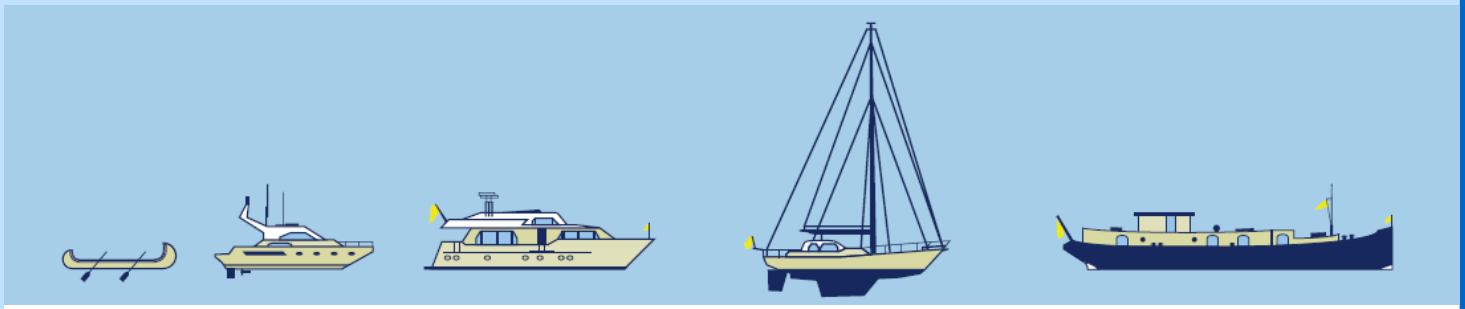
€ 4 billion total revenue

400,000 pleasure boats

2,000,000 water sport participants

€ 75 spending per boat per day

Recreational Navigation Classification



DESIGNATION	OPEN BOAT	CABIN CRUISER	MOTOR YACHT	SAILING BOAT	MOTOR BARGE
CLASS	RA	RB	RC	RD	I
MAX . LENGTH (M)	5.5	9.5	15.0	15.0	38.5
MAX. BEAM (M)	2.0	3.0	4.0	4.0	5.05
DRAUGHT (M)	0.5	1.0	1.5	2.0	1.8 – 2.2
MIN. HEIGHT UNDER BRIDGES (M)	2.0	3.25	4.0	30.0	4.0

SUSTAINABLE USE OF INLAND WATERWAYS

Rhine-Schie Canal **with adjacent waters in use for:**

- **Commercial craft for shipment of bulk cargo (raw materials, industrial & domestic wastes, finished products)**
- **Passenger cruises for visiting old Dutch cities: Leiden, Gouda, Schiedam, Delft, Vlaardingen, Alphen a/d Rijn en Katwijk**
- **Water buses & Water taxis**
- **Yachts of all sizes; heritage ships**
- **Water related sports: rowing, canoeing, rafting, fishing/angling, sailing**
- **Special events like floating flower shows, naval parade of historical vessels, concerts on**

Association Region Water (VRW)

Promotes the sustainable use of the waterway system with attractive waterfronts for tourism, recreation & sport.

Participants in this association: 13 Cities & 2 Water Boards with representation from Chamber of Commerce, hotel / restaurant / café-sector, leisure parks, water sport sector, fishing, canoeing, rowing, sailing, motor boating.

Close cooperation with Dutch Recreational Waterways Foundation (SRN), Province South-Holland & Local Harbour Masters (safe guarding nautical safety).

Taking into account laws and regulations on the various governmental levels.

ROTTERDAM
Waterfront development along river & harbours

Bron: Programma Rivieroevers - Toekomstperspectief
en Uitvoeringsprogramma - Gemeente Rotterdam

ROTTERDAM
Waterfront development along river & harbours

- Attractive routes along river and harbours with emphasis on walking & cycling
- Introduction of green spaces
- Special attractions along the waterfront
- More and improved shipping connections
- Sustainable river development: cleaner, more natural and climate proof
- Strengthening liveability and identity of the river and its waterfronts

ROTTERDAM
Waterfront development along river & harbours

ROTTERDAM
Waterfront development along river & harbours

ROTTERDAM

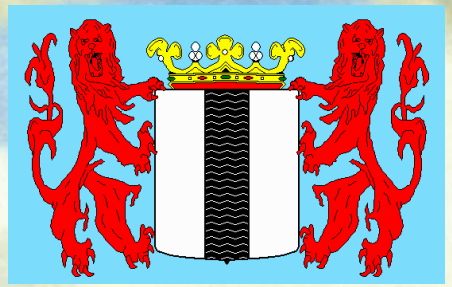
Waterfront development along river & harbours

ROTTERDAM
Waterfront development along river & harbours

ROTTERDAM

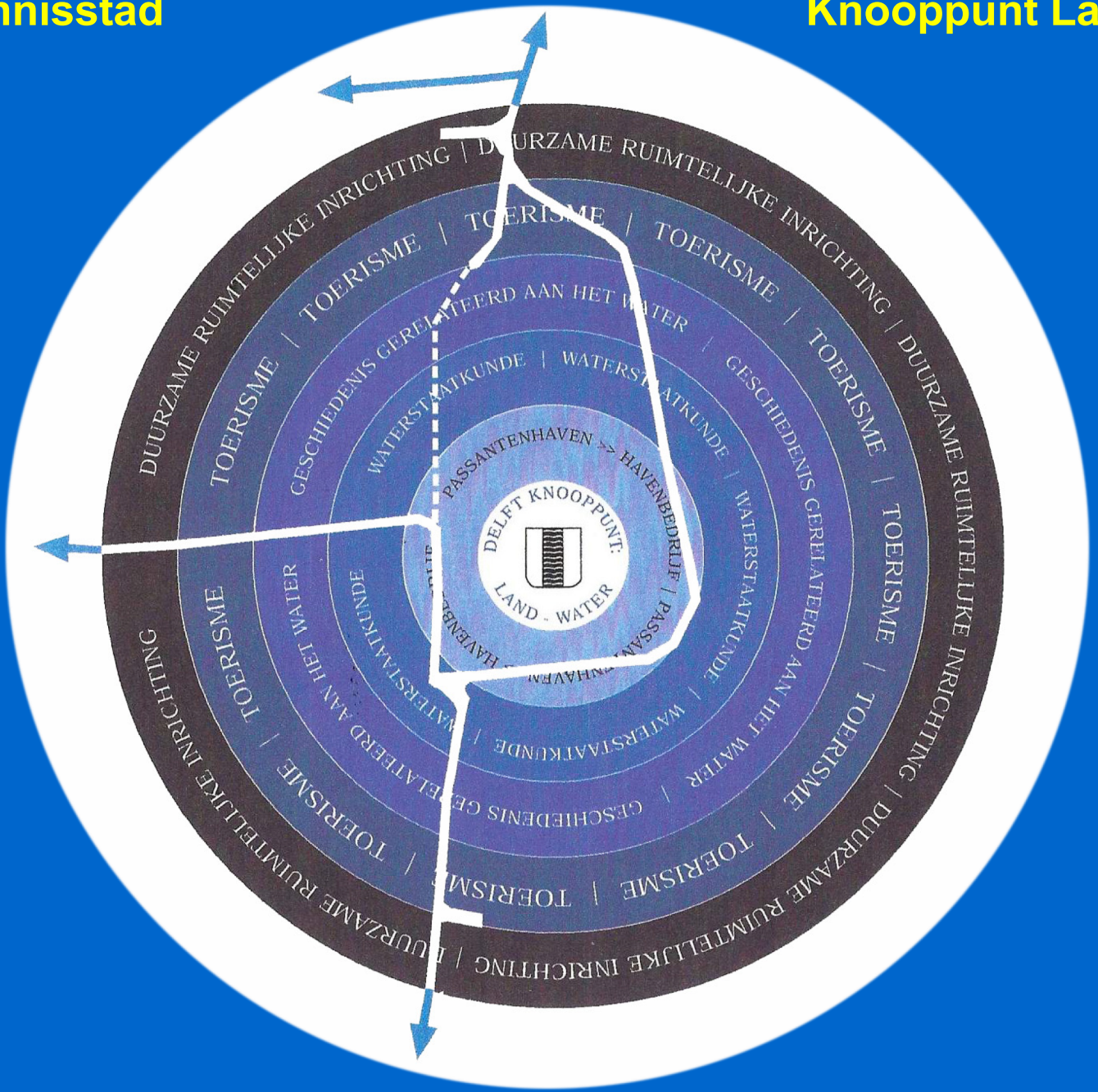
Waterfront development along river & harbours

RELATIE DELFT - WATER



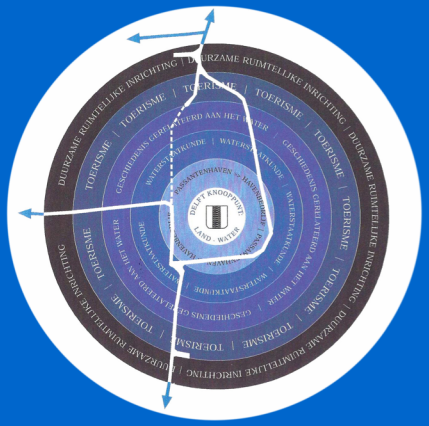
Dr. Ir. Ronald E. Waterman

Delft Kennisstad **Knooppunt Land-Water**



Delft Kennisstad

Knooppunt Land-Water



WATERSTAATKUNDE

Deltares, TU Delft CiTG, UNESCO-IHE-Water Education Institute, TNO, Rijkswaterstaat Geo-Info., Hoogheemraadschap Delfland

DUURZAME RUIMTELIJKE STEDELIJKE INRICHTING

TOERISME & RECREATIE

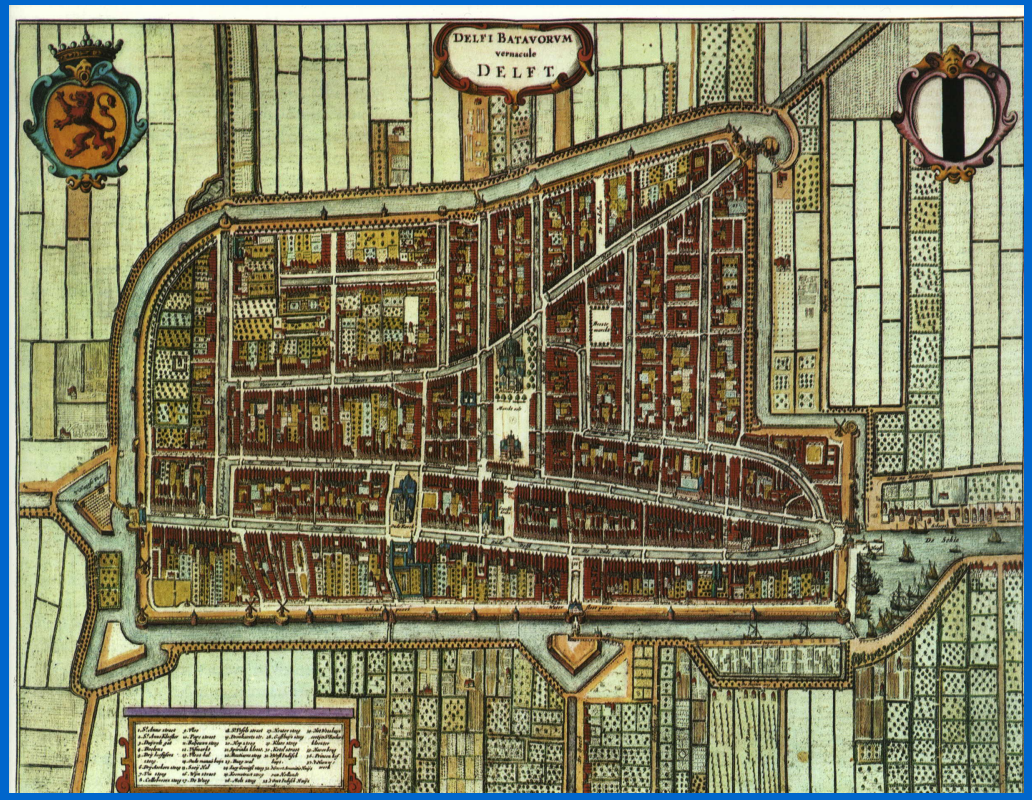
HISTORIE DELFT – WATER

‘Delven’ – Delfshaven, Oude Delft, Delft VOC-stad, Hoogheemraadschap Delfland, Zeehelden (Piet Hein, Maarten HPZ Tromp), Hugo de Groot (zeerecht),

Antonie van Leeuwenhoek (ontdekker micro-organismen in water), Vermeer (Gezicht op Delft),

Cultuurhistorie Delftse grachtenpanden, Watergerelateerde bedrijvigheid (bierbrouwerijen, leerlooierijen, VOC-handelshuizen, Armamentarium) Beroepsvaart (jaagpad, groente- en fruit, afval, mest, stro, turf, zand, grind, kolen, melk, vee, melasse, trek- en pakschuit), NGSF - Gist Brocades - DSM

Geschiedenis van de techniek (Watercentrum: waterkwantiteit & -kwaliteit, oppervlaktewater, grondwater, drinkwater, afvalwater, waterzuivering, natte infrastructuur, waterbouw) Roeiverenigingen (DDS, LAGA, PROTEUS-ERETES)



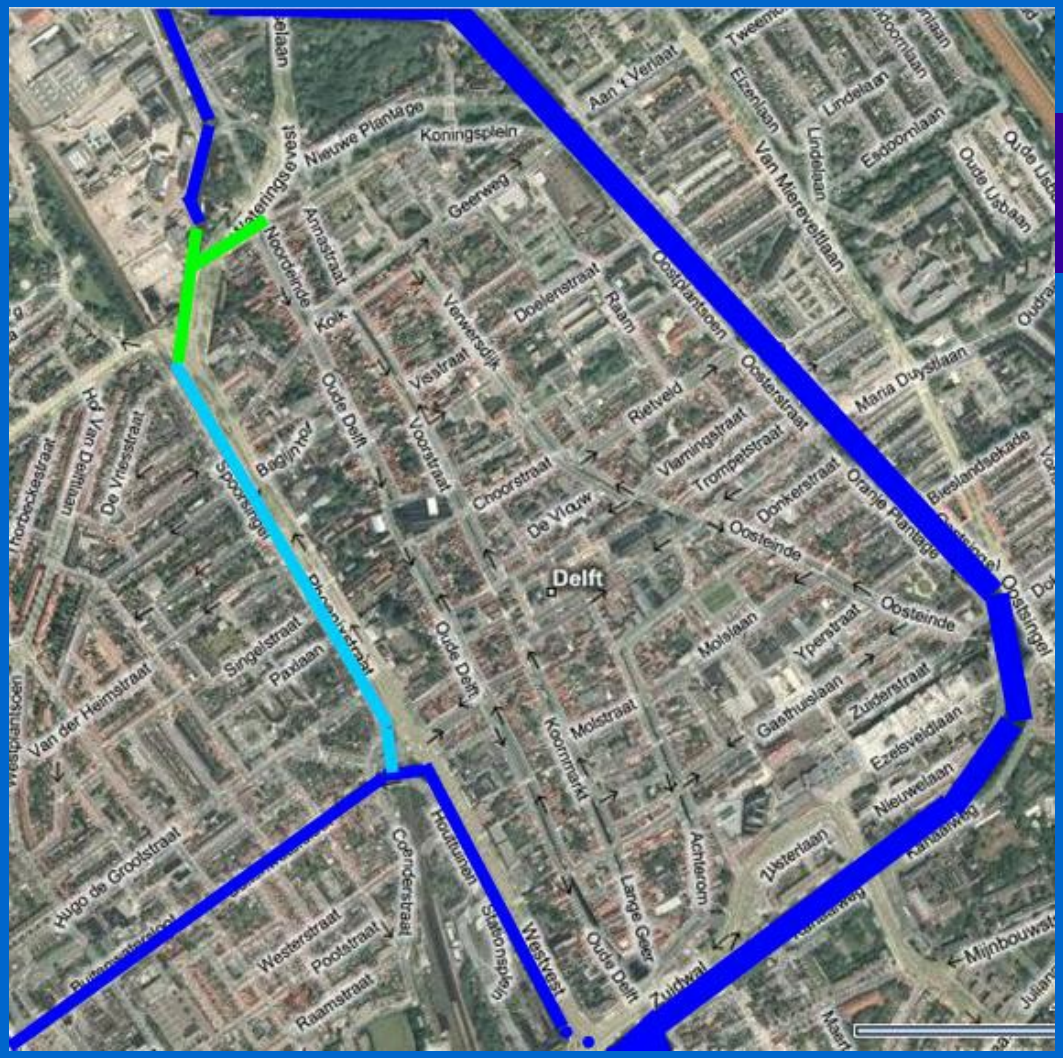
Sustainable whispering route

Duurzame fluisterroute in de historische binnenstad

Met speciale smalle, elektrisch aangedreven vaartuigen met een beperkt aantal zorgvuldig gekozen aanmeerplaatsen

Good plans have their roots in the past and are pointing towards the future

Goede plannen wortelen in het verleden en wijzen naar de toekomst



Canal Cruise
Rondvaarboten

&

Sustainable
whispering route


33

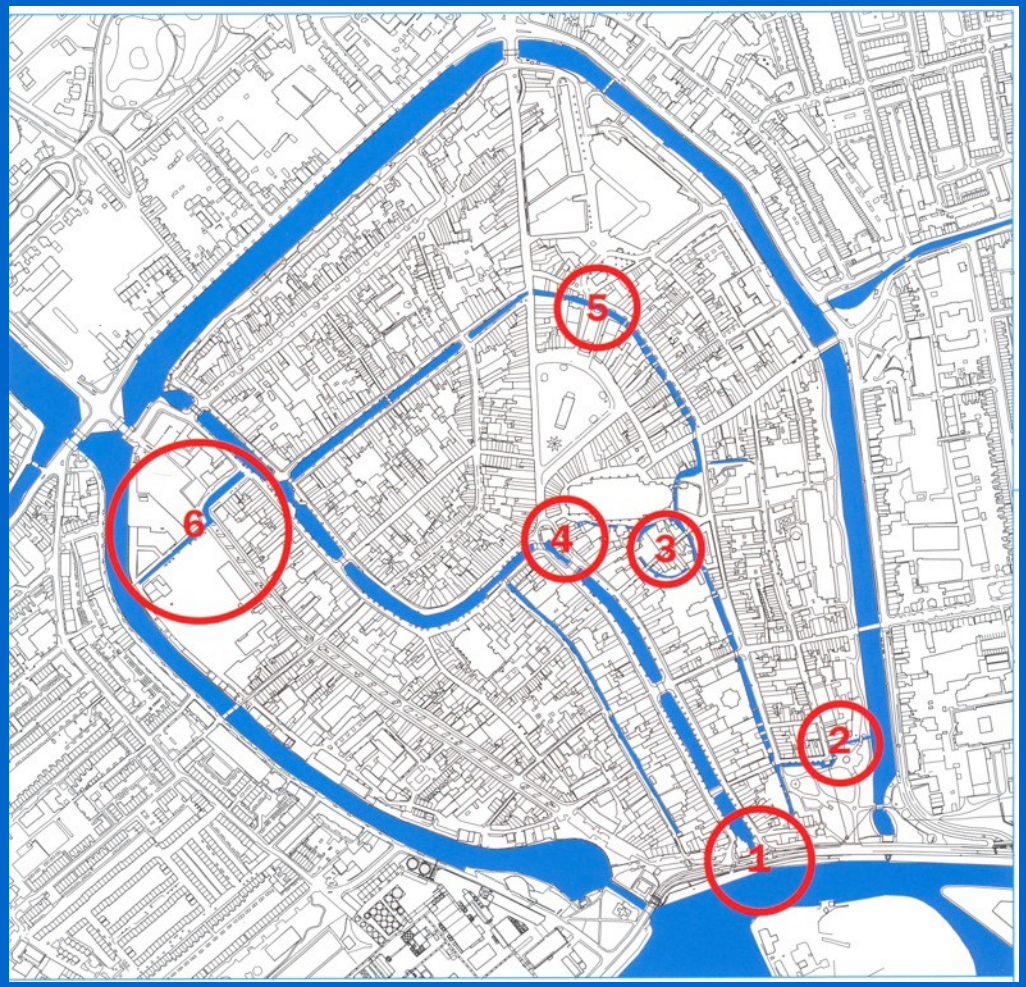
SUSTAINABLE USE OF INLAND WATERWAYS

"Als het Water weer gaat stromen,
krijgt Gouda zijn ziel terug"

SUSTAINABLE USE OF INLAND WATERWAYS

Gouda met waterverbindingen – vroeger en nu

SUSTAINABLE USE OF INLAND WATERWAYS



Knelpunten oplossen via Aquapunctuur

a) Sluis & sluiscapaciteit
b) Brughoogte
c) Baggerdiepte
d) Overige maatregelen

KNELPUNTEN

1 Havensluis
2 Vijverstraat
3 De Motte
4 Donkere Sluis / de Onderdoorgang
5 Achter de Waag
6 Nonnenwater / Verlorenkost

Waterfrontontwikkeling - Accent op cultuurhistorie

SUSTAINABLE USE OF INLAND WATERWAYS

Gouda als Waterstad in Zuid-Hollands en Europees perspectief

Binnen-Dieze & Maximakanaal

BINNENDIEZE

Aftakking Zuid-Willemsvaart

Association Region Water (VRW)

- Improving Canal conditions for navigation referring to depths, widths, canal bank conditions and slope. Loading / unloading platforms, container terminals

- Height under bridges, ship lock adaptation, bridge and lock servicing, maintenance dredging

- River canalization, river / canal / training works with regard to critical sections

- Provision for safe mooring, berths, marina's, yachting harbours together with adequate facilities. These facilities are: drinking water supply, pumping stations for delivery of domestic wastes and bilge water, sewer systems, toilets, showers, electrical current supply, sign posting

- Ensuring navigational safety for all users of the waterway, with special attention for interaction between commercial craft and recreational vessels

Association Region Water (VRW)

- Development of Waterfronts with attractive boulevards with green elements, real estate developments, sufficient hotel – restaurant – café capacity, museums, shops & water related companies.

- Towing paths, footpaths, bicycle tracks, parking space, loading/unloading platforms along the waterways and eco zones.

- Promotion, restoration and maintenance of cultural heritage values and of region specific products & services.

- Conservation and development of landscapes along the waterway in between the towns.

- Introduction of cruises with music and catering aboard.

- Introduction of special boating events such as floating flower shows, concerts on water, naval parade of historical vessels, regattas, rowing competitions, revival of historical journeys on the waterway, water taxis linking historical sites.

Association Region Water (VRW)

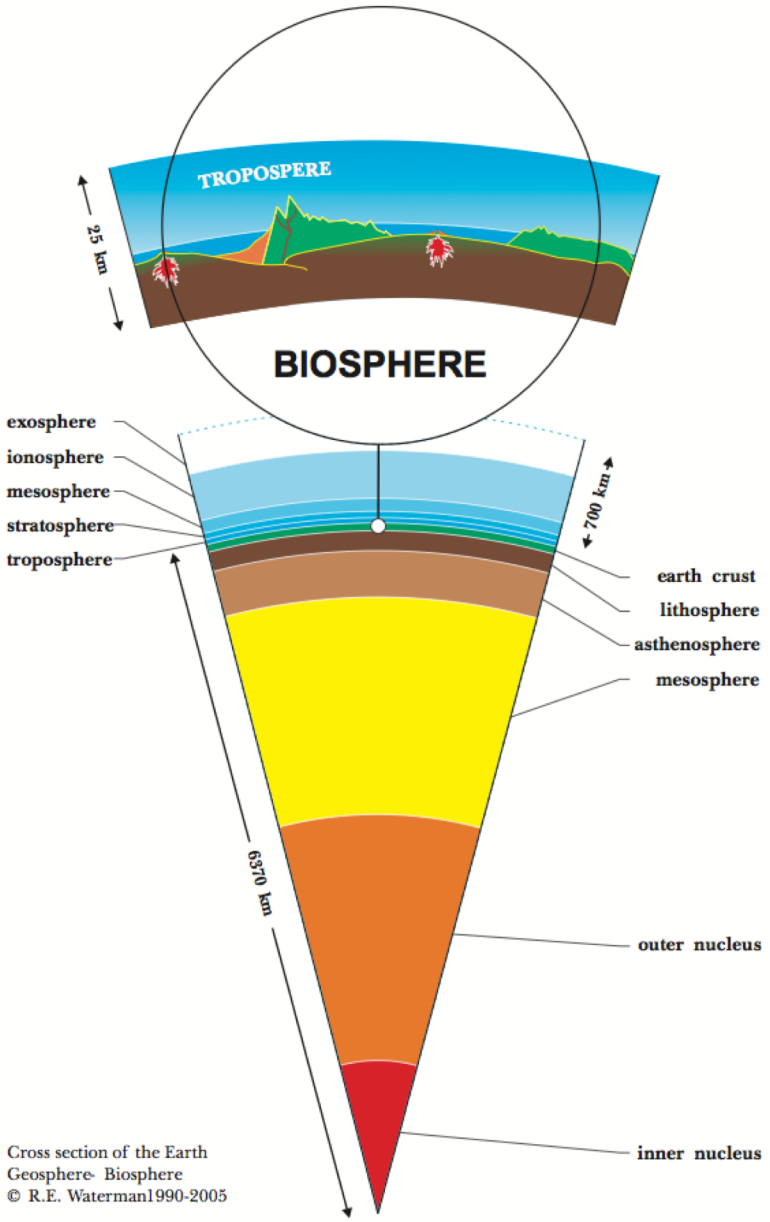
- Linkage of the inland waterway with the North Sea
- Katwijk on Sea with special design of a yachting harbour linked through portage or sluice/shiplock with Old Rhine River and Rhine Schie Canal.
- The design is coupled with dune-beach widening on each side of the river mouth for reasons of climate change in order to protect the hinterland from flooding.

Association Region Water (VRW)

- Linkage of the inland waterway with the North Sea
- Katwijk on Sea with special design of a yachting harbour linked through portage or sluice/shiplock with Old Rhine River and Rhine Schie Canal.
- The design is coupled with dune-beach widening on each side of the river mouth for reasons of climate change in order to protect the hinterland from flooding (+ under dune parking facility).

Scheveningen 4th harbour
with dune/beach expansion
on each side

Linkage of inland waterway
with Scheveningen harbour
Complete with sluice

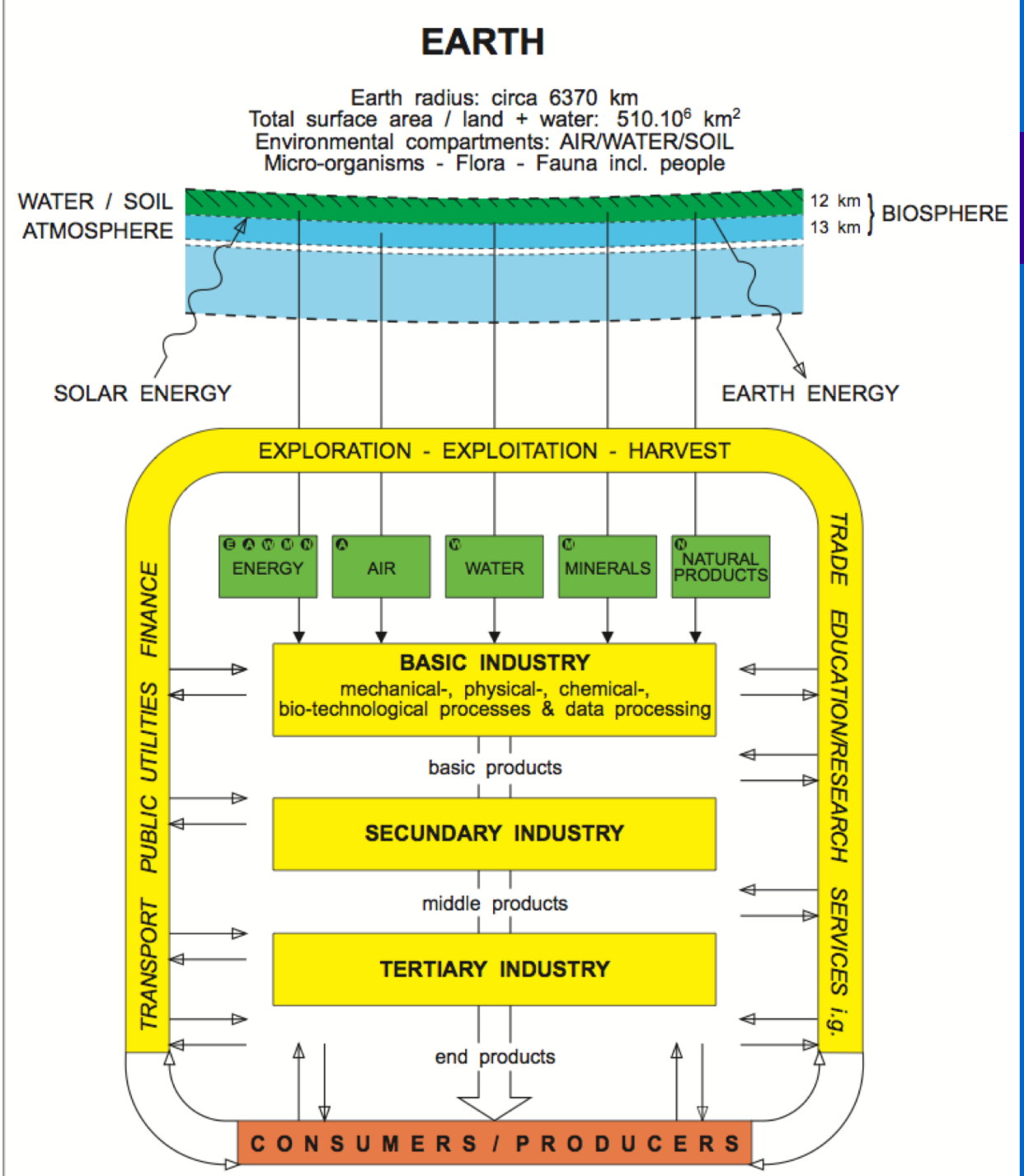


Cross section of the Earth
Geosphere- Biosphere
© R.E. Waterman1990-2005

Environment

Apart from space travel all human activities take place in a thin shell around the earth: the geosphere - biosphere – sociosphere system

There we find the environmental compartments Air – Water – Soil and all the material expressions of human activities



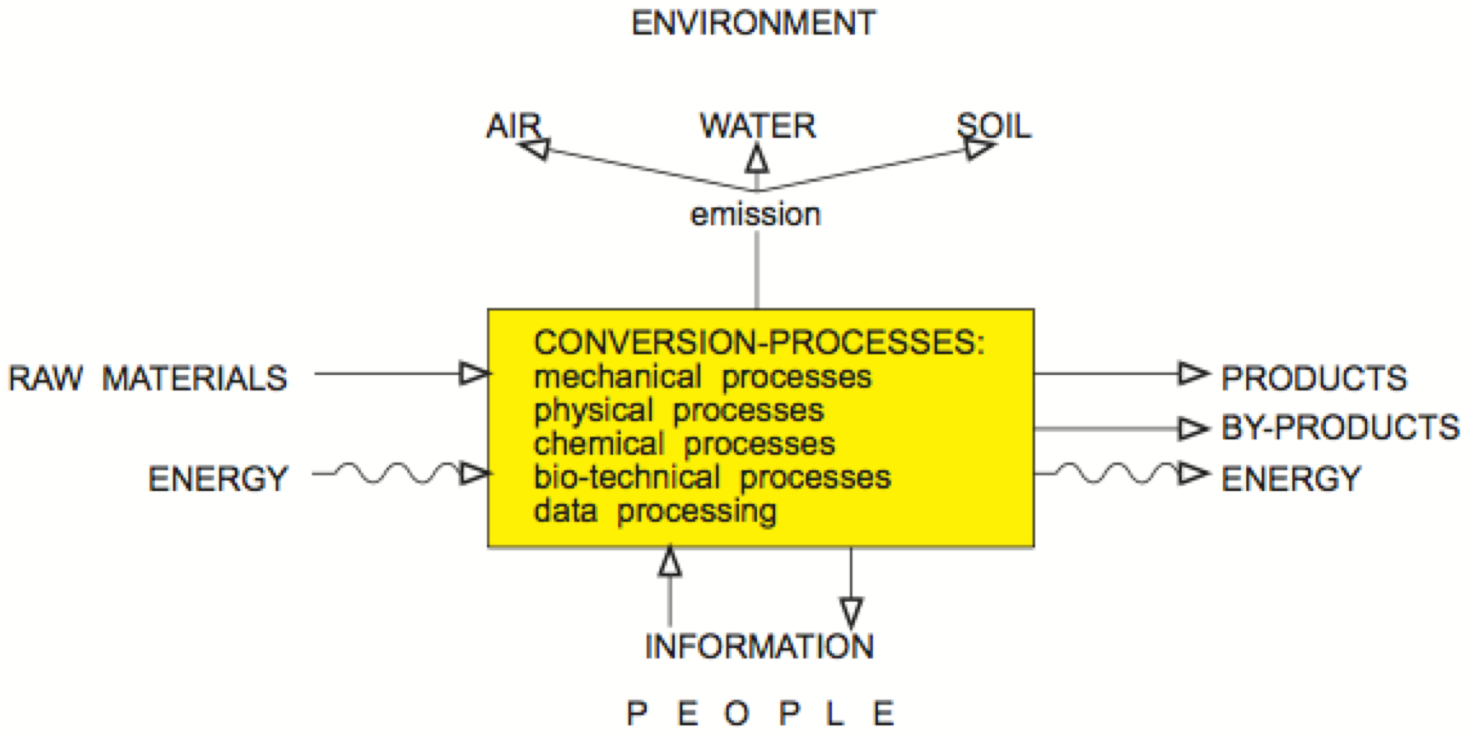
Environment

MANKIND extracts from / in the geosphere raw materials and energy

Every human being is at the same time

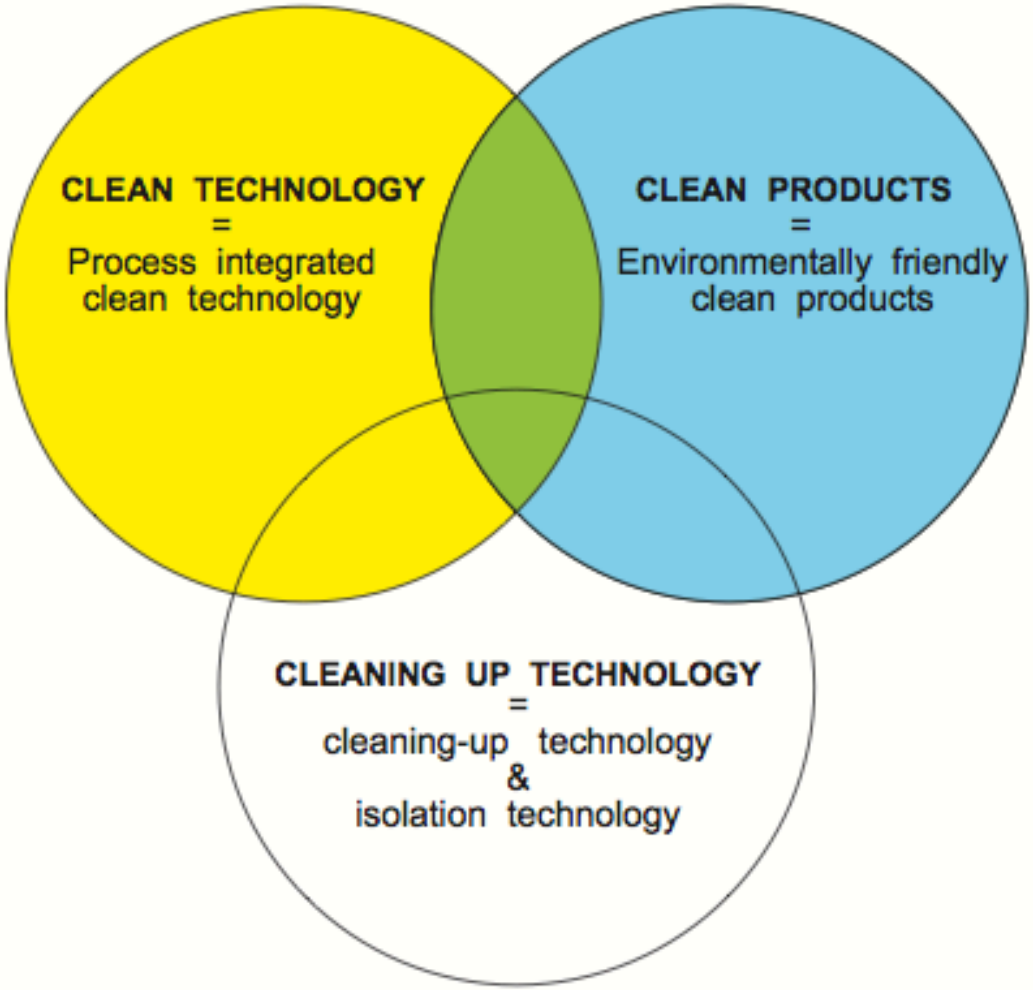
PRODUCER & CONSUMER

Process innovations take place in the environment and are initiated, developed and managed by people



The great challenge of the 21st century is to develop and implement conversion processes in such a way that at the same time the economy is strengthened and the environment improved

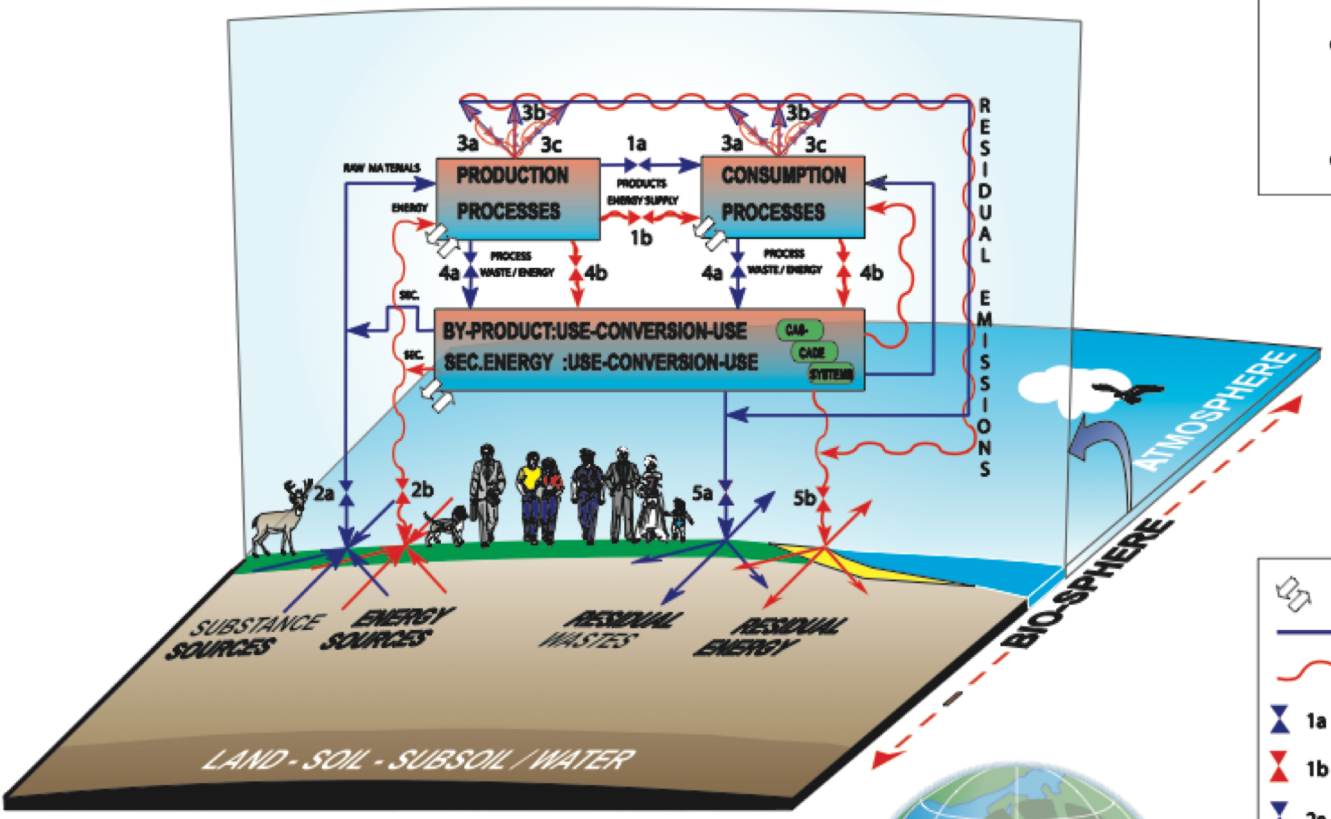
Environmental Technology



Triple - C approach

TOWARDS A (CLOSED) MASS / ENERGY - CYCLE IN A SUSTAINABLE SOCIETY

(in which up- and downgrading occurs)



ENVIRONMENTAL FOOT IMPRINT (IN HA)

=

FUNCTION (POPULATION, LIFESTYLE, TECHNOLOGY)

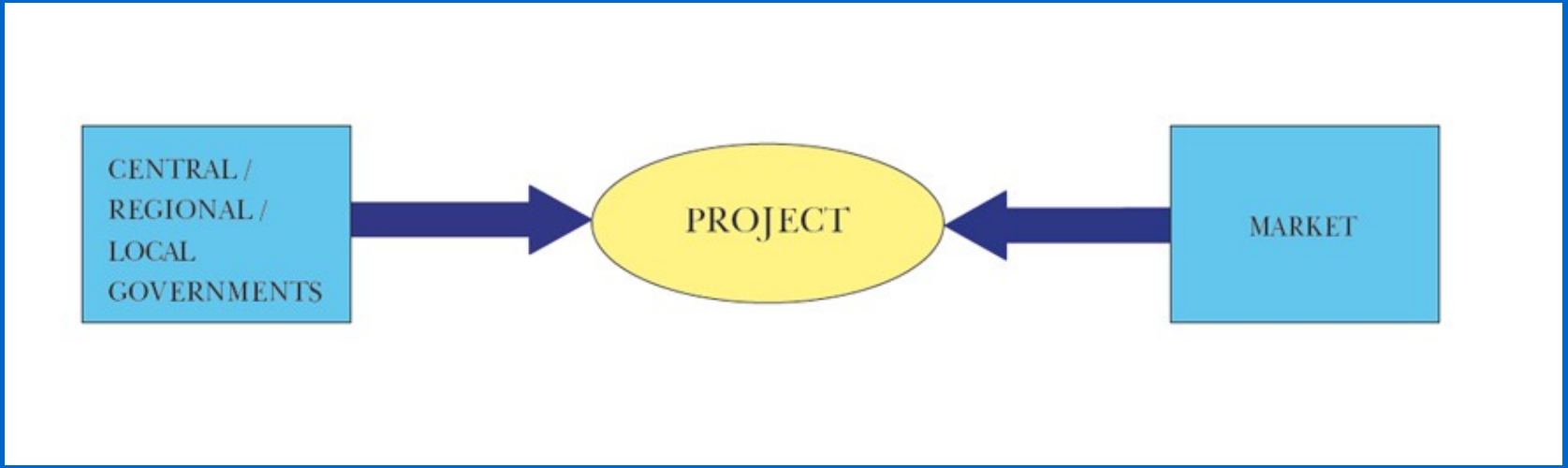
- The conversion processes take place in the environment. They are often initiated, developed and managed by people.
- Those processes should be developed whereby with less raw materials and less energy, valuable products can be produced at a higher yield, with less hazardous emissions to air/water/soil.
- In so far by-products are produced, these should be transformed into environmentally friendly products. If this is not feasible these by-products should be safely stored in order to protect the environment.
- Space- and time-factors should also be taken into account.

BIO-SPHERE :

- ENVIRONMENTAL COMPARTMENTS, AIR - WATER - SOIL
- MICRO-ORGANISMS, FLORA, FAUNA (INCL. PEOPLE)
- ECO - SYSTEMS
- ALL MATERIAL EXPRESSIONS OF HUMAN ACTIVITIES
- MASS SOURCES, ENERGY SOURCES } VIA EXPLORATIONS, EXPLOITATION, MINING, CULTIVATION, HARVEST, ETC.
- RESIDUAL WASTES, RESIDUAL ENERGY } IMMOBILISATION / DIFFUSION & DISSIPATION

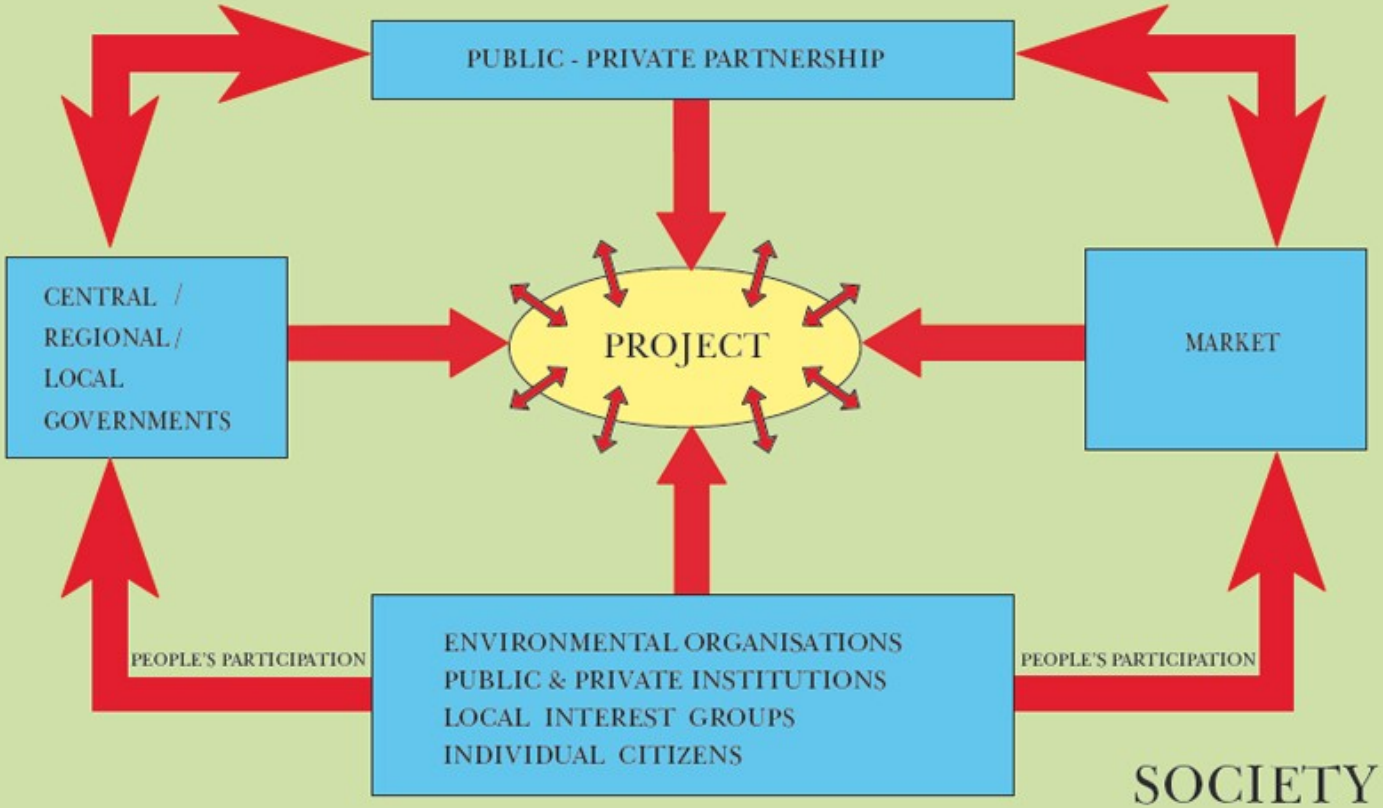
	INFORMATION IN / OUT
	MASS - TRANSPORT
	ENERGY - TRANSPORT
1a	CONTROL VALVE PRODUCT (QUALITY & QUANTITY)
1b	CONTROL VALVE ENERRGY SUPPLY (QUALITY & QUANTITY)
2a	CONTROL VALVE RAW MATERIALS (QUALITY & QUANTITY)
2b	CONTROL PRIMARY ENERGY FROM VARIOUS SOURCES (QUALITY & QUANTITY)
3a,b,c	CONTROL VALVE EMISSION REDUCTION (OF HARMFUL COMPONENTS TO AIR - WATER - SOIL
4a, 5a	CONTROL VALVE FOR BY-PRODUCTS & RESIDUAL WASTES (USE - CONVERSION - USE, IMMOBILISATION, DIFFUSION
4b, 5b	CONTROL VALVE FOR SECUNDARY & RESIDUAL ENERGY (USE - STORAGE, DIFFUSION & DISSIPATION)

INTERACTIVE PLAN DEVELOPMENT



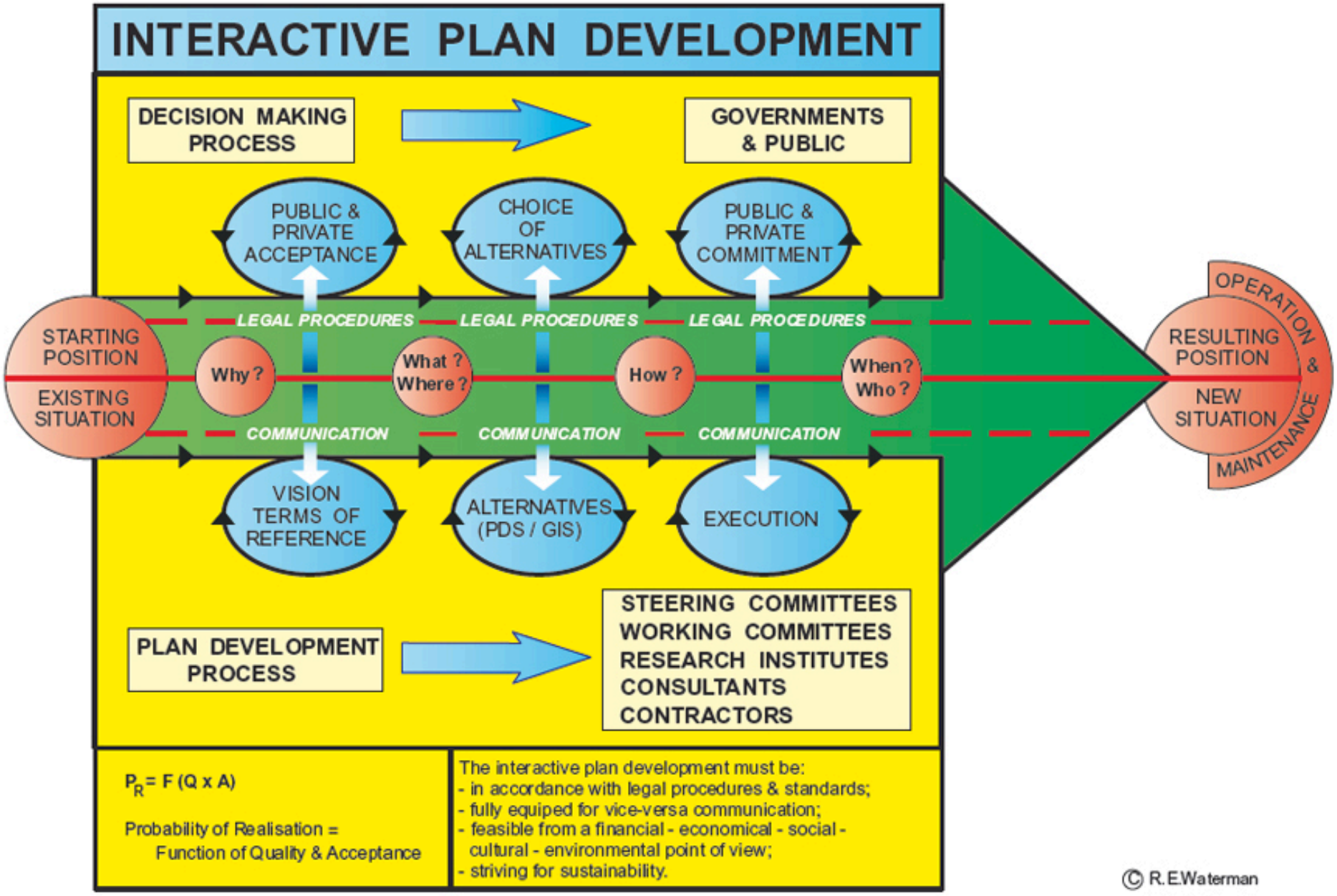
Plan Development in the past

ENVIRONMENT



SOCIETY

A project - including its plan development - is situated and takes place in the enviroment and is initiated, propagated, criticised and executed by people The project influences the environment and is influenced by the environment.


INTERACTIVE PLAN DEVELOPMENT
DECISION MAKING PROCESS
GOVERNMENTS & PUBLIC
PUBLIC & PRIVATE ACCEPTANCE
CHOICE OF ALTERNATIVES
PUBLIC & PRIVATE COMMITMENT
LEGAL PROCEDURES
LEGAL PROCEDURES
LEGAL PROCEDURES
STARTING POSITION
EXISTING SITUATION
Why ?
What ? Where ?
How ?
When? Who ?
COMMUNICATION
COMMUNICATION
COMMUNICATION
VISION TERMS OF REFERENCE
ALTERNATIVES (PDS / GIS)
EXECUTION
OPERATION & MAINTENANCE
RESULTING POSITION
NEW SITUATION
PLAN DEVELOPMENT PROCESS
STEERING COMMITTEES
WORKING COMMITTEES
RESEARCH INSTITUTES
CONSULTANTS
CONTRACTORS
$P_R = F (Q \times A)$
Probability of Realisation = Function of Quality & Acceptance
The interactive plan development must be:
- in accordance with legal procedures & standards;
- fully equiped for vice-versa communication;
- feasible from a financial - economical - social - cultural - environmental point of view;
- striving for sustainability.
© R.E.Waterman

SUSTAINABLE COASTAL & DELTAIC ZONE DEVELOPMENT VIA BUILDING WITH NATURE

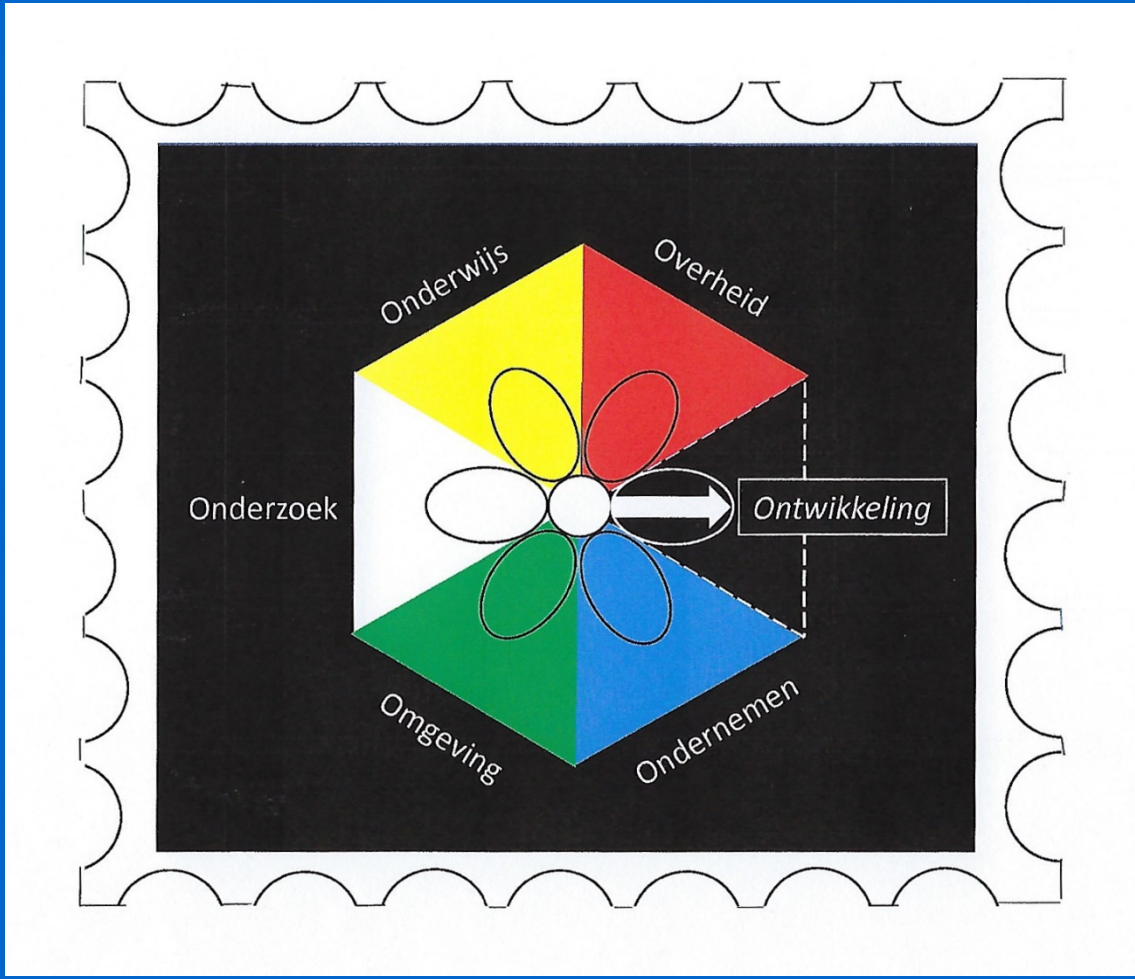
The described method is scientifically based and can be broadened and deepened.

Application can be realised on the basis of flexible masterplans, which can be executed phase after phase, segment after segment. Usage of an interactive plan development according the scheme is recommended.

To achieve sufficient support active co-operation of at least five sectors is necessary:

- governments
- education
- research
- companies
- environment, nature, landscape, social society, media

SUSTAINABLE COASTAL & DELTAIC ZONE DEVELOPMENT VIA BUILDING WITH NATURE



5 O's leidend tot een 6e O van Duurzame, Bio-based Circulaire Ontwikkeling

- governments
- education
- research
- companies
- environment, nature, landscape, social society, media

Leading to Sustainable, Bio-based Circulair Development

INTERACTIVE PLAN DEVELOPMENT

Vision

Vision plays a crucial and essential role from start to finish in any interactive plan development process.
Without vision neither an excellent plan design, nor its development can be achieved.
Every plan development is or should be based on a well-founded vision.
Ideally, this vision, placed in time and space, should be based on knowledge, insight, sensory perception, analytical skill, sound rational reasoning and intuition, inspiration and creativity.

1.1 *"Creative Thinking – Thoughtful Acting."*
Motto Royal Dutch Institute of Engineers

1.2 *"A Living Nation is Building its Future."*
Dr. Ir. C. Lely (1854 – 1929), the Netherlands

1.3 *"Luctor et Emergo." ("I struggle and emerge")*
Motto Province of Zeeland, the Netherlands

INTERACTIVE PLAN DEVELOPMENT

Vision

2.1 *"Nature is a brilliant source of inspiration and an excellent teacher for the development of well-designed plans."*
R.E. Waterman

2.2 *"Well-designed plans have their roots in the past and are pointing to the future."*
R.E. Waterman

2.3 *"The great challenge in this era is to develop methods that simultaneously improve the environment and strengthen the economy"*
R.E. Waterman

2.4 *"The most valuable resource available to us is our brain. Therefore let us together use these brains for the benefit of the environment, the economy and our fellow human beings."*
R.E. Waterman

2.5 *"Sharing knowledge is multiplying knowledge."*
Anonymous

2.6 *"Think Long-Term – Act Short-Term."*
P.J.A. van Hessen

3.1 *"If you will, it is no fairy-tale."*
Th. Herzl (1860-1904),
"Altneuland" (1899-1902)

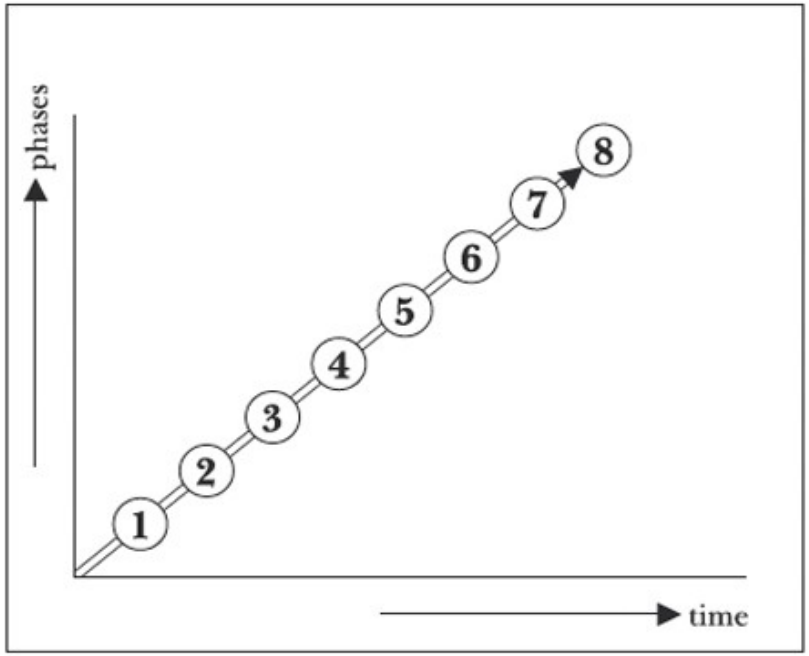
3.2 *"Who doesn't believe in dreams, is not a realist."*
D. Ben Goerion (1886-1973)

3.3 *"Dream great dreams and take practical steps to turn them into reality."*
Henrietta Szold (1860-1945)

3.4 *"Dreams are not to soothe us asleep, but to shake us awake."*
R. Magritte (1898-1967), 1929

INTERACTIVE PLAN DEVELOPMENT

1. PLAN DEVELOPMENT & EXECUTION



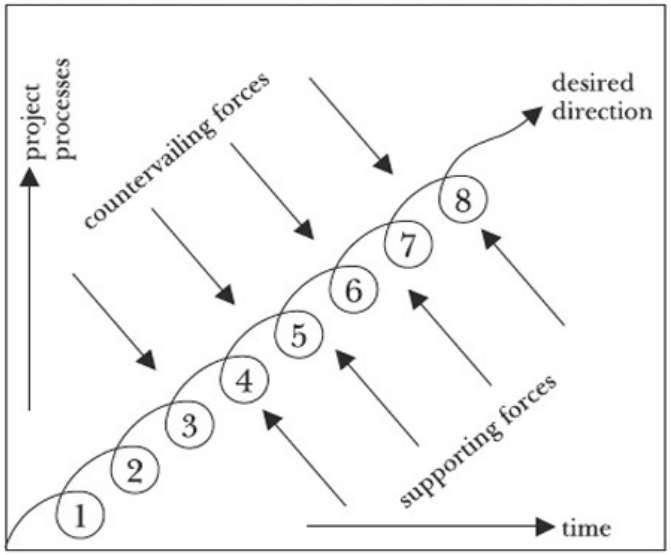
In the development and execution of a plan many phases can be distinguished. All other interacting processes, although of extreme importance, have been left out.

1. Existing situation.
2. Vision for a future situation.
3. Conceptual plan based on acquired data, trends, careful analysis and additional research.
4. From conceptual plan towards a number of concrete plans.
5. Fine tuning and final choice of selected plan.
6. Execution of chosen plan.
7. Wished for resulting situation.
8. Operation and maintenance of executed plan.

Additional Instruments

INTERACTIVE PLAN DEVELOPMENT

2. SERIES OF CYCLIC PROCESSES IN "FORCES FIELD"



- Mapping of Field Forces
- Field Force Analysis
- Weighing forces for and against a project

  Weighing factor = *f* (availability & power to influence change)

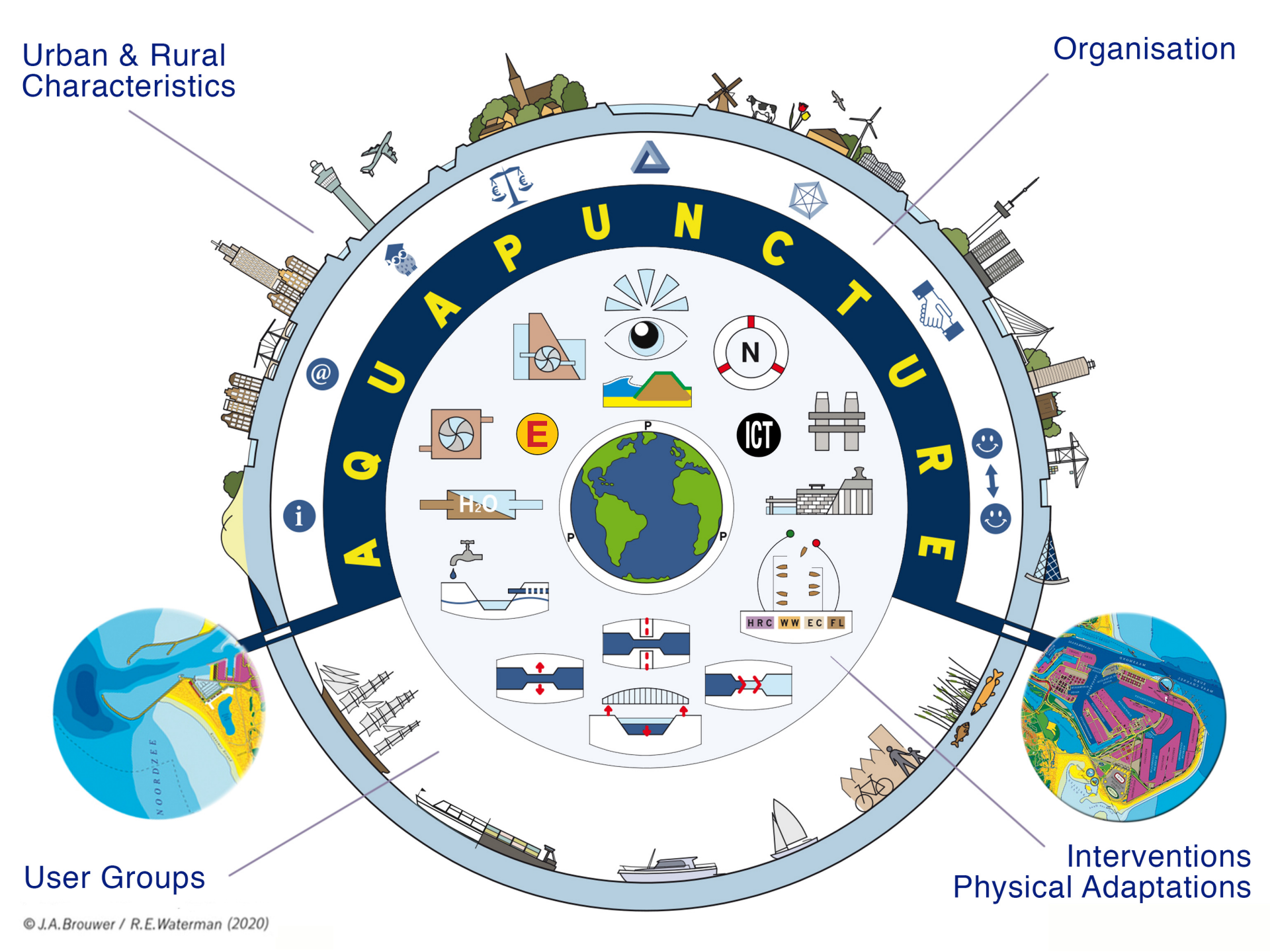
3. SWOT ANALYSIS

Strengths	Weaknesses
Opportunities	Threats

4. MULTI-CRITERIA ANALYSIS

Multi-criteria Analysis which weighs factors for comparative model research, whereby each relevant function from a to z is weighed qualitatively and quantitatively. This is an additional instrument to compare and evaluate a series of plans.

Additional Instruments


Urban & Rural Characteristics
Organisation
AQUAPUNCTURE
N
E
ICT
P
P
P
H2O
HRC WW EC FL
NOORDZEE
User Groups
Interventions Physical Adaptations
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