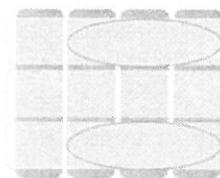




***LIFE 2015 INTEGRATED PROJECTS
CLIMATE ACTION***

Stage 2 - Full proposal

**Phase 2 – Approved Amendment
LIFE15 IPC/DK/000006-C2C CC
Part 3 – Actions (from C15 – C24)**



C15: CCA in Hedensted and Tørring

with focus on growth, added value, sustainability and innovation

This action focuses on sustainable CCA through a holistic concept, involving approaches that brings together the environment, society and the economy. The farming sector is important because of its agricultural production, while, at the same time, it manages areas that are important for the CCA of towns and cities. It is important to counteract the decline in residential areas and accommodate the potential for continued production opportunities in farming and for growth in general. Solutions must be implemented in collaboration between local farmers, technical water experts, and, if required, water utilities, that have knowledge of and experience with precipitation, water movement in the soil, drainage systems, hydraulics, watercourses, the use of the area and choice of crops. This action is primarily linked to governance and innovation within all aspects of the hydrological cycle apart from sea & fjords.

Main responsible beneficiary: Hedensted Municipality

Budget: 203.394€

Number of days estimated spent on action in phase 1: 88 Days

Number of days estimated spent on action in phase 2: 118 Days

Beneficiary responsible for implementation: HEDKOM

Role of HEDKOM

- Is the project manager
- Enters into dialogue with Brian Kronvang of the DEC - Danish Centre for Environment and Energy, and Jørgen Korning of SEGES, who have shown interest in the project or / and other experts and stakeholders.
- Coordinates with PM (CDR) and C13

Relation to CCA plans

HEDKOM CCA plan (page 21) + the related municipal plan's guidelines for low-lying areas and wetlands, guidelines for technical installations, guidelines for towns and cities, and guidelines for agriculture and Biogas are particularly relevant in this action, which qualifies and supports the goal with the towns Hedensted and Tørring: Knowledge generation about areas with water problems (page 23), Value management and assessment of climate initiative (page 21 + page 23), local organising and local goals (page 24).

Relation to cross-cutting capacity building actions (C1-C7)

Activity C15 CCA in Hedensted and Tørring will gain from actions under action C2 sharing knowledge on CCA and rivers developed under different actions. Modelling, interpretations, analysis and data sampling are similar in the different catchments and C15 will benefit from this

knowledge sharing. Scientific aspects currently the highly debated within EU, e.g. on the synergies and trade-offs between CCA and water ecology, the need for warning systems related to flooding of rivers and local contingency planning, and the synergies between farming and wetland restoration will also be shared and discussed for the benefit of action C15.

Under action C3, in selected areas a detailed local model is set up focusing on groundwater, surface and/or seawater. Models are based on the present data and collections of new data sets e.g. geophysical data and C15 will benefit from this model.

Under Action C4 Rainwater, C15 will gain from the identification and experience of different setup models and testing of SUDS within CDR. Under action C5 specific training courses, workshops and masterclasses, with point of departure in the challenges experienced by the partners will be implemented for the benefit of action C15 and other actions.

Linked to Complementary Actions

No actions identified at the moment.

Description (What, how, where, and when)

The outset of C15 is sustainable CCA through a holistic sustainable concept, involving thinking that brings together the environment, society and the economy. Farming is an important enterprise because of the production of agricultural goods, and it is an industry that manages areas that are important for the CCA of the towns and cities. At the same time, it is important to both counteract the decline in residential areas and accommodate the potential for continued production opportunities in farming and for general growth.

C15.1 CCA of Hedensted town

What:

In Hedensted town there are different options for CCA actions to achieve sustainability, added value and growth, focus should be on added value for the citizens, when challenges resulting from changed climate are handled, e.g. when residential areas are adapted to manage surface water. C15.1 works with methods that will be able to value what can be achieved by CCA, and compare with the investments that are required. This valuation can also be used when there is no convergence between the things that benefit from good climate proofing and the things that must support the initiatives for climate proofing and construction. Climate proofing must therefore be handled in larger and/or smaller communities. C15.1 covers the possibilities of achieving protection against flooding, in conjunction with the need for added value for the citizens. This will be done by using semi-economic models as a basis for prioritizing focus areas, efforts, and means and financing models. Specifically, a catalog for added value will be devised, which can be used with the prioritization of climate solutions locally in Hedensted town. Below figure 29 to 34 illustrates the ideas of added value in this action.



How:

Action C15.1 is expected to include:

1. Analysis of the climate proofing area, including: Residential areas, other protection assets (infrastructure, accessibility, valuable cultivated land, etc.), and areas that can be included in the solutions (In the risk area and in the catchment area)
2. Risk analysis from an asset perspective (entire area), involving: defining threatened assets, probability for flooding, value assessment in DKK.
3. Preparation of a catalogue of examples of all of the possible - and impossible – added values with CCA.
4. Stakeholder survey (the entire area)
5. Workshop on assets, solution options and added value, involving: Stakeholders and experts, assets, interplay and paradoxes, and a catalog for added value in collaboration with HbK and HK (C13).
6. C15.1 will finish with planning of climate proofing in one or several test areas: preparation of local zoning plans, development of at least one project, and at least one project is ready for implementation.

Phase 1

Where: Hedensted town

When:

Phase 1: Activity 1, 2, 3, and 4.

Phase 2 :

Activity 5 and 6



Figure 29: The marshland in Hedensted is a popular outdoor leisure area for the town's citizens and has a lot of biodiversity and functions already today as a basin for storing surface water from the town.



Figure 130: Gudenåen and pool areas support the basis for the tourist industry at Tørring.



Figure 31: Uldum Kær – a popular outdoor leisure area by Tørring – and an EU protected area for birds.

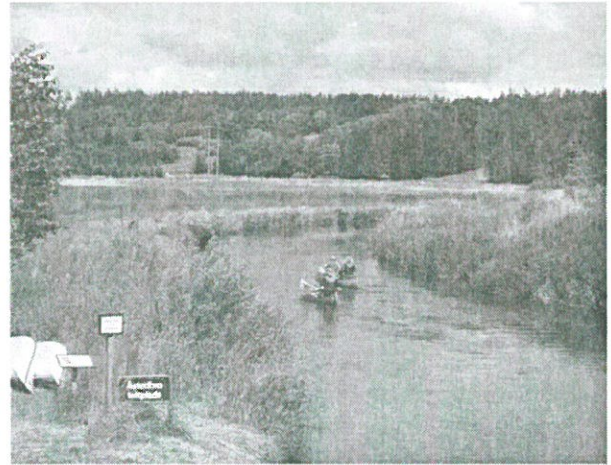


Figure 32: Blue and green tourism is important in the Tørring area.



Figure 33: Water provides added value in Uldum Kær.



Figure 34: Hedensted has good experience in engaging citizens in local solutions. Can we engage the citizens in climate change adaptation?

C15.2 CCA in the hinterland and in regard to agriculture

What

There is already some knowledge about which floodings to expect, when the watercourses have extra large volumes of water, and recent rainfall events around the transition from 2015/2016 show a high degree of concordance between HEDKOM's calculation of flooding from the watercourse and the Blue Spot map with the actual flooding – also on elevated land a long distance away from the watercourses. Despite this, our knowledge about the correlation between the watercourses and flooding caused by precipitation is limited. The same applies to what happens underground, between the cultivated soil and the watercourse, when the soil is saturated. Together these factors can have a crucial impact on the reliability of cultivation for farming activities on elevated land in



the future. We need a more nuanced approach to water drainage, so that the production potential is developed, and the cities and towns do not end up functioning as delaying basins when the watercourses carry high flows. The C15.2 will build on a survey of the area around Gesager Å system and knowledge generated from C15.1 and C13 Phase 1 and knowledge about:

- What happens between the cultivated soil and the watercourses;
- Which initiatives can best help optimize the cultivation reliability of elevated cultivated land in relation to changed precipitation patterns;
- What is the optimal land use in the area between the highland and the watercourse - seen in relation to the expected consequences of a changed climate
- What is the optimal design of the watercourse and the drainage system in the transition zone between elevated land and the watercourse?

How can the city's surface water management help to optimize the cultivation reliability of elevated cultivated land in relation to changed precipitation patterns

How:

C15.2 is carried out in collaboration with HbK and HK (C13), local farmers, municipal watercourse employees and, if required, water institutions that have knowledge of and experience with precipitation, water movement in the soil, drainage systems, hydraulics, watercourses, the use of the area and choice of crops. The project will relate to and use knowledge generated from e.g. Groundwater Model (C6), C15.1 and C13

C15.2 involves assessments in relation to the following levels: cultivated land, below cultivated land, in the transition zone between elevated land and watercourse, discharge into the watercourse, in the watercourse. At least one drainage system will be selected, studied and described in relation to:

1. Drainage in the catchment area, precipitation, use of the area and crops, exposed areas (based on the blue spot areas), the drainage systems' age and type and maintenance, recipient
2. Survey of the farmers' experiences of: Changed precipitation and cultivation conditions, the drainage systems' function, the drainage systems' maintenance
3. Workshop modeling scenarios: How can instruments in the city and in the open country together contribute to optimize the cultivation reliability of elevated cultivated land; e.g. change of crop, optimization of the drainage system, change of type of installation in the transition zone between the drainage catchment and recipient, change discharge to recipient, change water discharge's look and capacity
4. Assessment and recommendation: recommendations for process, instruments and cooperation on combined urban / open country solutions to common climate challenges
5. Preparation of a leaflet for submission to local stakeholders
6. It is expected that C15.2 will finish with planning and changed water conditions in one or more test areas.

Where: Gesager Å river system

When:

Phase 1: Activity 1

Phase 2: Activity 1, 2, 3 and 4

Phase 3: Activity 5 and 6

C15.3 Local organizing of CCA in Tørring town

What:

When CCA is established, it is often in a town or an area with many local stakeholders and the project will therefore, taking Tørring town as its point of departure, focus on how work can be done with local organising and local goals for CCA. The local formulation of goals will be able to provide a different kind of focus on added value and innovation as a result of the in-depth knowledge of the area. The knowledge and the recommendations about the reliability of cultivation and water systems (results from C15.1 and C15.2 as well as results from C12), will be used to look at the water catchment area around Tørring. At the same time, the catalog for added value from Hedensted town, will be included as inspiration to work locally with added value. River Gudenaa is Denmark's longest watercourse. The source of the river begins west of Tørring, and together with the extensive pool areas east of Tørring cf. Figures 29 and 30, it makes it a central area for green tourism in the municipality. Several citizen groups participate already today in voluntary management of the areas.

The project will through these two new approaches, in conjunction with the already existing knowledge, designate one or two smaller areas where in collaboration with local stakeholders, work with local goals will be carried out, where local stakeholders have influence and responsibility for helping to determine local goals. At the same time the project will lay down different options for solving climate proofing as a group. The project will particularly focus on the application and assess the total sustainability of the added value catalog for C15.2, and the organisational model that is chosen in C15.3.

How

Based on existing knowledge and results from C12, C15.1 and C15.2, C15.3 assesses which areas are attractive to work with. An organizational proposal will be prepared and together with the local areas, the following will be assessed:

1. CCA challenges,
2. local need for CCA
3. demarcation of climate proofing areas
4. local goals in relation to climate proofing (Assets, added values, development, and responsibility and influence),
5. local organizing.
6. It is expected that C15.3 will finish with planning of climate proofing in one or several test areas in connection with the Development Council's initiatives. The project will be executed in collaboration with local stakeholders, knowledge institutions and companies.
7. A final review will be carried out, looking at how C15.1, C15.2 and C15.3 have contributed to the overall goal of proofing the basis for living by adapting development to the expected climate changes, focusing on growth, more value, sustainability and innovation



Where: Tørring town and the hinterland

When: Phase 2: Activity 1, 2, 3, and 4

Phase 3: Activity 5, 6 and 7

Reasons why this action is necessary:

Our knowledge about the correlation between the water courses and flooding caused by precipitation is limited. The same applies to what happens under the ground, between the cultivated soil and the watercourse, when the soil is saturated. Together these factors can have a crucial impact on the reliability of cultivation for farming activities on elevated land in the future. We need a more nuanced approach to water drainage, so that the production potential is developed, and the cities and towns do not end up functioning as delaying basins when the watercourses carry high flows. Figure 35 and Figure 36 illustrates recent challenges related to flooding in agricultural and residential areas, respectively.

That which delivers CCA is not necessarily the same as those who benefit from climate change adaptation. It is necessary to have a tool that can value more value to enable the prioritisation of efforts in relation to achieving sustainable CCA. At the same time, concrete and useful knowledge of how the water as a consequence of climate changes impacts our fields, drainage and drainage discharge, will mean more options for action for the individual and for the community. This is in conjunction with that there are many local stakeholders within CCA, which provides the opportunity to work with other forms of organisation that can promote added value and innovation.



Figure 35: Flooded fields with winter crops in the winter of 2015/2016.



Figure 36: Even newer residential areas have "their feet in the water" in Hedensted.

Constraints and assumptions:

As a risk parameter in relation to ensuring the project's progress and results, look at:

- Lack of local participation in the towns of Hedensted and Tørring, respectively.

- Lack of understanding of and acceptance of that it is not always sufficient to carry out CCA where the problem is, and that changed precipitation can affect people and the business community in different ways.
- To gain ideas for creating added value in Hedensted town.

Through expert consultation, we will ensure that we create a good framework for local participation in the towns of Hedensted and Tørring. Our work will be broad in relation to new thinking (added value). Together with experts from the C2C CC advisory committee, we will designate the relevant areas for including citizens with the subsequent concrete reason for the designation, so that the local stakeholders are clear about the climate change issue in their entire local area.

Expected results:

C15.1: Through semi-economic models and a site-based and concrete approach as a basis for prioritising focus areas, efforts, and means an added value catalog is developed to prioritise CCA solutions in Hedensted town. The prioritization involves results based on risk analysis from an asset perspective. The results from the stakeholder survey contributes aspects of added value. At least one project is ready for execution by the end of the action.

C15.2: This sub-action provides knowledge on CCA, watercourses and cultivated soils and results in definitions of which initiatives are most suitable for optimizing cultivation under new climate conditions, involving e.g. the design of a watercourse in regard to agricultural drainage systems. The survey provides qualitative knowledge on the experienced impacts of climate change on agriculture. The scenario analysis results in options of crops, drainage, discharge, catchment, recipient, flow capacity under different climate scenarios. At least one project is ready for execution by the end of the action.

C15.3: The results of 15.1. and 15.2 is applied in this sub-action and provides recommendations about the reliability of cultivation and water systems for Tørring town and the hinterland. The added value catalog is also applied in involvement of several citizen groups. The result is definition of local goals and options for solving climate challenges as a group. This process results in recommendations on how climate proofing and goals can be executed through local organizing and specific local development projects . A local climate proofing plan formulated by citizens also linked to local development projects .

Cost estimation:

Expenses for external expert help is based on prior experience with external assistance to local projects. Estimation of person days for HEDKOM is based on present salaries + pension etc. Expenses will cover consultation for all of the points, with supplementary professional experts from HEDKOM organization, to ensure integration with local know-how. Furthermore, C15.2 will imply travel expenses for collaboration with the C13 project. For HEDKOM the total number of person-days per year is based on the basis of the total working hours/days according to national legislation, collective agreements, employment contracts, etc. – budgeted at 214 days per year.

Deliverables:

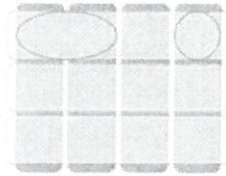


Action	Deliverables
C.15.1	<p>Phase 1: Technical background reports (bullet 1 and 2)</p> <p>A catalogue of examples of added values with CCA (bullet 3) Stakeholder map (bullet 4)</p> <p>Phase 2: Report from workshop on assets, solution options and added value (bullet 5) An added value catalog for Hedensted, including a method description (bullet 5)</p> <p>Phase 3: The stakeholders' (Citizens) local climate proofing plan(s) for Hedensted town (bullet 6)</p>
C.15.2.	<p>Phase 1 Report on drainage systems bullet 1)</p> <p>Phase 2: Report from workshop on combined urban / open country solutions to common climate challenges bullet 4)</p> <p>Phase 3: 1 leaflet with recommendations (bullet 6)</p> <p>Recommendations for process, instruments and cooperation on combined urban / open country solutions to common climate challenges (bullet 5) One project is ready for execution by the end of the action. (bullet 7)</p>
C.15.3.	<p>Phase 2 A process report/description on how climate proofing and the setting of goals has occurred through local organising. An added value catalog for Tørring, including a method description Stakeholder map</p> <p>Phase 3 The stakeholders' (Citizens) local climate proofing plan(s) for Tørring. 1-3projectproposals</p>

Milestones:

Action	Quantifiable milestones	Date by end of
C.15.1	<p>Phase 1:</p> <p>Risk and value mapping done Interest and stakeholder mapping done</p> <p>Phase 2: Added value catalog done Stakeholder integration done Local plans finalized</p> <p>Phase 3: At least one project is prepared At least one project is ready for execution</p>	<p>31/12/2018 31/12/2018</p> <p>31/12/2019 31/12/2019 31/12/2020</p> <p>31/12/2021 31/12/2022</p>
C.15.2.	<p>Phase 2 workshop on combined urban / open country solutions to common climate challenges bullet 4)</p> <p>Phase 3: Report for one area on elevated land done Leaflet about elevated land done</p>	<p>31/07/2020</p> <p>31/07/2021 31/07/2022</p>
C.15.3.	Phase 2 beyond:	

	Risk and value mapping done	31/12/2020
	Stakeholder mapping done	31/12/2020
	More value catalog done	31/12/2020
	Phase 3:	
	Local organization finalised	31/12/2021
	Local plans finalised	31/12/2021
	1–3 project proposals drafted	31/12/2021
	At least one project is ready for execution	31/12/2021
	Review of the project finalised	31/12/2022



C16: Randers Climate Ribbon

CCA as a Driver for urban Innovation

Randers City Council has a vision to connect the city to the water by 2021. Historically an industrial city with a busy port, the city now faces its back to the water and the nature. However, soon the industrial area will be abolished, and a possibility for the city to turn to the water has emerged. New CCA measures will be developed and implemented while fully respecting the unique nature of the Randers Fjord and the River Gudenå, bringing biodiversity closer to the city and generating nature based recreational activities close to the city center. The project defines the contents of the Climate Ribbon and the subsequent launch of an international competition for innovative nature-based solutions. The project involves investors, citizens, politicians and other stakeholders. This action is primarily linked to governance within all aspects of the hydrological cycle apart from groundwater.

Main responsible beneficiary: Randers Municipality

Budget: 678.111€

Number of days estimated spent on action in phase 1: 1206 days

Number of days estimated spent on action in phase 2: 425 days

Beneficiary responsible for implementation: Randers Municipality (RK)

Role of RK

- Is the project leader
- Works with the following secondary stakeholders: Randers Spildevand (Randers Wastewater), Randers Havn (Randers Port), landowners within the Climate Ribbon as well as with citizens, investors and others
- Reports and cooperates with C2C CC PM, and other C2C CC demo projects

Relation to CCA plans

- Randers Municipality CCA Plan: pp 11-13 + appendix pp. 35-37
- Randers risk management plan: pp 3; 13-23; 28-31; 33-38; 52-55; 58 + appendix s. 68-71

Relation to cross-cutting capacity building actions (C1-C7)

Action C16 Randers Climate Ribbon will gain from actions under C1 relating to desk analysis and identification of knowledge gaps and reviews of in the risk maps and planned actions. Experience will be exchanged between demonstration projects C8, C10, C11, C14 and C18 dealing with the coastal cities of Horsens, Grenaa and Juelsminde. A common understanding between stakeholders of sustainable solutions (economically, environmentally, socially and long term) with a focus on land use, cost-effective measures, planning, implementation, maintenance and operation

will be shared and developed across actions C8, C9, C11, C10, C14, C17, C18 and facilitated by CDR. Under C1 a workshop will be held to assess synergies and possibilities of integrated solutions for the fjords at the East Coast. Under action C2 knowledge on CCA and rivers developed under different actions will be shared. Modelling, interpretations, analysis and data sampling are similar in the different catchments and C16 may benefit from this knowledge sharing in relation to the Gudenå catchment area. Scientific aspects currently the highly debated within EU, e.g. on the synergies and trade-offs between CCA and water ecology, the need for warning systems related to flooding of rivers and local contingency planning, and the synergies between farming and wetland restoration will also be shared and discussed for the benefit of action C16. Under Action C4 Rainwater, C16 will gain from the identification and experience of different setup models and testing of SUDS within CDR. Under action C5 specific training courses, workshops and masterclasses, with point of departure in the challenges experienced by the partners will be implemented for the benefit of action C16 and other actions. Action C7 creates a number of innovative fora to unite important stakeholders within water businesses and to show case climate change and water technologies. Secondly, C7 will aim at gathering useful information and best practices from cross-cutting demonstration activities, such as C16.

Linked to complementary projects

As of now, no complementary projects are linked to C16.

The Climate Ribbon is an area between the city and the River Gudenå/the Randers Fjord, and is a significant part of the city's overall urban development project "The City to the Water". The area is appointed as a risk area R1 in the municipal CCA Plan. The CCA plan refers to the Flood Risk Management Plan regarding implementation of initiatives, and within the latter, the project "City of Water" is a major part of the plan containing several purposes and actions.

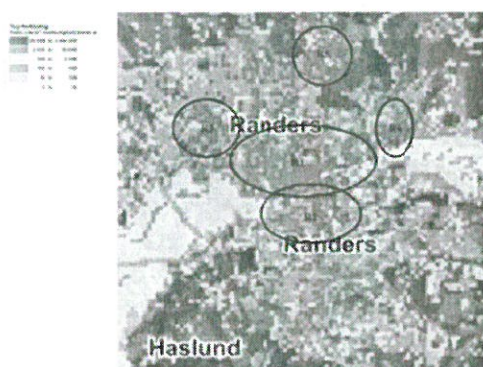


Figure 37. With 62,000 inhabitants (the 6th largest city in DK), Randers is situated at the river mouth of the northern part of the River Gudenå at the estuary of Randers Fjord, between the hillsides of the valley of the River Gudenå to the north and south.

Randers City Council has a vision to connect the city to the water by 2021. Historically an industrial city with a busy port, the city now faces its back to the water and the nature. However, soon all port functions shall be totally relocated to another area along the fjord, the industrial area will be abolished, and a possibility for the city to turn to the water has emerged. Thus, convening the city, the nature, and the water constitutes a major potential for future urban development. New CCA measures should be developed and implemented while at the same time fully respecting the unique nature of the Randers Fjord and the River Gudenå, bringing biodiversity closer to the city and generate nature based recreational activities close to the city center.



'The City to the Water' covers 92 hectares along the River Gudenå and the Randers fjord. The previous industrial and port area must be climate-proofed for urban development without losing its direct, attractive location at the center of nature with easy access to the water. In this process, RK is seeking means to find new, innovative CCA solutions and mobilise investments (the C16 action) protecting the city against flooding by storm surge, while keeping direct and close contact with unique nature and future access to water.

Traditional CCA based on embankments, dams and dikes saves the city from water damage, but also creates new barriers between the city and the water, resulting in a poorer experience of nature and greater distance between the city and the water. New buildings on high plinths create closed facades and dreary spaces that are not pleasant to pass by.

An important feature of the urban development project is the creation of a new large coherent 'Climate Ribbon' connecting the city with the countryside to the east and west and at the same time connecting it to the water. The Climate Ribbon is a green corridor of 8.8 km, winding between the city and the water. Here, docks and embankments, urban nature, infrastructure, buildings, urban spaces, and city life integrate into one large CCA project.

Furthermore, the relocating of the port operations, and reducing of the traffic on Randers Bridge, two types of water could easily merge with a positive impact on biodiversity in this area. The meeting between the salty water of the Randers Fjord and the fresh water of the River Gudenå an improved water environment create the basis for a healthy and stable ecosystem with the potential of more animals and plants as well as new species of fish, birds and insects.

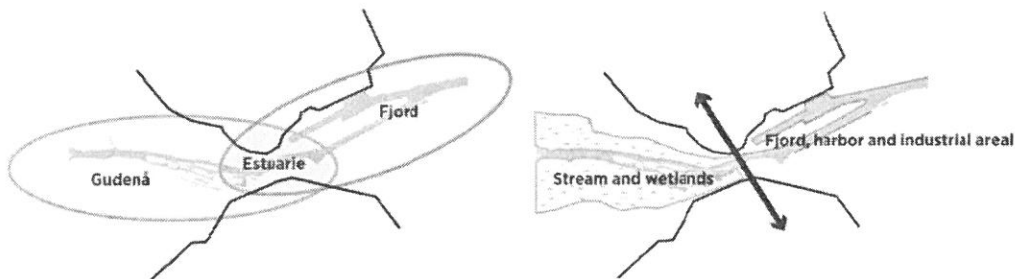


Figure 38: the merger of the two types of water – the fresh water of the River Gudenå and the salty water of Randers Fjord

The ultimate goal is to avoid new barriers between the city and the water, and instead include water as a positive resource and an active part of the solution to the city's challenges. However, solutions are not evident, so the purpose of the project is to gather knowledge and innovative CCA answers, disseminate and consolidate this knowledge, and create new experiences and eventually generate investments and continued momentum in the realization of the project.

Phase 1 deals with collecting relevant data on the contents of the Climate Ribbon and the subsequent launch of an international competition for innovative nature-based solutions.

C16.1 *Inspiration from EU projects, international projects, as well as C2C CC partners*

What

With the help of external expertise, gained from other sub-projects, the complexity of the CCA should be completely illuminated. In order to mark out a particular zone for future works, prior analyses and studies of the Climate Ribbon should assess the real content and identify the Climate Ribbon area, soil conditions, establishment of sluice in the basin, controllable water mirror in the northern basin, nature content and terrain. These assessments feed into the development of a program for an international competition (C.16.2) on the development of innovative solutions to CCA in the context of urban development, maintaining access and contact with the nature and the water as the main parameter.

How:

1. Thematic meetings with stakeholders, experts, institutions, universities, water companies, etc., to involve best practice from the European projects,
2. study tours,
3. Create new study environments for research, the involvement of college students.

Create a professional workshop with the aim to illuminate risk and barriers as well as potentials for synergies related to the complexities of implementing and financing actual CCA measures integrated in staged urban development processes in a context of uncertainty.

When:

Phase 1: activities 1 - 3

Phase 2: Activities 2-4

Phase 3: Activities 2-4

Where:

The project area is a zone of about 8.8 km alongside the Gudenå River and Randers Fjord within the Randers City Center area.

C16.2 *Launch of an international Climate Change/landscape/architectural competition*

What

This activity deals with a professional international competition (with prequalification of teams) that in the best possible way can bring forth innovative CCA solutions highlighting the greatest possible contact between the city and the water. A major theme in the competition and for the subsequent project is the manner in which the energy of the water can be used as a defense against water by the storm surge as well as in other innovative nature based CCA solutions. The expected results must be holistic and include several professional disciplines. This content can be seen as a kind of 'Toolbox' of CCA solutions depending on the development of the city and the urban spaces, buildings as well as the establishment of the natural areas. Possible solutions should to the greatest extent assess the potential for gain and/or recovery of biodiversity in the area, as well as creation of growth in business development, (nature-based) tourism, and employment.

The competition should attract professionals within climate change, innovative people across disciplines from landscape architects to hydrologist, biologist and engineers. Solutions should be



found in the interaction between disciplines, and adapted to the specific socio-cultural-natural surroundings at the "Climate Ribbon" with a focus on CCA, innovation and applicability. It is important to attract international teams, as these may assure that the best available practices and knowledge will be at hand. We are looking for urban solutions which do not create physical barriers between the city and the water, but integrated solutions where city and water may go hand in hand with CCA, urban development, recreational activities and urban life. We want holistic solutions, which may be a future inspiration for urban development cum climate change adaptation across Europe.

A demand for the competing teams will be digital presentations presenting present risk scenarios through videos, holograms or digital 3D modelling. Solutions will be shown in the workroom /Showroom (C16.3), which will be publically accesable in the city of Randers. The results of the international competition will be used for public dissemination of ideas for citizens and the city council.

How:

1. An international competition on the Climate Ribbon underlining the holistic approach, resulting in innovative and visionary CCA solutions as exemplary projects for other port and coastal cities of the EU
2. The competition takes place in 2018 and the best CCA solution will be selected by a jury of professional judges, local politicians etc.
3. Dissemination of results: communication and awareness raising, where investors, citizens, politicians and other stakeholders get information on the solution and CCA effects on city-life in general.
4. Establishment of project website at byentilvandet.randers.dk to be used for dissemination of results aimed at local citizens as well as a broader audience.

When:

Phase 1: Activities 1-3

Phase 2: Activity 3-4

Phase 3: Activity 3

Where: As above

C16.3 *Establishing of a showroom and workroom*

What:

C16.3 focuses on communicating and branding the Climate Ribbon's vision for innovative solutions. A showroom/workroom in the city are established and maintained conveying the competition results and the further development of the Climate Ribbon and its urban context. The showroom will consist of

- Visualizations of the ideas
- Models of the possible solutions
- A digital communication in the form of a movie showing one team's suggestions

- and a webbased application allowing citizens to participate in urban development and development of integrated CCA solutions and show visually how this might look.

The workroom will be named Havnegadeboksen (directly translates to “The harbor street box”) and will be a workshop-like area in an altered container structure, in which different models and pictures can be displayed. The mobile container structure allows the workroom to be established directly in the project area close to the city center and be moved later on should this be relevant.

The box will be open to the public at regular intervals. Moreover, special events will be held when there are important news on the project. Moreover, schools, learning institutions, universities and museums will be invited to the box to participate in the development of ideas for the Climate Ribbon.

The objective is to show what a storm surge means for the city as it looks today without CCA, but also what the city *wins* by making the right solutions with a focus on protection against storm surge and strengthening of the relation with nature. The goal is to tell about the Climate Ribbon's solutions locally, nationally and internationally.

Schools and universities are offered information and study possibilities in order to ensure sustainability. Specifically, a constructive collaboration has been established with the University of Aalborg, which will further be developed with the box as one of many objects of research.

How:

1. Establishment of a showroom/workroom for communication of solutions, methods and experiences
2. Maintenance of the showroom with at least one yearly update on the content
3. At least two annual events in the box aimed at different types of citizens engagement plus informal opening hours depending on demand and news activity.
4. Interaction with local schools, college students and university students through thematic courses, internships or similar.

Where: Havnegadeboksen, Kornkajen 4, 8900 Randers

When:

Phase 1: 1-4

Phase 2: 2-4

Phase 3: 2-4

C.16.4 Development of financial plans and plans for the implementation of the climate ribbon in the city of Randers

C16.4 focuses on developing the Climate Ribbon's content together with citizens, investors and property owners as well as encouraging the establishment and realization of CCA solutions. Many stakeholders – the municipality, future constructors and investors, existing site owners/property



owners, etc. – are involved in the realization of the project, facing both gains and challenges, and all of them must grasp the basic approach.

The first step is to further develop and specify the ideas from the toolbox (16.1), thus ensuring that the CCA measures are fully integrated into the planned urban development and all potentials for added value are harvested. Therefore, the principle solutions developed in C16.1 will be used directly in the development of a masterplan for the urban development project “The City to the Water”. The masterplan will thus not only set the course for the next 20 years of urban development – but also describe the CCA measures to be implemented.

An overall and long-term strategy for the CCA of Randers City and Randers Fjord will be conducted, combining the initial results of C11 and C12 as well as C16. This allows us to decide the optimal protection levels in Randers City short and long term. In this strategy, a particular focus is put on how to meet the need for flexibility in relation to the uncertainties in CC until 2100 and beyond.

An initial budget for the CCA measures in the Climate Ribbon is produced, in a light and full version showing the possibilities of upscaling and downscaling ambitions depending on funding options. For each version, a brief analysis of the benefits for urban development, nature, biodiversity etc. will be carried out.

Thereafter, an investigation of different strategies for the funding of CCA measures will be undertaken. Specifically, an initial financial model will be developed showing how the budget is expected to be divided amongst potential contributors. Moreover, the legal requirements and opportunities for co-financing CCA solutions integrated into an urban renewal project will be thoroughly investigated.

How:

1. A description of future CCA measures in the Climate Ribbon is developed as part of The City to the Water – Masterplan (udviklingsplan for Byen til Vandet).
2. An thorough analysis of the optimal protection levels with particular focus on flexibility in regard to the uncertainties in CC until 2100 and beyond.
3. An analysis of different financial models for implementation urban CCA in Randers as well as an initial expected financial model for the Climate Ribbon as part of the urban development project The City to the Water.
4. A budget for realizing the Climate Ribbon in a light- and a full version, as well as an analysis of the added value gained for each version.
5. A strategy for the staged development of the Climate Ribbon, showing which stages may be implemented first and later, as dependent on the urban development project.

Where: the city of Randers

When:

Phase 2: Activities 1-3, 5

Phase 3: Activities 3-5

Reasons why this action is necessary:

Climate changes within the next hundred years can lead to an increase in sea level of up to 1 meter compared to normal times. Randers city's location by the Gudenå River and the Randers Fjord offers challenges and a special obligation to be ready when the water threatens. In other words, local solutions are needed to a global problem. The River Gudenå and the Randers Fjord is designated as one of the 10 areas in Denmark most at risk of flooding by a storm surge. With the prospect of future climate change with rising sea levels, the whole existence of Randers town as well as the city's overall urban development potentials is at stake. Also the unique peri-urban nature by Gudenåen and Randers Fjord will be threatened due to erosion and floods due to rising sea levels.

Constraints and assumptions

As elsewhere, lack of public and private funding necessary for investments in CCA may exist. Furthermore, it may be difficult to visualize the construction of dikes, embankments, walls and other CCA solutions that will cut off the city from the water. To overcome this and in order to ensure the implementation of the Climate Ribbon, the objective is to create a synergy – also in investments – between CCA and the various sub-elements of the urban development projects, especially nature and water, but also with new infrastructure, new buildings, new connection between city and nature and new urban spaces. The objective is to create added value in all new solutions, to retain direct physical and visual access to the water, as well as to secure that CCA plays together with the urban development project, and does not become a new climatic barrier between the city and the water in the form of dikes, embankments, walls and new buildings on high plinths.

Expected results:

If Randers city is flooded, the total damage amounts to about 5-6 billion DKK. A large part is financed by insurance companies, increasingly reducing the possibilities for full coverage of buildings, etc. in areas with a high risk of flooding by storm surge. In the context of urban development, the 'City to the water' project intends to enhance avoidance of costly damage by conditioning the construction of new buildings on the new CCA guidelines - including direct contact with the water and the nature rather than the construction of new houses on elevated pedestals behind walls, dykes and embankments. Therefore, the expected result of the project is that the municipality in cooperation with citizens, stakeholders, investors and property owners can reduce the risk of negative consequences for human health, the environment, cultural heritage and economic activity in case of extreme flooding. A total number of 50,000 visitors are expected to visit the Climate Ribbon showroom.

In phase 2, expected results furthermore include:

- Thorough investigations conducted on at least one sub area prior to a sale to a specific developer
- CCA measures is implemented for at least two sites within the project area for The city to the water.

Cost estimation:



Working on the Climate Ribbon – and linking it to city development – is a huge task, and a lot of personnel cost is allocated to it. Furthermore, expenses for external expert help is expected to amount to 241,452 € based on prior experience with external assistance to local projects and best judgements. Estimation of person days for RK is based on present salaries + pension etc.

A professional international landscape/architectural competition (C16.2) will cost an estimated €187.796. We expected that to attract the best innovative teams from all over Europe, we will need a prize winning sum of €134.128, including prizes for the 1., 2. and 3. runner up in the competition. Additionally we will need funds to prepare the material for a round of prequalification to select 6-10 competitive participants, from where we will find the winners. The residual sum of €53.668 will cover external professional help for writing up the programme description and competition rules, translation of the material for the selection committee, meetings and public presentations of the competition proposals. Subsistence costs are also based on prior experience and can be further subdivided into Hotel costs, Daily allowances/Payment for meals and local transportation categories, as shown below for this action's subsistence costs items:

Travels	<u>Study travel to relevant location in DK</u>	<u>Study travel to relevant location in EU</u>	<u>Travel to project meetings</u>
<i>Partners</i>	RK	RK	RK
<i>Cost categories:</i>			
Hotel cost:	0	578	0
Daily allowances/Payment for meals cost:	100	0	150
Local transportation costs:	163	0	120
Total subsistence cost:	263	578	270

Deliverables:

Action	Deliverables
C16.1	<p><u>Phase 1</u> Report on best practice from other EU projects, similar international and national projects and other knowledge (01/06/2016)</p> <p>Report on the identification of the Climate Ribbon's exact size as well as geographical, biological circumstances (e.g. groundwater layers, soil, contamination etc) (01/10/2017)</p> <p><u>Phase 2</u> Brief evaluation from study trip published</p> <p>Minutes of meetings accessible on MidtRum</p> <p><u>Phase 3</u> Summary of meeting on implementation of CCA measures</p>

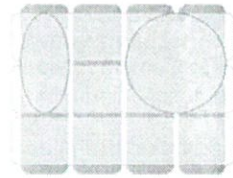
	Minutes of meetings accessible on MidtRum
C16.2	<p><u>Phase 1</u> Publication of program for an international professional competition on the Climate Ribbon (01/01/2018)</p> <p><u>Phase 2</u> Publication of summary report from Climate Ribbon Competition ("Klimabåndskonkurrencen") (01/01 2019)</p> <p>The project website is online and updated with relevant materials available</p> <p>Minutes of meetings accessible on MidtRum</p>
C16.3	<p><u>Phase 2</u> Report on best practice from showroom/workroom og events, seminars as well as methods for development of digital forms of communication (01/12/2019)</p> <p>Evaluation of the collaboration with schools and college students</p> <p>Minutes of meetings accessible on MidtRum</p> <p><u>Phase 3</u> Final summary of best practices in CCA communications with citizens with a particular emphasis on digital methods and young people</p>
C16.4	<p><u>Phase 2</u> <u>A masterplan for The City to the Water with CCA integrated into urban development</u></p> <p><u>Memo on storm surge protection levels with a particular focus on flexibility in regard to the uncertainties in CC until 2100 and beyond.</u></p> <p><u>Brief report on available methods for financing CCA and the expected model for financing the Climate Ribbon and related CCA measures</u></p> <p><u>A long-term strategy for CCA in Randers Fjord and Randers City, integrating C11, C12 and C16, and with a focus on long-term effects and uncertainties.</u></p> <p>Minutes of meetings accessible on MidtRum</p> <p><u>Phase 3</u> <u>An initial budget for the Climate Ribbon full and light versions</u></p> <p>A strategy for staged development on the Climate Ribbon</p> <p>An evaluation of C2CCC C16 The Climate Ribbon with strategy for the continuous development of CCA within the city of Randers</p>

Milestones:

Action	Quantifiable milestones	Date by end of
C16.1	Review of existing knowledge from other EU projects, international and national projects and experiences finalised.	01/06/2017
	Area of the Climate Ribbon identified.	01/10/2017
	Analyzes and studies of geographical and biological conditions within the Climate Ribbon finalized	
	Studies of groundwater layers, former depot grounds, soil, pollution, foundations opportunities finalized	
	Brief evaluation from study trip published	31/12 2020
	Summary of meeting on implementation of CCA measures	31/12 2020



C16.2	Competition programme for an international professional competition for the Climate Ribbon's future content, design and realization opportunities publicized. Prequalification of 4-6 teams done Launching competitive process done Announcement of the winner of the international "Climate Band Competition" Publication of summary report "Climate Band Competition" Website online and updated	01/01/2018 01/03/2018 01/03/2018 01/10/2018 01/01/2019 15/7 2019
C16.3	Opening the show room / workroom 2 annual events and a seminar held Methods for the use of digital communication developed Evaluation of the collaboration with schools and college students Final summary of best practices in CCA communications with citizens with a particular emphasis on digital methods and young people	01/08/2018 01/04/2022 01/08/2018 31/12 2019 31/12 2022
C16.4	<u>A masterplan for The City to the Water with CCA integrated into urban development</u> <u>An overall and long-term strategy for the CCA of Randers City and Randers Fjord</u> <u>Investigation of expected model for financing the Climate Ribbon and related CCA measures</u> Phase 3 <u>An initial budget for the Climate Ribbon full and light versions finalised</u> A strategy for staged development on the Climate Ribbon An evaluation of C2CCC C16 The Climate Ribbon with strategy for the continuous development of CCA within the city of Randers	31/12/2019 31/12 2020 31/12 2020 31/12 2022 31/12 2022 31/12 2022



C17: Thyborøn City and Harbour

As well as the Harboøre Tange

The town of Thyborøn is among the most climate vulnerable in Denmark and is challenged by climate change from all sides. This is aggravated by the fact that large parts of Thyborøn underground is based on filling material from the past. In some areas of Thyborøn, subsidence of 1 cm per year can be seen. At the same time, Harboøre Tange is massively polluted due to the fact that the factory Cheminova has occupied the area since 1952. Based on prior work, the project partners initiate together with relevant stakeholders the development of a dynamic adaptation model describing groundwater level as a function of seawater level, groundwater level, subsidence and wind conditions. Innovative methods to extend the lifespan of pipelines will feature as an important part of this action. This action primarily links to governance and tools within all aspects of the hydrological cycle apart from rivers.

Main responsible beneficiary: Lemvig Municipality

Budget: 651.545€

Number of days estimated spent on action in phase 1: 404 Days

Beneficiaries responsible for implementation: Lemvig Municipality (LK), Lemvig Vand og Spildevand A/S (LVS), and CDR

Role of LK:

- is project manager
- monitors project progress
- Integrates and cooperates with complementary project
- reports and cooperates with C2C CC PM

Role of CDR

- contributes to the model focusing particularly on polluted areas at Harboøre Tange¹

Role of LVS

- is responsible for cooperation on innovative development of new methods to extend the lifespan of pipelines in areas with land subsidence.

Relation to CCA plans

Lemvig Municipality CCA plan p 26.

¹

http://ec.europa.eu/environment/life/project/Projects/index.cfm?fuseaction=search.dspPage&n_proj_id=3701



Relation to cross-cutting capacity building actions (C1-C7)

Activity C17 Thyborøn City and Harbour will gain from actions under C1 relating to desk analysis and identification of knowledge gaps and reviews of in the risk maps and planned actions. Experience will be exchanged between demonstration projects C8, C11, C14 and C18 dealing with the coastal cities of Horsens, Randers and Juelsminde. A common understanding between stakeholders of sustainable solutions (economically, environmentally, socially and long term) with a focus on land use, cost-effective measures, planning, implementation, maintenance and operation will be shared and developed across actions C8, C9, C10, C11, C14, C18 and facilitated by CDR. Under C1 a workshop will be held to assess synergies and possibilities of integrated solutions for the fjords at the East Coast from which the western city of Thyborøn and its harbor may also benefit.

Under action C3, in selected areas a detailed local model is set up focusing on groundwater, surface and/or seawater. Models are based on the present data and collections of new data sets e.g geophysical data and C17 will benefit from this model. Under action C3, in selected areas a detailed local model is set up focusing on groundwater, surface and/or seawater. Models are based on the present data and collections of new data sets e.g geophysical data and C17 will benefit from this model.

Under Action C4 Rainwater, C17 will gain from the identification and experience of different setup models and testing of SUDS within CDR.

Under action C5 specific training courses, workshops and masterclasses, with point of departure in the challenges experienced by the partners will be implemented for the benefit of action C16 and other actions. Under action C6, the groundwater-surface water model and screening tool is developed and tested, and known warning systems in DK and in other countries are explored, and simple warning systems with flood prediction are tested and demonstrated, all activities which may benefit C17 directly.

Linked to complementary projects

C17 is linked to a complementary project by LVS. In the coming years, LVS is going to invest in maintenance and innovation of sewer systems and other measures to make LK infrastructure to drainage more sustainable. The eventual investment strategy of the renewal of the sewer system is highly linked to the C17 action. Furthermore, the analyses and models of the action will affect the choices of future investments in coastal areas. 2.9 mio € are allocated to this project.

Description (What, how, where, when)

Heavy or prolonged rain events are becoming an increasingly problem in Thyborøn. The top soil layer is saturated, and the water can neither infiltrate nor drain off. The result is water on roads that can only slowly be drained. There is an increasing need to climate adapt Thyborøn, which will require large investments. These investments must be multifunctional, providing added value to citizens and others who must finance climate solutions.

C.17.1 Providing sound data of the project area and building a dynamic model

What:

Based on previous work by among others Lemvig Municipality, the Danish Coastal Authority, Geodatastyrelsen, the Harbour of Thyborøn, CDR, the need for further data will be assessed. Many factors influence future climate challenges in Thyborøn: How much and how rapidly is groundwater rising? Where, how much and how quickly is the subsoil subsiding in Thyborøn? A solid database to provide a qualified estimate of future investments is required. During Phase 1, a thorough mapping will take place supplemented with a study and monitoring program to construct a dynamic CCA model that adapts to the reality that we measure.

*How***Phase 1**

1. Building on existing work, a more detailed mapping of the groundwater level and subsidence in Thyborøn takes place. Thyborøn City should be divided into zones having different degrees of CCA needs. Low-lying areas where the groundwater is high and subsidence is prominent need urgent reaction.
2. Establishing a more detailed monitoring program on groundwater levels and subsidence in Thyborøn. In cooperation with the Agency for Data Supply and Efficiency (SDFE), a plan for the monitoring of subsidence in Thyborøn will be developed. Project partners are already engaged in a Horizon 2020 application from SDFE as end-users (cf. complementary project), in which the possibility of using satellite-based measurements of land is examined. In addition, an even more comprehensive monitoring program of groundwater levels in Thyborøn is to be established. Project partners' skills will here be supplemented by external advisors.
3. Around the polluted areas, existing data collated and assessed what new data is needed.
4. The project partners initiate together with relevant stakeholders the development of a dynamic adaptation model describing groundwater level as a function of seawater level, groundwater level, subsidence and weather conditions. This includes: analysis and the modeling of the interaction between rainwater, groundwater and seawater on the basis of a simplified hydrogeological model. Another model will form the basis for an assessment of the impact from the contaminated areas facing the vulnerable natural areas at Harboøre Tange.

Phase 2

5. The subject for the C18 ("Citizen-driven climate adaptation in Juelsminde") is the modeling of rising groundwater after high tide. We expect that the two projects can benefit greatly from each other as rising groundwater after high tide is a key challenge in Thyborøn.
6. Weather conditions and seawater levels are already monitored today, and data are publicly available at national level. It will be studied whether there is a need for a more detailed local monitoring.
7. The dynamic adaptation model must be a user-friendly tool for both professionals and lay people, providing an overview of climate change impact on a local scale in the next 5, 10 and 50 years.

Where: the project area around Harboøre Tange and Thyborøn



When:

Phase 1: activities 1-4

Phase 2: activities 5-7

C.17.2 Dialogue with citizens and other stakeholders

It is crucial to achieve local support and understanding of the work on CCA and thus secure the future of Thyborøn City and Harboøre Tange. So far, the Municipality of Lemvig and Lemvig Water and Wastewater has primarily informed the public about the challenge through press releases in local newspapers and local TV. The aim has been to describe the climate challenge on the basis of valid data, before involving citizens actively in finding solutions. However, the municipality has already had many inquiries from citizens not being able to infiltrate surface water, and that surface water covers roads and large areas because of cloudbursts and longer-lasting rainfall. Therefore, contact with the citizens is highly prioritized in this project – through more public meetings, workshops, cooperation with companies and other stakeholders. There is also a need for a close dialogue between relevant authorities (the municipality, the CDR, the Danish Nature Agency, the Coastal Authority, Environmental Agency) and companies (such as the chemicals company FMC/Cheminova) in order to ensure broad support for the efforts and effective implementation of solutions.

How:

Phase 1 and 2

1. The project includes a series of public meetings and workshops where citizens and other stakeholders are informed of the progress of the project and in various ways encouraged and motivated to take part in the process of mapping the climate challenge to concrete proposals for solutions.
2. A technical advisory group (partners, the Coastal Authority, Thyborøn Harbour, Danish EPA, etc.) participates. Such a forum for cooperation on handling climate challenges already exists in Thyborøn today.
3. In addition, we will establish an advisory group of key stakeholders - local citizens' associations who contribute to disseminate the project's progress, the Danish Nature Agency in Western Jutland, which has significant of interest in the area around Thyborøn.

Where: the project area around Harboøre Tange and Thyborøn

When:

Phase 1: Activities related to 1

Phase 2: Activities related to 2 and 3

C.17.3. Development of innovative methods to extend the lifespan of pipelines

Subsidence affects the underground supply infrastructure. Conventional pipelines for the transport of surface water and wastewater last much shorter as local subsidence lead to fracture. This is already a challenge for Lemvig Water and Wastewater, being responsible for underground infrastructure for approximately 50 mio. DKK in Thyborøn. Usual life expectancy of 100 years for pipelines is not realistic in Thyborøn. Part of the solution to the climate challenge in Thyborøn may well be pumping water in order to lower the groundwater level in critical areas. This requires pipelines that last for many years despite local subsidence. Knowledge and monitoring of local land subsidence will be used to make sure that only short and critical sections of the underground infrastructure has to be replaced regularly giving a significantly longer average lifespan of pipelines.

How

1. **Phase 2** An innovation work is initiated together with knowledge institutions and private actors in order to develop methods to extend the lifespan of pipelines.
2. Together with specialists different ways to extend the lifespan of pipelines in areas with land subsidence will be investigated.
- 3.

When

Phase 2: Activities related to 1-2

Where: the project area around Harboøre Tange and Thyborøn

C.17.4. Providing the basis for decision-making

Activities C.17.1, 2, and 3 are expected to provide thorough knowledge of climate challenges in Thyborøn, contact with the citizens and businesses, that are landowners in the exposed area. This forms the basis for discussing CCA solutions – organizing stakeholders as well as installations to solve climate challenges. The project also investigates how contamination of Harboøre Tange is expected to be affected by future climate change it forms the basis for designing future preventive measures.

How

1. Based on the survey of the main problem areas in Thyborøn, stakeholders are motivated to organize in order to establish joint solutions at a fair sharing of costs.
2. Architectural competition will be launched for architects and consulting agencies can put forward sketch projects for the drainage of critical areas in Thyborøn. Bids must contain added value in other areas, such as using the pumped water for recreational purposes, water sports or other activity.
3. Solutions to the CCA challenges are sought inside and outside of Denmark (e.g. the Netherlands and Northern Germany)

When

Phase 2: Activities related to 1



Phase 3: Activities related to 2 and 3

Where: the project area around Harboøre Tange and Thyborøn

Reasons why this action is necessary:

The town of Thyborøn is among the most climate vulnerable in Denmark and is challenged by climate change from all sides: from the top, the bottom, and the sides. It is protected by dikes against storm surges from the North Sea and the Limfjorden, but since the water level in the North Sea affects the groundwater level, the latter is seen to be increasing in the area. This is aggravated by the fact that large parts of Thyborøn underground is based on filling material from the past. In some areas of Thyborøn, subsidence of 1 cm per year can be seen.

At the same time, Harboøre Tange experiences massive pollution due to the fact that the factory Cheminova has occupied the area since 1952. The manufacturing sites are heavily contaminated, as is an old chemical dumpsite (called Groyne 42) on the beach front to the North Sea. Toxins have spread in the Nature2000 area, making wastewater pipe-lines leak and caused numerous accidents over the years. The areas on Harboøre Tange is also affected by climate change because of increased rainfall and rising sea levels, which could potentially mobilize and lead to the spread of the contaminants into the groundwater.

Constraints and assumptions

Monitoring groundwater level builds on cooperation with citizens who must accept the drilling activities. The Project group has a strong knowledge of local stakeholders, being in a dialogue with citizens in great many ways. The model contains many variables that must be handled in a manageable, dynamic model. In cooperation with counsellors, the model will be adjusted so that there is a good balance between the need to be accurate and the need to be simple and clear.

Activity C17.2 requires that citizens and other stakeholders will take responsibility and contribute constructively. This challenge will be dealt with through the many contacts between the municipality and local people in Thyborøn in many other contexts. C17.3 assumes an interest from pipeline manufacturers and knowledge institutions. To counter a lack of engagement, the project team has made initial contact with a pipe manufacturer, who has shown great interest in the project. C17.4 assumes that citizens and other stakeholders are ready both to find solutions and financing solutions actively. The project partners have extensive experience with the establishment of drainage associations and dyke unions where landowners contribute extensively. This experience will enable us to benefit greatly from the process.

Expected results:

C17.1: Phase 1: A detailed investigation and/or surveillance program for monitoring groundwater levels, pollution and land subsidence in Thyborøn and Harboøre Tange provides an essential insight in the actual development. Phase 2: A dynamic adaptation model describing the interaction between e.g. rainwater, groundwater and seawater on the basis of a hydrogeological model create concrete data for decision-making. C17.2 creates broad support from the public and from businesses for the project and climate protection of Thyborøn general. C17.3 results in

development of methods to extend the lifespan of pipelines in areas influenced by local land subsidence. C17.4 provides additional funding and financing possibilities for CCA.

Cost estimation:

During Phase 1, expenses for external expert help is expected to amount to 177,651 € based on prior experience with external assistance to local projects. External assistance is used for the dynamic model – but apart from that, partners contribute with personnel for meetings, planning, awareness-raising. Estimation of person days for LK is based on present salaries + pension etc. Subsistence costs are also based on prior experience and can be further subdivided into Hotel costs, Daily allowances/Payment for meals and local transportation categories, as shown below for this action's subsistence costs items:

Travels	<u>Inspirational trip for staff and politicians</u>		
<i>Partners:</i>	CDR	LK	LVS
<i>Cost categories:</i>			
Hotel cost:	300	1.500	1.500
Daily allowances/Payment for meals cost:	200	1.000	1.000
Local transportation costs:	0	0	0
Total subsistence cost:	500	2.500	2.500

Deliverables:

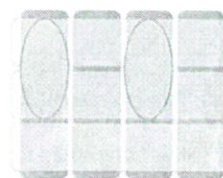
Action	Deliverables
C17.1	<p>Phase 1: A detailed investigation program for monitoring groundwater levels, pollution and land subsidence in Thyborøn and Harboøre Tange. A report on compilation of data on pollution Deadline 31/12 2018</p> <p>Phase 2: A dynamic adaptation model describing the interaction between e.g. rainwater, groundwater and seawater on the basis of a hydrogeological model. Deadline: 31/12 2019</p>
C17.2.	<p>Phase 1: Reporting from citizens meeting 1; deadline 30/6 2018 Reporting from citizens meeting 2; deadline 30/12 2018</p> <p>Phase 3: Reporting from last workshop; deadline 30/11 2022</p>
C17.3	<p>Phase 2: Status report on development; deadline: 31/05 2019</p> <p>Phase 2:</p>



Status report on development; deadline: 31/12 2019
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Milestones:

Action	Quantifiable milestones	Date by end of
C17.1	Kick-off meeting with project group done.	28/02/2017
	Counselor contracted for delivering a detailed program for investigation and surveillance	31/08/2017
	Counselor contracted for delivering a dynamic CCA model	30/06/2018
	Reporting on dynamic CCA model delivered, incl. modeling on contaminated areas at Harboøre Tange	31/10/2019
C17.2.	Phase 1: 1st large citizens meeting done 1st workshop for stakeholders and decision-makers done	31/02/2018 30/06/2018
	Phase 2: 2 nd large citizens meeting done 2nd workshop for stakeholders and decision-makers done 3rd large citizens meeting done	30/06/2019 31/12/2019 31/12/2020
	Phase 3: 3rd workshop for stakeholders and decision-makers done 4th large citizens meeting done	31/02/2022 31/04/2022
C17.3.	Contract with private company and counselor on development of new, flexible pipes done	30/04/2018
	Reporting on development of methods	31/10/2020
C17.4	Counselor contracted for assistance with preparation of material for architectural competition	30/11/2020
	Launching a design competition done	30/04/2021
	A number of conceptual designs developed, that can solve the climate challenges in Thyborøn and Harboøre Tange and contribute with added value	31/12/2021



C18: Citizen-driven CCA in Juelsminde

The sea level is rising and the high tides are expected to increase and become more extreme with higher sealevels and episodes that last longer. High tides in some locations will push the seawater through the soil matrix in the hinterland, which means the groundwater will rise causing a lot of inconvenience for industry and citizens. The project supports and qualifies the climate actions by gaining renewed knowledge about the interaction between saltwater and groundwater and the associated challenges. Citizen participation is a pre-requisite for success. This action is primarily linked to governance and tools with sea & fjords and groundwater.

Main responsible beneficiary: Hedensted Municipality

Budget: 134,042€

Number of days estimated spent on action in phase 1: 89 Days

Number of days estimated spent on action in phase 2: 155 Days

Beneficiary responsible for implementation: Hedensted Municipality (HEDKOM) is the project manager, VIA University College is project partner

Role of HEDKOM:

- is responsible for progress in the project, providing advice and contact to the stakeholders.

Role VIA:

- is responsible for carrying out and planning data collection, and producing hydrological models of the area.

Relation to CCA plans

- The action follows HEDKOM CCA plan, which aims to prevent the consequences of climate changes, where major existing assets are threatened (page 211) and HEDKOM risk assessment plan.

Relation to cross-cutting capacity building actions (C1-C7) and innovative actions (C20-C24)

Activity C18 Citizen-driven CCA in Juelsminde will gain from actions under C1 relating to desk analysis and identification of knowledge gaps and reviews of in the risk maps and planned actions. Experience will be exchanged between demonstration projects C10, C11, C14 and C8 dealing with the coastal cities of Horsens, Randers and Grenaa. A common understanding between



stakeholders of sustainable solutions (economically, environmentally, socially and long term) with a focus on land use, cost-effective measures, planning, implementation, maintenance and operation will be shared and developed across actions C9, C10, C11, C14, C17, C8 and facilitated by CDR. Under C1 a workshop will be held to assess synergies and possibilities of integrated solutions for the fjords at the East Coast. Under action C3, in selected areas a detailed local model is set up focusing on groundwater, surface and/or seawater. Models are based on the present data and collections of new data sets e.g. geophysical data and C18 will benefit from this model. Under action C5 specific training courses, workshops and masterclasses, with point of departure in the challenges experienced by the partners will be implemented for the benefit of Action C18 and other actions.

Linked to Complementary Actions

As of now, there is no complementary action to C18

Description (What, how, where, and when)

The sea level is rising. According to the Danish Meteorological Institute (DMI), the sea level is expected to increase by up to 0.7 m by 2100 cf. Figure 39

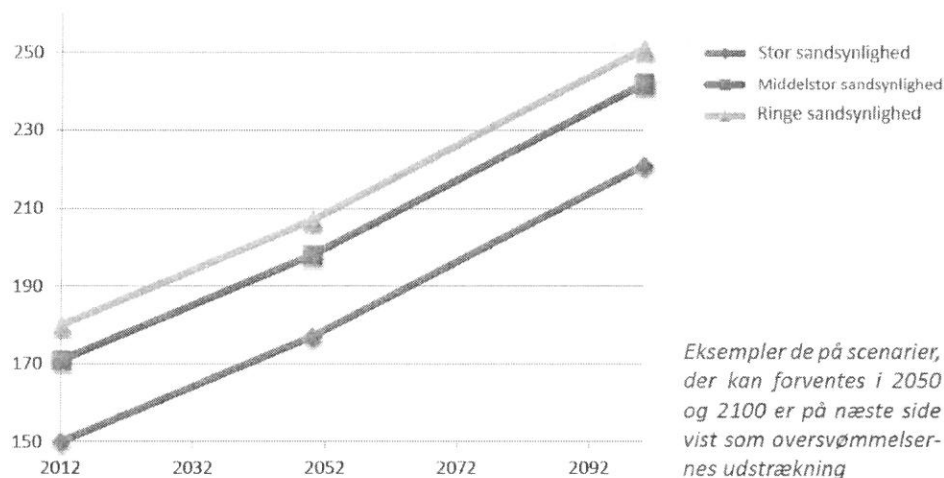


Figure 39: Sea level is expected to rise by up to 0.7 m by 2100 (Source: DMI).

The total number of high tide incidences are also expected to increase and become more extreme with higher sealevels and episodes that last longer. High tides in some locations will push the seawater through the soil matrix in the hinterland, which means the groundwater will rise causing a lot of inconvenience for industry, businesses and citizens. The frequency and impact of these events will vary, for example depending on the geological conditions and the volume of high tide water (scale) and duration. The occurrence of these events can have a significant impact on the future use of the area in the coastal hinterland, the choice of any coastal protection system and for the run-off of surface water into residential areas and in areas where land is cultivated. In urban and holiday home areas, the problem is topical because of the planning of new homes and the replacement of existing homes. The problem is described in the literature, e.g. in Groundwater in a

future climate, December 2011 (co-financed by the EU Interreg IV B program), particularly with regard to infiltration of saltwater into the groundwater and into drinking water.

In HEDKOM's risk assessment plan, three basic challenges for making Juelsminde safe from sea flooding in the future have been identified: at Strandengen, by the harbor, and at the existing dike. The municipality wants citizens and companies to be involved in finding solutions that the town's future will be based on, and which will constitute part of the basis for how the town can develop. At the same time, the action plan states that a dike association will be established during the plan period. This dike association is expected to engage all of the landowners, whose properties currently benefit from the dike's protection, and in addition the landowners, whose properties will be protected by an expansion of the dike in the future. Figure 40-42 illustrates some of the challenges the area faces.

C18 supports and qualifies the climate actions by gaining renewed knowledge about the interaction between saltwater and groundwater and the associated challenges.

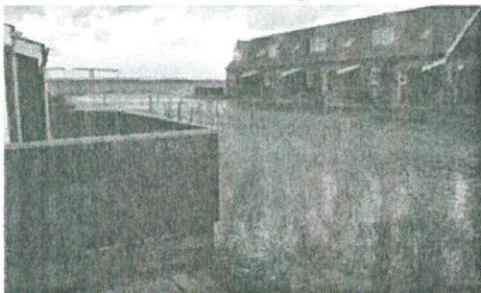


Figure 40: High tide at Strandengen

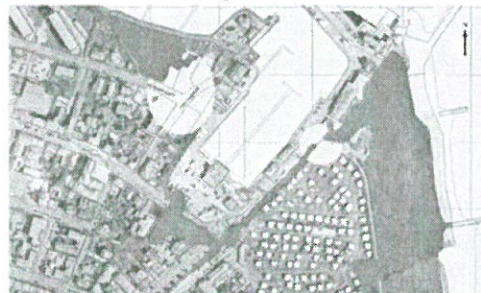


Figure 41: Juelsminde harbour. In the yellow areas, it must be ensured that those areas are protected from the sea penetrating the town, with a medium-large probability already today



Figure 42: Juelsminde was protected by a coastal headland 150 years ago. Today, the coastline is close to homes and holiday homes



C.18.1 *Interaction between saltwater and groundwater*

What:

This action seeks to find a correlation between high tides and subsequent rising groundwater in the upper soil layer, approx. 0-2 meters below the existing terrain identified in relation to the distance from the sea/fjord and different geological soil types. The project will shed light on the problem in the area between Snaptun and Juelsminde (cf. C8). Tools for modelling the local risk will be set up and tested, based on existing models and local measurements. Recommendations for how to utilize the new knowledge will be devised.

How:

It is proposed that the C18.1 is defined and carried out in a collaboration between CDR, the Danish Coastal Authority and other C2C project partners with an interest in the issue, HEDKOM and VIA. C18 involves the following activities:

1. The establishment of data loggers for measuring water levels and salinity at 0-2 meters depth at different distances from the coastline, and up to 800 - 1000 m from the coastline. The data loggers must cover wide geographical conditions e.g. from marine soils to moraine soils. The data logging must be carried out in selected local sites in Juelsminde and between Juelsminde and Glud Håb.
2. The data logging is assessed at a midway evaluation point, for local use in area planning and climate change adaptation.
3. Monitoring is carried out on an on-going basis until the end of 2022.

Where: selected local sites in Juelsminde and between Juelsminde and Glud Håb.

When: January 2017 - December 2022.

Phase 1

Activities related to 1 and 3

Phase 2

Activities related to 2 and 3

Phase 3

Activities related to 3

C18.2 *Organizing stakeholders*

What:

The purpose of C18.2 is to establish a shared local understanding of the challenges from climate changes and the basic efforts in this project. Where results related to the challenges of pressurised water from C18.1 will also be included.

When preparing the risk management plan, representatives of the three sub-areas (Strandengen, at the harbour, and at the existing dike) expressed a strong wish to help to find long-term solutions to the challenges. The three groups of (secondary) stakeholders represent respectively, home owners at a particular risk of flooding, companies around the harbour and a large group of home owners and holiday home owners, who today manage the primary protection of Juelsminde against floods. Challenges and solutions to climate changes are made between the three groups and the municipality's CCA employees.

Juelsminde has a local vision committee, elected by local citizens. The vision committee makes decisions about the development in/of Juelsminde and a working group, which reports to the vision committee, works on a master plan for the town's development. The vision committee and HEDKOM are responsible for the concept 'Juelsminde Strandpark' (beach park), a project to utilize the establishment of the new coastal protection as an opportunity to create an epicenter for the town, harbour and beach.

This action aims to create a citizen-driven development, so that the challenges resulting from climate change, including in particular sea level rises and the solutions for this, are included in the development of Juelsminde.

How:

C18.2 will be carried out in collaboration with the C2C CC Advisory Committee, knowledge institutions and companies that have knowledge and experience in mobilizing and facilitating citizens and companies on interconnected and holistic development, and at the same time, to create broad public support for the solution of the long-term challenges.

C18.2 contain the following elements:

1. Establishing a new dike association
2. Establishment of a shared local understanding of the challenges
3. Evaluation in relation to the three main challenges (Strandengen, at the harbour and at the existing dike).

When:

Phase 1: Activities related to 1 and 2

Phase 2: Activities related to 1, 2 and 3

Where: Town of Juelsminde, Strandengen, the harbour, and the existing dike.

Reasons why this action is necessary:

To acquire the knowledge about how rising sea levels affect an area, climate proofing in an area like Juelsminde is an option. At the same time, there is a need to make climate proofing sustainable and holistic, which is why a well-functioning stakeholder organization is necessary in an area like Juelsminde. At the same time, the organization is tested in connection with the



establishment of the new dike association, which is an important part of the climate proofing of Juelsminde after 2021.

Constraints and assumptions:

C18.1 requires that data collection and monitoring can be carried out in the area. To achieve this, contact with local landowners and stakeholders made early on. C18.2 requires active participation from existing local partnerships in Juelsminde. To achieve this the C2C CC Advisory Committee partners that have knowledge and experience in mobilizing and facilitating citizens and companies will be included.

Expected results:

The data loggers and the ongoing monitoring will result in data and insight in the actual interaction between the sea and the groundwater in Juelsminde and between Juelsminde and Glud Håb. 500-600 hectares of land screened.

The local organising in Juelsminde will result in increased social resilience through establishment of a new dike association and the creation of a shared understanding locally of the challenges and mobilizing local front runners. 5000 citizens involved. The Advisory Committee contributes with best practice knowledge on citizen involvement and recommendations and the methods applied are communicated.

Cost estimation:

During Phase 1, Expenses for external expert help is expected to amount to 21,400 € based on inquiries. Estimation of person days for HEDKOM and VIA is based on present salaries + pension etc. C18 will mean expenses for purchasing and setting up data logging equipment for data acquisition and monitoring. It is expected (18.1) that HEDKOM and VIA will contribute by providing advice, data processing and the setting up of a hydrological model. HEDKOM will contribute 100 hours and VIA 600 hours. For HEDKOM the total number of person-days per year is based on the basis of the total working hours/days according to national legislation, collective agreements, employment contracts, etc. – budgeted at 214 days per year. C18.2 will mean external expert consultation for all of the points with supplementary professional experts from HEDKOM to insure integration with local know-how.

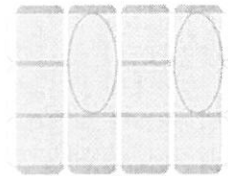
Deliverables:

Action	Deliverables
C.18.1	<p>Phase 1: Technical reports on data collection and data processing</p> <p>Phase 2 Technical reports on data collection and data processing Hydrological model of the risk of rising groundwater (saltwater) after high tides Continued monitoring and verification of hydrological model for C18.1. Midway evaluation.</p> <p>Phase 3: Continued monitoring and verification of hydrological model for C18.1. Recommendations Booklet about rising groundwater in coastal areas Articles for international periodicals, e.g. Journal of Hydrology Conference material from presenting results</p>

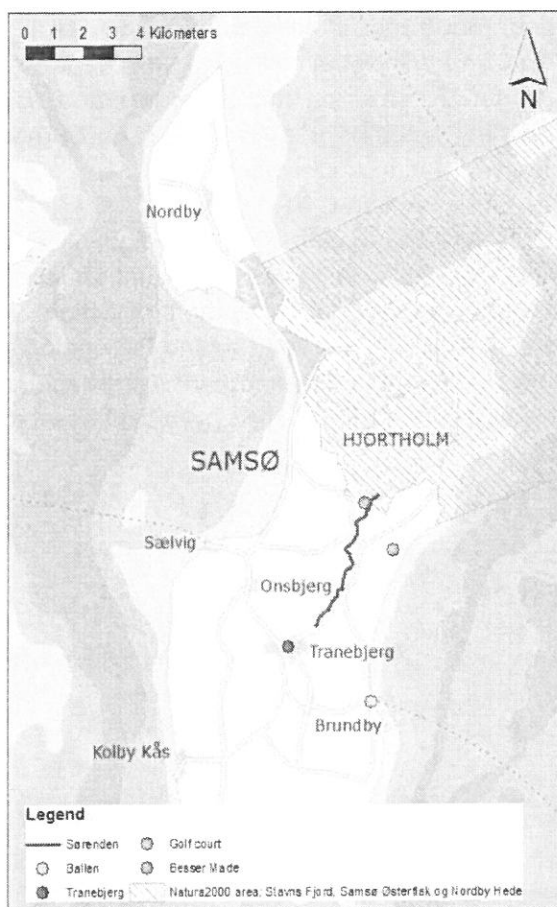
C.18.2.	<p>Phase 1: Process description for the establishment of a new dike association. Dissemination of dike association and cost sharing model.</p> <p>Phase 2: Evaluation of local organisation for climate change adaptation and development in Juelsminde related to the three main challenges</p>
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Milestones:

Action	Quantifiable milestones	Date by end of
C18.1	Data loggers established and data logging started.	31/07/2017
	Continued monitoring and verification of hydrological model for C18.1 done	31/07/2019
	Midway evaluation. First tool for local use is prepared.	31/07/2019
	The project is finished with model/tool for general use.	31/12/2022
C18.2	Dike association created	31/12/2019
	Evaluation done of local organisation for climate change adaptation and development in Juelsminde related to the three main challenges	31/12/2020



C19: Sustainable Urban Drainage Systems (SUDS) as recreational elements to handle coupled events between rainfall and storm surge



The Samsø island wants to implement SUDS solutions with added value for biodiversity and of recreational use for the citizens. The municipality and Samsø Waste Water Utility are in dialogue on alternative locations to accommodate both heavy rains and storm surges. The east coast lies at very low elevation, which results in flooding inland in situations of coupled events. The project will focus on stakeholder and citizen involvement on the design of SUDS to create added value. Conceptual designs and hydraulic modelling will be developed. This action is primarily linked to governance and tools within rivers and rainwater.

Main responsible beneficiary: Samsø Municipality

Budget: 239.911€

Number of days estimated spent on action in phase 1: 23 Days

Beneficiary responsible for implementation: Samsø Municipality (SAK)

Role of SAK

- is project manager
- cooperates with Samsø Waste Water Utility
- coordinates with C2C CC project leader

Relation to CCA plans

- SAK CCA plan is included in SAK spatial plan at pp. 8-28 and mentioned in the plan.

Relation to cross-cutting capacity building actions (C1-C7)

Action C19 Sustainable Urban Drainage Systems will gain from action C2 sharing knowledge on CCA and rivers developed under different actions. Modelling, interpretations, analysis and data sampling are similar in the different catchments and C19 will benefit from this knowledge sharing. Scientific aspects currently the highly debated within EU, e.g. on the synergies and trade-offs between CCA and water ecology, the need for warning systems related to flooding of rivers and local contingency planning, and the synergies between farming and wetland restoration will also be shared and discussed for the benefit of action C19. Under Action C4 Rainwater, C19 will gain from the identification and experience of different setup models and testing of SUDS within CDR.

Under action C5 specific training courses, workshops and masterclasses, with point of departure in the challenges experienced by the partners will be implemented for the benefit of action C19 and other actions. Under action C6, the groundwater-surface water model and screening tool is developed and tested, and known warning systems in DK and in other countries are explored, and simple warning systems with flood prediction are tested and demonstrated, all activities which may benefit C19 directly.

Linked to Complementary Actions

As of now, no complementary projects are linked to C19

Description (What, how, where, and when)

What:

SAK has a long history in engaging and activating local entrepreneurs in energy and climate aspects. By local entrepreneurship and community action SAK has obtained to implement solutions within renewable energy to an extent that it today is not only self-sufficient with renewable energy, it is delivering a surplus (cf. Table 2). For that reason, SAK is famous as the "Energy Island" and attracts corporate tourists from all over the world.

The local Samsø spirit also affects how planning is carried out in other aspects than energy. In regard to CCA, SAK wants to implement SUDS solutions with added value for biodiversity and of recreational use for the citizens. Often several meetings are held with interest groups, where the



first meeting is held locally and the following meetings are held at the Island's Energy Academy or at the City Hall.

In relation with Samsø Waste Water utility is to establish two retention ponds, SAK and Samsø Waste Water Utility are in dialogue on alternative locations of the two ponds around Tranebjerg to accommodate both heavy rains and storm surges. The East coast of SAK lies at very low elevation, which results in flooding inland in situations of coupled events, whereas it is important to retain rain and surface water in SUDS. Furthermore, establishment of new sewers at Tranebjerg, Langemark, Torup and Besser an opportunity arises to change the stream Sørensen from a drainage channel into a real watercourse. Sørensen have originally gone to Stavns Fjord, but to protect Stavns Fjord against pollution by nutrients and sewage, Sørensen's water has been pumped to Kattegat via sea pipes since 1976. The recovery of Sørensen also means that the restoration of Besser Made as a wet meadow area is possible. Such wetland will promote biodiversity with species such as geese, whooper swans and lapwings, which is linked to fresh meadow and marsh areas. If Besser Made subsequently nurtured by grazing, hay or other follow-up care, nutrient discharge to the sea will be reduced. In addition, there will be created even an attractive natural area on the island.

Protection of breeding birds and wildlife will have top priority, but in some places it is possible to meet the recreational needs of the construction of trails and shelters. The restoration of Besser Made is an important part of SAK's efforts in relation to the Natura 2000 area Stavns Fjord.

How:

The action will include the following activities:

Phase 1: Year 2017-18

1. Analyses of alternative locations for the two retention ponds together with Samsø Waste Water Utility: incl. GIS, site analysis and hydraulic modelling using different climate scenarios.
2. Analyses of Tranebjerg, Samsø Golf Course, Besser Made and Ballen: incl. GIS, site analysis and hydraulic modelling using different climate scenarios. Moreover, additional sites are investigated to further retain water upstream

Phase 2:

3. .
4. Stakeholder and citizen involvement on the design of SUDS, recovery of Sørensen, restoration of Besser Made and recreational value. The stakeholder involvement will at least include: Samsø Golf Course, land owners and the Besser Made Association.
6. Based on activity 4 and 5, conceptual designs will be developed.

Where: Samsø Island

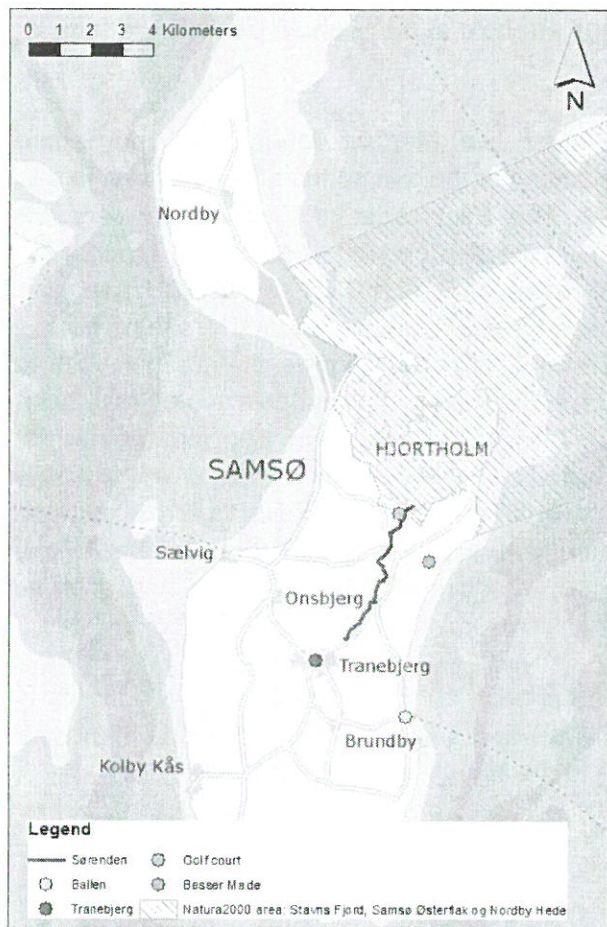


Figure 43: Map of Samsø Island

Phase 1

Activities 1-3

When: January 2017 – December 2018

Phase 2

Activities 4-6

When: January 2019 – December 2020

Reasons why this action is necessary:

Retention of rainwater is necessary in situations where cloudbursts or long term heavy rains cause flooding in urban low laying areas. This situation combined with storm surge provides an even greater demand for rainwater retention upstream to delay surface water from the watercourse till the water level has decreased back to normal. This is especially important on Samsø, where urban areas are located in low elevation, near a watercourse and with short distances to the sea.

Constraints and assumptions:



A general constraint is the fact that resources are short and not prioritized till a disaster has hit. In this case, traditional solutions are often chosen, and the opportunity of an integrated solution that also creates added value for the citizens is missed. The added value is often what makes a project interesting for stakeholders and citizens, and an important parameter for a good involvement process and interesting outcome. The involvement of the local community is essential for the success of the action. The many local projects established through Samsø's Energy Island efforts were only realized because of the engagement of the local community and entrepreneurs.

Expected results:

Hydrologic modelling with different scenarios: zero-alternative, coupled events between heavy rains and storm surge, and climate scenarios provides background knowledge for the demands of the SUDS' design. Engagement of local stakeholders benefit with knowledge on locals' use of the area and aspects that benefit added value for the local community. Furthermore, conceptual designs for: SUDS at Tranebjerg, the area around Samsø Golf Course and Besser Made, rainwater retention and coupled events at Ballen will be made. This results in a truly holistic CCA project combining usage of town and hinternland in an integrated solution, that also make nature restoration possible.

Cost estimation:

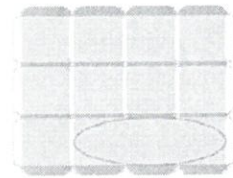
- Personnel costs (Form F1): € 41.139 (-€ 6.000). A consequence of the Analyses of Tranebjerg, Samsø Golf Course, Besser Made and Ballen moved up from phase 2 to phase one is a shift of personnel costs between the phases. In addition, a shift in resources to financial assistance is necessary as the initial cost estimation was insufficient.
- Travel and subsistence costs (Form F2): € 9.050 (+€ 2.347). Budget is shifted to phase 2 due to a large part of the stakeholder involvement is moved to phase 2.
- External assistance costs (form F3): € 49.170 (-€ 7.139). The Analyses of Tranebjerg, Samsø Golf Course, Besser Made and Ballen was a deliverable which required a large part of external assistance and as it was moved from phase 2 to phase 1 it was necessary to move the budget as well.

Deliverables:

Action	Deliverables
C19	<p>Phase 1:</p> <p>Technical background reports on site analyses and hydrologic modelling</p> <p>Report of conceptual design for the area around Samsø Golf Course and Besser Made .</p> <p>Documented stakeholder network methodology</p> <p>Report of conceptual designs for SUDS at Tranebjerg</p> <p>Phase 2:</p> <p>Technical background reports on site analyses and hydrologic modelling</p> <p>Stakeholder involvement material and stakeholder input</p> <p>Report of conceptual design for rainwater retention and coupled events at Ballen</p> <p>Tender documents</p> <p>General for Phase 1 and 2:</p> <p>Project video accessible at the C2C CC portal and at Samsø Municipality's homepage (with LIFE logo).</p> <p>Documented press coverage in minimum 20 articles.</p>

Milestones:

Action	Quantifiable milestones	Date by end of
C19	Phase 1:	
	Preliminary investigation and initial involvement of possible stakeholders done.	31/06/2017
	Technical background report for modelling finalized.	31/06/2017
	Hydraulic modelling incl. zero-alternative, coupled events and climate scenarios done.	31/12/2018
	Conceptual Design for Samsø Golf Course and Besser Made finalized	30/06/2019
		30/06/2019
	Phase 2:	30/06/2020
	Preliminary investigations and initial stakeholder involvement done	31/12/2020
	Technical background report for modelling finalized	31/12/2020
	Hydraulic modelling for Ballen incl. zero-alternative, coupled events and climate scenarios done.	
	Conceptual Design for Ballen finalized.	
	Tender material finalized.	



C20: AquaGlobe

The vision of AquaGlobe is to create a development and knowledge transfer centre, which will form the physical setting for a value-creating network between the business community, universities, Danish administrative regions, municipalities and water companies using tests, demonstrations and a showroom, and which is also a recreational and inspiring area for citizens, institutions and tourists. By focusing on transferring an understanding of the water cycle, climate proofing, the countryside in the area and water as a resource, visitors will gain a better understanding of the climate in the future. This action primarily links to innovation within all parts of the hydrological cycle apart from sea & fjords.

To develop and establish AquaGlobe, several stakeholders are to be involved.

Main responsible beneficiary: Skanderborg Utility A/S

Budget: 275.223€

Number of days estimated spent on action in phase 1: 605 Days

Beneficiary responsible for implementation: Skanderborg Utility a/s (SFV)

Role of SFV:

- is project manager
- cooperates with primary and secondary stakeholders
- AquaGlobe supplements Action C21 Climatorium, which both deals with co-creation, quator helix and awareness rising. AquaGlobe is focused on freshwater, C21 is focused on saltwater. All C2C CC action can use C20 and C21 for presentation of their results

Other stakeholders:

Local plans/Permits/SEA and EIA authority/activity Water School: Skanderborg Municipality
The stakeholders of the action are not fully clarified but work is being carried out to bring the stakeholders under 'what' the project:

Relation to CCA plans

This action relates to innovation and the need for developing new technology within CCA, and awareness raising among citizens mentioned in the CCA plans.

Relation to cross-cutting capacity building actions (C1-C7) and innovative actions (C20-C24)

Activity C20 AquaGlobe will gain from actions under action C2 sharing knowledge on CCA and rivers developed under different actions. Modelling, interpretations, analysis and data sampling are similar in the different catchments and C20 will benefit from this knowledge to improve the national and global knowledge transfer. Scientific aspects currently the highly debated within EU, e.g. on the synergies and trade-offs between CCA and water ecology,

the need for warning systems related to flooding of rivers and local contingency planning, and the synergies between farming and wetland restoration will also be shared and discussed for the benefit of activities under action C20.

Under action C3, in selected areas a detailed local model is set up focusing on groundwater, surface and/or seawater. Models are based on the present data and collections of new data sets e.g. geophysical data and C20 will benefit from the outputs of his model and its implementation under different actions.

Under Action C4 Rainwater, C20 will gain from the identification and experience of different setup models and testing of SUDS within CDR. Action C7 creates a number of innovative fora to unite important stakeholders within water businesses and to show case climate change and water technologies. Secondly, C7 will aim at gathering useful information and best practices from cross-cutting demonstration activities. C20 will benefit directly from these actions. Last but not least, AquaGlobe will benefit from a close collaboration with Action C21 Climatorium, which both deals with co-creation, quatro-helix and awareness rising

Linked to Complementary Actions

Supplementary funding for AquaGlobe will be sought by SFV. Supplementary funding may include elements for the activities of Hot-Spots and the Water School to add local value.

The facility itself will be financed by SFV.

Description (What, how, where, and when)

What:

The vision of AquaGlobe is:

“We want to create a development and knowledge transfer centre, which will form the physical setting for a value-creating network between the business community, universities, Danish administrative regions, municipalities and water companies using tests, demonstrations and a showroom, and which is also a recreational and inspiring area for citizens, institutions and tourists.”

SFV is to expand their facilities and in that regard they wish to add societal value by create an innovation hub and awareness rising centre. The aim of AQUAGlobe is to create an inspiring and motivating environment and physical settings for transferring knowledge and developing solutions where the main focus is on water and climate.

AquaGlobe has the following success criteria:

- AQUAGlobe will be a living location
- AQUAGlobe will create more value for the wider society
- AQUAGlobe will be attractive to the business community, so much so that businesses will use and/or contribute to the development of the facilities.
- AQUAGlobe will be attractive to people of all ages (by transferring knowledge through experiences and experiments that are executed in a motivating and inspiring way).
- AQUAGlobe and the surrounding areas will attractive to visitors (outdoor areas and a recreational area will be self-contained features).

AQUAGlobe will be responsible for communicating with ordinary citizens of all ages, tourists, families, kindergartens, schools, upper secondary schools and associations.



Through knowledge and inspiration, the new centre and area will motivate visitors and citizens from the municipality, CDR and the whole of Denmark, by providing a greater understanding of their own water consumption and how they can deal with the challenges that Denmark faces with regard to climate change. By focusing on transferring an understanding of the water cycle, climate proofing, the countryside in the area and water as a resource, visitors will gain a better understanding of the climate in the future.

The fundamental foundation of the project is made up of concrete business collaborations between commercial players, educational institutions, water utilities and authorities cf. Figure 44. Collaborating on high-quality development projects, which also have major societal value, will attract other stakeholders, such as associations and stakeholder organisations – and lead them to the foundation's core- and sub-activities: Test Area, Demonstration, Networking, Play and Learning, Education and Recruitment, and Sales and Exports cf. Figure 45.

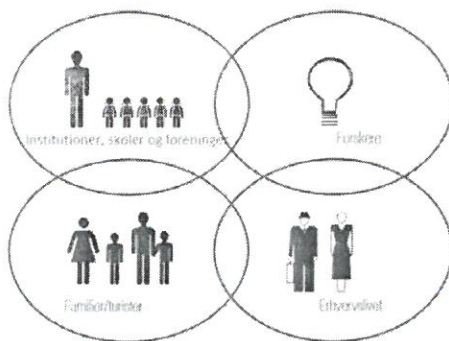


Figure 44: AquaGlobe is an innovation house for institutions/Schools, researchers, families and tourists, and businesses.

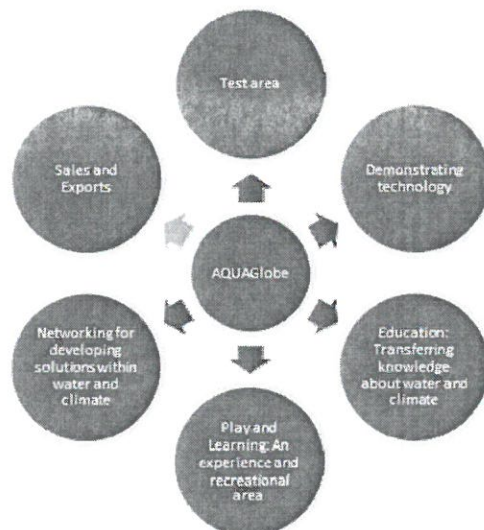


Figure 45: The activities of AquaGlobe

To establish AquaGlobe, several stakeholders are to be involved, the following stakeholder categories have the potential to offer various values and contributions to AquaGlobe. The stakeholders of the action are to date not fully clarified but work is being carried out to bring the following stakeholders into the project cf. Table 6.

Table 2: Potential values and contributions of stakeholders

Stakeholder	Potential values and contributions	Potential stakeholders
Commercial and private players	Part of an innovative network Facilities for customer visits Development of solutions in collaboration with partners	Grundfos A/S Aarsleff A/S Kamstrup A/S AVK Danmark A/S EnviDan A/S Degremont

NGOs	Meeting venue for stakeholders and professionals with competencies in water and climate	
Education and research	Potential for providing students and researchers the setting for real life studies. Opportunity for connecting researchers/students and companies. Opportunity for promoting the teaching of natural sciences in motivating and inspiring environment.	VIA University College Aalborg University Aarhus University Danish Technological Institute
Associations	Opportunity to influence and participate in the development of the immediate environment	VisitSkanderborg (tourist organisation) State of Green (public-private partnership) Lemvig Vand & Spildevand ("Climatorium" – action C21) AQUA Ferskvandscentret (FwC) ErhvervSkanderborg (business enterprise centre)
Public authorities	Skanderborg and Central Denmark Region will become more attractive for both existing citizens, businesses and tourists. The creation of an attractive recreational area.	Skanderborg Municipality Central Denmark Region The authorities of C2C CC
Opinion formers	Offer to participate in creating something that is important for society and the environment.	

How:

Action C20 AquaGlobe initiates the following activities:

1. Hot Spots - Water as a guide

The overall transfer of knowledge concept, is to transfer knowledge through experiences and play, where all of the senses are involved – sight, hearing, taste, smell and touch. The basic approach will involve a wide range of intuitive forms of transferring knowledge, from playful digital installations to physical hands-on experiences and presentations using models.

Hot spots are linked with watercourses as a communication means, the visitors will follow the watercourse as a guided path. It is used in transferring knowledge e.g. by emphasising the ground's terrain it is illustrated the slowdown of water flow, collection of water, pumping of water up, and pumping of water onto the next stage of the watercourse. Most of the transfer of knowledge will take place outside, however, the activity includes the design of a dedicated knowledge transfer centre in the form of a smaller building with low-energy solutions and which to a high degree will be self-sufficient with renewable energy.

Concrete activities:

Project management related to:

- Concept development for 6 hot-spots
- Organisation and training of personnel for communication/visitor guiding.

2. Water School

Collaboration with schools focusing on establishing a teaching course and a Master Class (e.g. in Climate Innovation). Children and young adults will gain an insight into the water cycle, work with managing water and wastewater and its impact on our



society and the environment (e.g. climate change). Interactive learning material will be prepared, which will be integrated with the institutions' learning goals.

Concrete activities:

Project management related to:

- Development of online/offline teaching material.
- Organisation and training of personnel.
- Collaboration with teachers/municipality.

3. Innovation Camp

Collaboration with universities and private players with regard to holding an annual Innovation Camp, where new and innovative solutions are sought for the water and climate field.

Concrete activities:

Project management related to:

- Development of concept between stakeholders/collaborative agreements.
- Organisation and facilities.
- Coordination of existing initiatives (like AQUA in Silkeborg and State Of Green).
- Development of standards for planning, execution and follow-up.
- System support.

4. Water Visits

Offer to stakeholders on meetings/seminars for potential and existing customers, and to present products at the operational level. The utility will provide rooms and the plant for use, and resources for presenting, speakers and hospitality if required. There will be the opportunity for stakeholders to use their own personnel and any marketing material for branding with regard to the visit.

Concrete activities:

Project management related to:

- Development of concept between stakeholders/collaborative agreements.
- Coordination of existing initiatives (like AQUA in Silkeborg and State Of Green).
- Development of standards for planning, execution and follow-up.

5. Demonstration system

The stakeholders will be offered to bid on relevant demonstration systems in collaboration with the utility. The demonstration system can be installed in direct connection to AQUAGlobe at Døjsøvej in Skanderborg, or at other locations in the utility area (Skanderborg Municipality). The idea is that the demonstration system will be fully operational at the same time as visitors and presentations are scheduled. For instance, this could be project solutions such as 'the intelligent water city' in Stilling, the new waterworks at Fredensborg or energy production via the purification plant.

Concrete activities:

Project management in relation to

- Identification of relevant demonstration system (project/room) with stakeholders.
- Develop the concept and project, incl. architecture.

- Identify other relevant stakeholders (with multi-solution if required).
- Clarify roles with the use of the system (presenting, maintenance, etc.)

6. Test and Prototyping

The stakeholders at AQUAGlobe can use the utility and infrastructure in the utility area as a large laboratory and for developing and testing new solutions. Whether it is testing full-scale prototypes, correlating data against experience from the utility's project "The Intelligent Water City", big data and/or the Internet of Things, together we can tailor make solutions that meet the stakeholders development needs. The utility will make competencies available for use at rates in relation to a charge rate sheet and the stakeholders pay for the installation, and any establishment of data interfaces, operation, maintenance and dismantling.

Concrete activities:

Project management related to:

- Identification and development of relevant test projects with external partners
- Identification of relevant partners (with multi-solution if required).
- Clarification of roles with the use of the system (presenting, maintenance, etc.)

Where:

In connection with Skanderborg Utility a/s' facilities at Døjsøvej, AQUAGlobe will be located on a 35,500 m² site on the outskirts of Skanderborg town. The site is surrounded by forest and is next to Sorte Lake, an area that will also see activity in the project. The actual terrain is uneven, with a series of different plateaus connected to small slopes and embankments. Sorte Lake also share an interesting history – in particular the innovative environmental effort to clean up Sorte Lake. A history that is well worth sharing with the wider public and the business and research communities. The location is a short drive from both Skanderborg centre and the E45 East Jutland motorway, and geographically it is located in Central Denmark and professionally centrally located in relation to competencies and other networks in water and climate technology.



Figure 46: Map over the area of Skanderborg Waste Water Utility with the surrounding forest and the lake Sorte Sø. The surroundings will be part of the activities of AquaGlobe.



When:

Phase 1: January 2017 – December 2018

Activities related to 1 to 6 are initiated and established, and the AquaGlobe is officially opened and activities started. C2C CC action results on freshwater are disseminated through AquaGlobe.

Phase 2 and beyond:

AquaGlobe' activities continues.

Reasons why this action is necessary:

AQUAGlobe links research, education, tourism and business together, both physically and mentally in relation to rethinking solutions to climate challenges. The novelty of this action is its holistic-oriented approach for a centre for children/adults, companies/educational institutions, locally/nationally/internationally as a communication and innovation hub. The holistic concept is necessary to generate knowledge and solutions of the future with regard to climate challenges. In line with C2C CC's aim, AQUAGlobe has been created with the aim of developing partnerships across municipal borders and professions. Via innovative partnerships, AQUAGlobe is a centre for knowledge sharing and innovative solution proposals with the opportunity to test solutions.

Constraints and assumptions:

The main constraint is the commitment to AQUAGlobe: The stakeholders difference is a strength, but different stakeholders can also pose a threat to the commitment to AQUAGlobe. The stakeholders differ in size, focus, financial means and individual aims, creating a need for very strong stakeholder management. The action is a co-creation project, which requires steering and that everyone pulls in the same direction. This action thus puts great emphasis on stakeholder involvement and management, a clear vision, emphasis of results, and contracts covering several years. Furthermore, knowledge sharing is made with Action C 21 Climatorium on co-creation, stakeholder involvement and management, tourism and presentation.

Expected results:

Phase 1: Establishment and opening of AquaGlobe. Hot spots park is established and open for visitors incl. the 'water school'. Knowledge sharing, networking and innovative initiatives between business and research stakeholders. Phase 2 and beyond: Workplaces: Via innovative projects, create at least 50 new jobs over a six-year period from 2017-2022. Visitors : That AQUAGlobe will generate 1,000 visitors a year from a regional, national and international perspective. New solutions for exports: Via innovative projects, create at least five new products/solutions over a six-year period from 2017-2022. Schools: AQUAGlobe , in collaboration with schools, provide an optional subject in innovation and entrepreneurship with focus on water solutions and climate solutions and/or other themes. Innovation Camp: From 2018, an Innovation camp will be held yearly with participation from higher educational establishments and private players.

Cost estimation:

Because the project will be strongly supported by co-creation and partnerships between the utility, private players, educational and research institutions, associations, citizens and

public authorities, it must be expected that significant resources will be spent on concept development, workshops, preparation of concepts, drawings and things of that nature.

Innovation Camp involves total costs for planning, production of materials, PR and marketing and execution of the Innovation Camp and the awarding of prizes to participants may be expected to amount to at least DKK 500,000, since a professional process is desired, which will strike a chord inside and outside the sector. Associated stakeholders and any foundations will contribute with financing of the scale + DKK 50,000 and man-hours for planning and execution, and for advising participants. Sponsorships will be provided for the Innovation Camp. Sponsors will contribute with financing, consulting, or non-financial prizes to participants.

In relation to the estimation of costs, it is estimated that there will be an average hourly cost of DKK 500 per man-hour for project management, administrative work, etc.

Deliverables:

Action	Deliverables:
C.20	Partner agreements A concept for a Master Class Funding applications Description of innovation camp concept Visitor concept description Water Academy concept descriptiondescription Water School concept descriptiondescription Evaluation report of amount of visitors and business collaboration Online and offline teaching material

Milestones:

Action	QuantifiableQuantifiable milestones	Date by end of
C.20	Application submitted for financing from relevant foundations	31/03/2017
	Stakeholder agreements established with central actors	31/03/2017
	Description of innovation camp concept done	31/08/2017
	Innovation Camp partnerships agreements closed	31/12/2017
	Optional subject in Innovation/Entrepreneurship provided	31/12/2017
	Water Visits established	31/12/2017
	AQUAGlobe physically built	31/12/2018
	Innovation Camp is launched	31/12/2018



C21: Climatorium

An innovative showroom for climate development and climate tourism

The Climatorium is pivotal in the establishment of a CCA Cluster on coastal environment in the region. The purpose of the Climatorium is to gather knowledge, business and tourism on CCA aspects within an innovation house. The objective is to increase innovation through day-to-day interaction and planned in house seminars. A list of local climate change measures and landscape characteristics will be part of a showroom. This action is primarily linked to innovation within sea & fjords and rivers.

Main responsible beneficiary: Lemvig Utility A/S

Budget: 376.107€

Number of days estimated spent on action in phase 1: 340 Days

Beneficiary responsible for implementation: Lemvig Vand og Spildevand A/S (LVS) is responsible beneficiary with Lars Holmegaard as project manager.

Role of LVS:

- Is the project manager
- Cooperates with partners: LK, AU and secondary stakeholders: Geopark West Jutland, The Danish Coastal Authority as well as the companies Plastix og TripleNine (potential stakeholders).

Relation to CCA plans

- LK CCA plan pp. 13-15 and 25-27

Relation to cross-cutting capacity building actions (C1-C7) and innovative actions (C20-C24)

Action C21 Climatorium will gain from actions under C1 relating to desk analysis and identification of knowledge gaps and reviews of in the risk maps and planned actions. Experience will be exchanged between demonstration projects C8, C9, C10, C11, C14, C16, C17 and C18 dealing with the coastal cities of Thyborøn, Horsens, Randers, Grenaa and Juelsminde. A common understanding between stakeholders of sustainable solutions (economically, environmentally, socially and long term) with a focus on land use, cost-effective measures, planning, implementation, maintenance and operation will be shared and developed across actions C8, C9, C11, C10, C14, C17, C18 and facilitated by CDR. Under C1 a workshop will be held to assess synergies and possibilities of integrated solutions for the sea and fjords at the East and West Coast. Under action C2 knowledge on CCA and rivers developed under different actions will be shared. Modelling, interpretations, analysis and data sampling are similar in the different catchments and C21 may benefit from this knowledge sharing in relation to the different catchment areas in the east and the west. Scientific aspects currently the highly debated within EU, e.g. on the synergies and trade-offs between CCA and water ecology, the need for warning systems related to flooding of rivers and local contingency planning, and the synergies between

farming and wetland restoration will also be shared and discussed for the benefit of action C21. Action C7 creates a number of innovative fora to unite important stakeholders within water businesses and to show case climate change and water technologies. Secondly, C7 will aim at gathering useful information and best practices from cross-cutting demonstration activities. Action C21 will benefit directly from these activities. Last but not least, Climatorium will benefit from a close collaboration with Action C20 AquaGlobe, which both deals with co-creation, quatro-helix and awareness rising.

Linked to Complementary Actions

"Geopark West Jutland": A UNESCO Global Geopark with focus on the geology, groundwater and landscape of the area. [Funded by LK, STK, HbK, LAG Lemvig and Ringkøbing-Skjern, LAG Holstebro-Skjern, CDR].

Description (What, how, where, and when)

What:

The Climatorium is pivotal in the establishment of a CCA Cluster on coastal environment in the region. Other C2C CC actions, dealing with the coastal environment (C8, C9, C11, C14, C17, C18, C 24) can use the Climatorium for communication and innovation. The Climatorium and AquaGlobe (C20) benefit each other by their different locations in the region and their focus on saltwater and freshwater, respectively. The two actions thus collaborates on ideas, exchange of data, research, tourism, exhibitions etc. The two different locations secures geographical dispersion and attraction of tourists across the region.

The purpose of the Climatorium is to gather knowledge, business and tourism on CCA aspects within an innovation house. This house will have shared office spaces for companies and research institutions (for researchers as well as master and ph.d. students). The objective is to increase innovation through day-to-day interaction and planned in house seminars. In the core of the house a dynamic climate exhibition will inform about climate change and illustrate selected solutions for the visitors of the house as well as tourists. The results of the coastal C2C CC actions (C8, C9, C11, C14, C17, C18, C24) will be exhibited in the Climatorium. Exhibitions are coordinated with AquaGlobe (C20). The Climatorium showroom will be expanded continuously with the best practice from C2C CC and with new CCA knowledge in general.

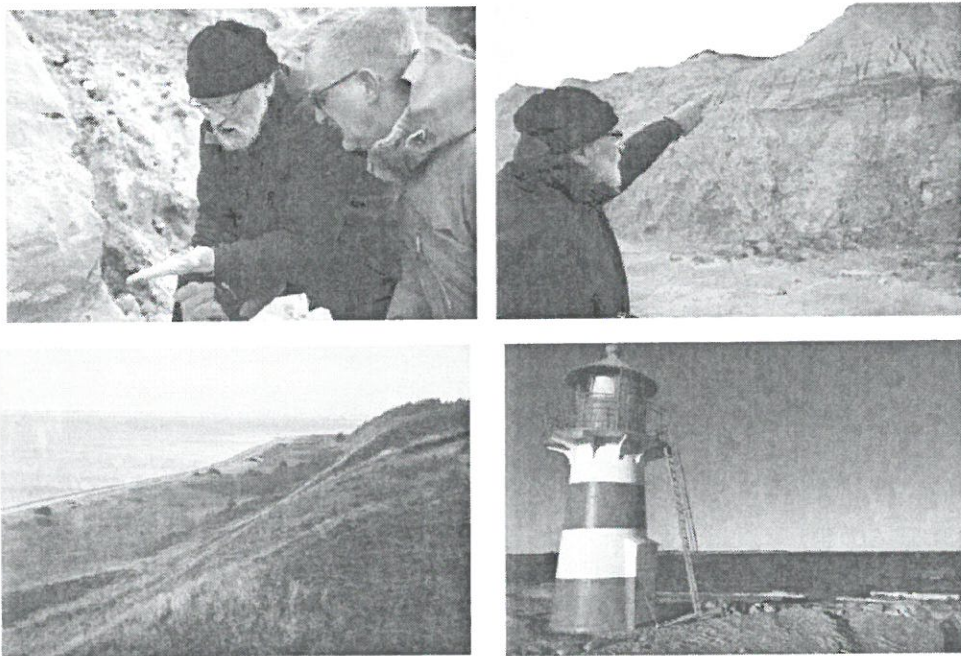


Figure 47: Besides the innovation house of the Climatorium, the Climatorium will also offer climate tours in the area. Pictures of geosites and examples of Danish coast lines.

The Climatorium will create a showroom based on companies, innovation, entrepreneurs, researchers, authorities, organizations and tourist actors within water and climate change. The house will be open for holiday- and corporate tourists with exhibitions on the ground floor, special climate tours in the area, presentations of CCA technologies and research, as well as innovation seminars with the companies and organisations in-house. There are 8.3 mill. coastal tourists from all over Europe per year in the Central Denmark Region, mainly related to the west coast (Dansk Erhverv, 2013), and besides the coast itself Jesperhus Blomsterpark (250,000 tourists per year), Klitmøller surf area, and Nationalpark Thy (Natura 2000 area) are well known tourist attractions, which target group the Climatorium supports.

It will be established on the harbor front in the city of Lemvig, a central location in the region in regard to saltwater and coastal challenges, and the location supports and benefits from other climate activities in the area, e.g. Geopark West Jutland (in consideration at UNESCO Global Geopark), which focuses on the geology, groundwater, historical landscape changes and sustainability of the area. Climate change impacts this area physically, which already attracts 'climate' tourists in bad weather. The local weather and climate conditions set demands for the solutions developed, see Figure 9 (Lemvig Le Mur during the Bodil storm). The location itself and the innovative solutions will be of inspiration for others.

The following local climate change measures and landscape characteristics will be part of the showroom:

"Showroom"	Description
"Le Mur"	Flooding and flood risk in Lemvig solved with an architectural designed flood wall called (see Figure 9)
Disembarking in Thyborøn	Disembarking in Thyborøn and the issues of rising groundwater level and saltwater intrusion, which impacts underground infrastructure such as shorter lifetime of sewer pipes. Research and innovation processes between research institutions, private actors and local governments
Geosites	The sea eats of the coastline and exposes the geological layers from the two recent ice

	ages. 135,000 years of climate history is visualized. Geopark West Jutland involves different geosites and examples of most Danish coast types (cf. figure 47)
Coastal protection solutions	Climate change and natural hazards lead to local flooding, erosion and silting of fairways – New solutions are implemented incl. dikes, coastal protection, sand removal, and new coastal planning. The Danish Coastal Authority in Lemvig and Lemvig Municipality are collaborating on these measures.
Co-creation	Climate change impacts agriculture by larger leaching of nutrients to freshwater and coastal environments, furthermore is the farmland challenged by an increase in days with waterlogged soils and flooding. The solutions demand collaboration between agricultural businesses, water utilities, companies and authorities that results in a more sustainable environment and a business model for farming. Lemvig has 30 years of experience with co-creation on biogas. Lemvig Water and Wastewater A/S delivers ferrous sludge for phosphor extraction, the yield is 100 % (compared to 40 % by existing technology), and with less CO ₂ emissions.
Stormwater basins to prevent phosphor discharge	Lemvig Water and Wastewater A/S and Lemvig Municipality collaborates on implementing stormwater bassins in natural areas to prevent flooding and to prevent phosphor leaching into streams and fjords. Lab tests are carried out and sludge is removed if containing hazardous substances to secure ecology and biodiversity.

How:

Phase 1 (2017-2018):

Analysis of the potential of a CCA business network and tourism.

1. Analysis of company types in the region and visualization of the synergies between business areas and products.
2. Interviews with entrepreneurs on their needs and interests in an innovation house
3. Interviews with companies on their needs and interests in an innovation house
4. Feasibility study on the potential of tourism incl. spin off from other tourist attractions in the area.

Planning and conceptual design.

5. Preparation of design criteria of the innovation house incl. tenants commitments, knowledge sharing measures and climate features.
6. Preparation of zoning plan.
7. Preparation of conceptual design incl. climate features, design and construction costs.

Phase 2 and beyond:

The Climatorium will be constructed and taken into use.

Phase 1

Activities related to bullet 1 to 4

Where: The Climatorium will be situated in Lemvig, however, act as a regional hub together with AquaGlobe (C20)

When: January 2017 – December 2018

Phase 2 and beyond

Activities related to bullet 5 to 7

When: Phase 2 and Phase 3

Reasons why this action is necessary:

The Climatorium will initiate and push for innovation and business development within CCA solutions, and act as a centre for presenting CCA for corporate tourists as well as holiday tourists. CDR is well known for its corporate tourism within wind energy, though, the region has a large potential in increasing corporate tourism within CCA and water technologies, this potential is not yet fully developed. The Climatorium will together with AquaGlobe (C20)



create innovative environments for the water businesses that also act as physical centres for showing showcases within CCA solutions and technologies, not at least the C2C CC results. The Climatorium is expected to host a number of private companies, who will benefit from being part of the innovative environment presented by the Climatorium set-up. All so-called tenants will be asked to give a product presentation, organise a social/technical event or a series of knowledge sharing activities for Climate tourists, official or private company delegations. To develop a paradigm for the organisational and financial setup for the Climatorium, we need a consultant.

Constraints and assumptions:

The largest challenge is the final financing for constructing the building. The financing model is based on the tenants of the house, and initial pre-requests indicate an interest among businesses. The activities in Phase 1 have the purpose to investigate the potential of the Climatorium, and the house will be financed through tenants. The tenants will furthermore commit to make products available for exhibitions, contribute to events and seminars on CCA, and be available for meetings and conversations with the visitors and tourists of the house.

Expected results:

The Climatorium expects to facilitate a minimum of 10 companies and organisations situated in the house. The the activities of the house and the companies businesses will create 50 new jobs. All companies and organisations have a product, event or a process to present and exhibit for awareness raising and attraction of corporate tourism. That at least 3 new CCA products or methods are produced by the companies in the Climatorium by December 2020. At least 6 new CCA products or methods are produced by December 2022. The Climatorium attracts 10.000 climate tourists per year.

Cost estimation:

Expenses are mainly personnel, and estimation of person days for project managers, project administrators and delivery officers is based salaries and pensions.

Travel costs are based on prior experience and average costs for transportation. External assistance is need for the outline proposals for the Climatorium, which includes costs for architectural programming, the project design and the design of the proposal, including technical solutions and budget planning. The estimation of these costs are based on prior experience and preliminary surveying of the market prices. These costs are to be shared between LVS and LK. Expenses for external assistance is based on prior experience. Subsistence costs are also based on prior experience and can be further subdivided into Hotel costs, Daily allowances/Payment for meals and local transportation categories, as shown below for this action's subsistence costs items:

Travels	HOFOR Visit		Inspirational trip to Amsterdam (NL)	
<i>Partners:</i>	LVS	LK	LVS	LK
<i>Cost categories:</i>				
Hotel cost:	120	120	900	300
Daily allowances/Payment for meals cost:	80	80	600	200

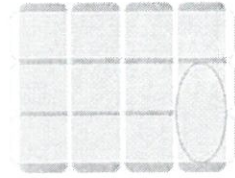
Local transportation costs:	0	0	0	0
Total subsistence cost:	200	200	1500	500

Deliverables:

Action	Deliverables
C21	<p>A list of potential companies and knowledge institutions.</p> <p>A concluding report with feedback from interviewees on their interest in the Climatorium and a list of potential entrepreneurs who have expressed interest as tenants.</p> <p>A concluding report with feedback from interviewees on their interest in the Climatorium and a list of potential companies which have expressed interest as tenants.</p> <p>A feasibility study of tourism documented in a report.</p> <p>Design criteria for the purpose of the house documented in a report.</p> <p>A zoning plan (digital and pdf.)</p> <p>Conceptual design documented in a report.</p>

Milestones:

Action	Quantifiable milestones	Date by end of
C.21	Analysis of company types is finalized	31/06/2017
	Interviews with entrepreneurs and companies are finalized	31/09/2017
	The feasibility study of tourism is finalized	31/12/2017
	Design criteria for the innovation house is finalized and the preparation of zoning plan and the political process is initiated.	31/03/2018
	The conceptual design is finalized.	31/08/2018



C22: Infiltration of surface water through permeable coating

The majority of drainage infrastructure in Denmark consists of joint sewage. This solution has shown that it is not geared to the current amount of drainage volumes; where large, densely populated towns and cities are especially challenged. SUDS are increasingly applied, however, can be difficult to apply in dense urban environments. Another challenging problem with SUDS solutions, including permeable surfacing, is how potential contamination is managed and how to ensure that the systems is operational now and in the future. In an attempt to solve these challenges this action will carry out a number of trials on permeable coating called the climate road. This action is primarily linked to tools and innovation within rainwater.

Main responsible beneficiary: Hedensted Municipality

Budget: 346,337€

Number of days estimated spent on action in phase 1: 250 Days

Beneficiary responsible for implementation: VIA University College (VIA) and Hedensted Municipality (HEDKOM) are project managers. The action is relevant for all C2C CC partners who will attend knowledge sharing activities in action C4 and C5.

Role of HEDKOM: is responsible for providing advice, authorities processing and contact to the stakeholders.

Role of VIA: VIA is responsible for the progress in the project, the construction phase, monitoring, data processing and reporting about the project.

Relation to CCA plans

The action is a consequence of several of the C2C CC partners' CCA plans, which aim to prevent the consequences of climate change by using increased infiltration in permeable coatings (e.g. p. 6 in the CCA plan for HEDKOM, p. 7 in the CCA p. for Horsens, p. 25 in the CCA plan for SSK-KOM and p. 17 in the CCA plan for SDK)

Relation to cross-cutting capacity building actions (C1-C7) and innovative actions (C20-C24)

Activity C22 Infiltration of surface water through permeable coating will gain from action C3; C4, C6, C7 and C23. In selected areas a detailed local model is set up focusing on groundwater, surface and/or seawater. Models are based on the present data and collections of new data sets e.g. geophysical data from C3 and further modelled under action C23 will improve understanding of the infiltration potential in urban development areas. Under Action C4 Rainwater, C22 will gain from the identification and experience of different setup models and testing of SUDS within CDR.

Under action C6, the groundwater-surface water model and screening tool is developed and tested, which may benefit C22 directly. Action C7 will aim at gathering useful information and best practices from cross-cutting demonstration activities and urban development stakeholder processes. C22 will benefit directly from these actions.

Linked to Complementary Actions

VIA expects to design and realise complementary projects, where there will be focus on studying how climate roads can be integrated with other SUDS solutions, so that the most integrated and robust climate change adaptation can be found. MUDP and EUDP are potential sources of financing. The amount of financing that is sought is DKK 2-4 million. Potential co-applicants may be Danish and foreign knowledge institutions (e.g. Danish Technological Institute), consultants and manufacturers.

Description (What, how, where, and when)

What:

Rapid urban development, climate changes with increased and more frequent rainfall and increasing environmental consciousness have created intensive focus on the management of wastewater and surface water in Danish towns and cities. The majority of drainage infrastructure in Denmark consists of joint sewage. This solution has shown that it is not geared to the current amount of drainage volumes; where large, densely populated towns and cities are especially challenged. Financially it is also unsuitable that the utilities shall clean mixed rainwater/wastewater, because the costs of cleaning for this is increasing markedly.

Steadily increasing urban populations produce more wastewater and together with the large volumes of surface water from extreme rainfall, this creates flooding in many low-lying urban areas. The flooding typically results in damage to businesses, people's homes and infrastructure. It is therefore necessary to carry out preventative efforts, which make the towns and cities safe from this problem. Flooding as a consequence of overloaded drainage systems is particular bad, as the water is a mix of rainwater and wastewater.

The previously used solutions to the challenges are either to renovate the existing sewer systems, establish a parallel rainwater pipe, or partially or wholly disconnect the surface water from the sewer system. SUDS are increasingly applied, however, can be difficult to apply in dense urban environments. Another challenging problem with SUDS solutions, including permeable surfacing, is how potential contamination is managed and how to ensure that the systems is operational now and in the future

In an attempt to solve these challenges VIA in collaboration with HEDKOM, will carry out a number of trials on a permeable coating testing system which we call the climate road, see example in figure 48.

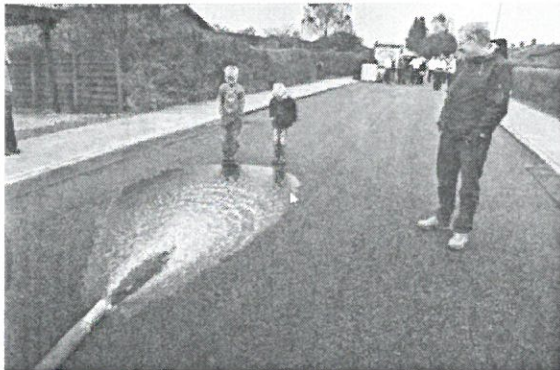


Figure 48: Example of permeable surfacing on Agerlandsvej in Odense (www.fyens.dk)

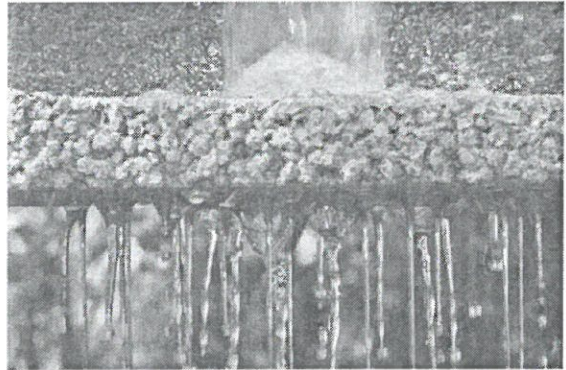


Figure 49: Example of permeable concrete (<http://www.equipmentworld.com/>)

The action is carried out through two overall activities:

1. Establishment of a climate road (pilot project)
2. Involvement of politicians and other stakeholders

Throughout the two actions, the related researchers will attend both national and international conferences. This is done in order to gain newest knowledge within the field is applied in the action and to present the results of C22. This is also done in order to facilitate the realization of complementary projects.

C22.1 *Establishment of a climate road (pilot project)*

What:

For the purpose of mapping the seepage potential of permeable coating, VIA will establish a climate road, which will function as a test installation with which a number of trials will clarify the following: A) The seepage potential in different types of permeable coating (Figure 49), B) The clean-up potential of pollution components, and C) Clarify the options for incorporating green solutions in the form of geothermal heating/cooling in the climate road.

How:

1. Two workshops: Before the establishment of the climate road, two workshops will be held with stakeholders such as municipal employees, citizens, companies and knowledge institutions, e.g. the Danish Technological Institute. At the workshops, design, types of surfacing that shall be used in the climate road, monitoring strategies and success criteria will be discussed and established. This will ensure that the latest knowledge is included in the project and stakeholder' ownership for the project. Next, the climate road will be constructed and a baseline will be established for the climate road before the trials begin.
2. Construction of climate road: The climate road will be built using permeable asphalt, whereas side roads, if these are possible to construct in the project, will be constructed using alternating surfacing.
3. Infiltration tests: During the first four years and on an ongoing basis, many infiltration tests of the permeable asphalt will be carried out, to assess time-related and seasonal seepage potential.

4. Purification tests: During the construction of the climate road, different structural constructions of the road will be made in interplay with different types of filter and absorption media to clarify which influence different types of filter and absorption media and their structural design may have on the road's ability to purify the surface water with regard to xenobiotic substances. To clarify the cleaning effect of the road, a drain will be established in and under the climate road, where discharge concentrations can be monitored on an ongoing basis. To ensure the groundwater is not contaminated, an impermeable membrane will be established in a section under the climate road. This also ensures that the water balance is known. During the project period, samples will be taken on an ongoing basis to determine the filter and sorption media's physical and chemical soil properties and porosity, hydraulic capability, organic content and concentration of heavy metals and salt.
5. Geothermal/cooling potential: The degree to which the permeable surfacing can be integrated with geothermal heating/cooling will be examined. Previous studies at VIA have successfully shown that geothermal heat tubing can be incorporated in among other things, asphalt in the underlying road. In the future, climate roads can integrate several environmentally-friendly and sustainable solutions in the same system, which will be a great benefit to society in Denmark and in the EU.

In addition, VIA wants students to be very much included in the work. In collaboration with companies/consultants, the students will work to develop new products and put forward proposals for the design of the subsoil for surfacing and the design of types of surfacing.

Phase 1

Activities related to the abovementioned bulletpoints 1-4.

Phase 2

Activities related to the abovementioned bulletpoint 4-5.

Phase 3

Activities related to the abovementioned bulletpoint 4-5.

Where: The project area will be located at a site in HEDKOM that is close to VIA, so that students have the opportunity to easily carry out trials on the installation

When: Phase 1 - 3

C22.2 Involvement of politicians and other stakeholders

What:

The climate road itself is a large and innovative infrastructure, that together with the results of C22.1 serve as a great means of presenting climate change, SUDS and environmental concerns to involve politicians, citizens, companies, students and other stakeholders. This is done in the following way:



How:

1. Political discussions of the results and survey of the challenges: Field trip to the climate road and discussion of the challenges and opportunities. Choice of important elements, which shall be clarified and discussed with citizens and stakeholders. The intention is that this will be executed in collaboration with existing innovation networks e.g. "Vand i Byer" (Water in urban areas).
2. Stakeholder process (landowners, citizens, municipal employees and knowledge institutions):
3. Review of the results from the current project and how they can be used in the future.
4. Execution of two workshops using stakeholder process, where we discuss the advantages, disadvantages, possibilities and consequences of the results.
5. Recommendations to the authorities: in the form of guidelines or handbooks about future working processes for the purpose of establishing climate roads and making permeable coating ready for the market as novel water technology (cf. action C7).
6. Conference: The results are presented to other municipalities and stakeholders facing similar challenges. In this way, it is ensured that experiences from the project are passed on and widely integrated. The intention is that the conference will be held under the auspices of EnviNa or in connection with pipe centre days at the Danish Technological Institute.
7. Other communication: articles will be prepared so that the experiences we have gained through the project can be passed on to the EU.
8. Complementary projects: Preparation of complementary projects based on the results. The intention is that this will be done in collaboration with other EU companies and/or knowledge institutions. Initiation of complementary projects with external co-financing.

Phase 2

Activities 5 to 6

When: 2019-2020

Phase 3

Activities 1 to 6.

When: 2021-2022

Reasons why this action is necessary:

Municipalities acquire a number of tools that will enable them to determine how surface water can be managed with regard to permeable surfacing in urban areas, and thus create a climate resilient cities and with regard to the environment. The climate road itself will also inspire Danish and foreign authorities, knowledge institutions and companies and push for innovation and business development. The project's results and guidelines are to be used by the C2C CC partners and to contribute to innovative complementary projects, which can be replicated in Denmark and in the EU.

Constraints and assumptions:

One of the constraints are related to stakeholder involvement and whether we will succeed in engaging them in the action. Therefore, experts from the C2C CC Advisory Committee are

included in the process and workshops and knowledge sharing in C4 and C5 no on stakeholder involvement will benefit C22.

Another constrain could be that it is logistical challenging to establish the climate road in the urban area. However, as the climate road is planned as a test road connected to an already planned regular road, the climate road will be established at the same time as the rest of the road, which will diminish the constraint. The EIA process of the climate road is included in EIA of this road.

Expected results:

C22.1: The workshops ensures that BAT is used for the establishment of the climate road. The climate road is constructed and in function. Infiltration test and purification tests provide detailed knowledge on the effectiveness of the road as a SUDS. Possibilities for geothermal/cooling potential is investigated.

C22.2 results in wareness raising among politicians on climate change and CCA solutions in dense urban areas, recommendations for authorities and broader communication. This is coordinated with the C2C CC PM unit. The results will also benefit with applications for complementary projects.

Cost estimation:

C22.1 will have expenses for external expert consultation in connection with the establishment of the climate road. Expenses for the construction work are expected to be DKK 1,000,000 based on inquiries. HEDKOM and VIA will contribute by providing advice, holding workshops and if required, help with C2C CC actions related to C4, consulting and guidance in connection with the construction phase, monitoring, data processing and the interpretation of data. HEDKOM will contribute 150 hours and VIA with 3,300 hours. Person hours are calculated on the basis of actual payroll + pensions, etc. Regarding C22.2, it is expected that Hedensted Municipality and VIA University College will contribute by providing information, reporting and meeting activity in collaboration with politicians and stakeholders. VIA University College will contribute by providing information, preparation of complementary projects, reporting, planning of workshops and the final conference.

Deliverables:

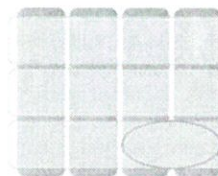
Action	Deliverables
General	Phase 1 (2017-2018): An online portal with LIFE logo and link to C2C CC main portal: Accessible on www.c2ccc.eu Workshop results: PPT presentations published on the portal: Accessible on www.c2ccc.eu
C.22.1	Phase 1 (2017-2018): Test installation Phase 2 (2019-2020): Ongoing reporting on the individual permeable surfacing's time-related infiltration capabilities Ongoing reporting on the individual permeable surfacing's time-related infiltration capabilities under the influence of typical icy road conditions in Denmark, as well as salt and sand spreading Sub-report on examination of which filter media the road is best built with to provide the most optimal removal of road-related xenobiotic substances – it was impossible to have different filter media in the road bed. Instead the two types of asphalt pavement will be evaluated with respect to optimal removal of road-related xenobiotic substances. Sub-report on examination of the degree to which permeable surfacing can be integrated with geothermal heating/cooling. A constructed section of a climate road



	Reporting of results: Reports, workshops, articles and conferences.
C.22.2.	<p>Phase 2 (2019-2020):</p> <p>Recommendations: Reports and simple handbooks, which are published on the project portal. The results will be presented to conferences in Denmark and abroad. The intention is that this will be executed in collaboration with existing innovation networks, like "Vand i Byen". (Water in urban areas).</p> <p>VIA University College was invited by the Danish Technology Institute to make an overall report on climate roads together with multiple collaborators e.g. the private sector. We used this opportunity to extend the cooperation so it also covers the report on recommendations prepared in connection with the establishment of the climate road. It will undoubtedly make the results of the report better rooted in the industry</p> <p>Finishing conference: Knowledge sharing across municipalities and stakeholders. PPT presentations published on the online portal.</p> <p>Complementary projects: complementary project proposals, which is sent for example to EUPD or MUDP.</p>

Milestones:

Action	Quantifiable milestones	Date by end of
C22.1	Phase 1: One pilot climate road established	31/12/2017
C22.1.1	Baseline established for monitoring programme	31/12/2017
C22.1.2	First season measurements are evaluated	31/12/2018
	Report on recommendations prepared in connection with the establishment of the climate road	31/12/2019
C22.1	Phase 2: Third season monitoring results are evaluated and reported.	31/12/2020
	Guidelines and recommendations are finalized – moved to phase 3. No need to stop monitoring before it is necessary	31/12/2020
	Results presented on two workshops and one conference	31/12/2020
	Report on recommendations prepared in connection with the establishment of the climate road	31/12/2020
	Phase 3: Fifth season monitoring results are evaluated and reported	31/12/2021
	Article about the climate road is made	31/12/2022
	Guidelines and recommendations are finalized	31/12/2022
C22.2	Phase 2: Recommendations to the municipalities and stakeholders prepared in report	31/12/2020
	Phase 3 Planning of meetings with politicians and stakeholders done	31/08/2021
	Field trip done	31/12/2021
	Stakeholder integration done	31/12/2021
	Workshops held and working groups meet.	31/12/2021
	Finishing conference done	
	Pilot project descriptions prepared.	31/08/2022
	At least one complementary project description ready for execution.	31/08/2022
		31/12/2022



C23: Potentials for increased infiltration in new urban areas

This action deals with sustainable CCA through a holistic sustainable concept with a specific focus on increased infiltration in urban areas, in particular new urban development areas. Due to the lack of basic knowledge, it is difficult for the municipalities to give firm advice to the developers on where and how to manage surface water by infiltration. For the purpose of mapping the infiltration potential in urban development areas, areas will be mapped with high-precision geophysics, which may show in detail the upper 5 to 10 meters of the ground surface. Relevant stakeholders will be involved in an integrated stakeholder process, where technical results will be transformed and disseminated through field trips, workshops and subsequent development of description of best practices and guidance for stakeholders on how to best make use on infiltration of surface water in future urban development projects. In the end the stakeholders will define coming complementary projects. This action is primarily linked to innovation within groundwater and rainwater.

Main responsible beneficiary: Horsens Municipality

Budget: 175.388€

Number of days estimated spent on action in phase 1: 242 Days

Beneficiary responsible for implementation:

Horsens Municipality (Horsens) and VIA University College (VIA) are project managers.

Role of Horsens:

- is responsible for progress in C23, providing advice and contact with the stakeholders.

Role of VIA:

- is responsible for executing the infiltration measurements, drillings, geophysical mapping and the production of a detailed infiltration potential map for urban areas.

Relation to CCA plans

The action is a consequence of Horsens CCA plan, aiming at preventing consequences of climate change by using increased infiltration in future urban areas with specific reference to page 7 in the municipality's CCA plan.

Relation to cross-cutting capacity building actions (C1-C7)

Activity C23 Potentials for increased infiltration will gain from action C3. In selected areas a detailed local model is set up focusing on groundwater, surface and/or seawater. Models are based on the present data and collections of new data sets e.g. geophysical data and C23 will benefit from the outputs of this model and its implementation under different actions, thereby improve mapping of the infiltration potential in urban development areas. Under Action C4 Rainwater, C23 will gain from the identification and experience of different setup models and testing of SUDS within CDR. Action C7 will aim at gathering useful information and best practices



from cross-cutting demonstration activities and stakeholder processes. C23 will benefit directly from these actions.

Linked to Complementary Actions

Horsens and VIA expect subsequently to design and realise complementary projects, with a focus on examining how water delaying measures can be integrated with SUDS solutions. Danish Eco-Innovation Programme (MUDP) and similar national funds are potential sources of financing. The amount of financing sought is DKK 1-2 million.

Description (What, how, where, and when)

The outset of this action is sustainable CCA through a holistic sustainable concept, with a specific focus on increased infiltration in urban areas, in particular new urban development areas. As with other towns and cities in Denmark, Horsens faces future climate challenges in the form of more frequent and intensive precipitation. Towns and cities are vulnerable to climate changes, and preventative efforts are required to protect urban areas from intense rainfall events, which may lead to flooding and subsequent damage to buildings and infrastructure. Subsequently, expenses for handling surface water are increasing significantly in most municipalities. It is therefore in the interests of the municipalities as far as possible to manage infiltration locally, thereby disconnecting surface water completely or partially from the sewer system.

However, with regard to the establishment of new urban development areas, at present it is difficult for the municipality to give firm advice to developers on where and how to management surfacewater by infiltration. This is partly due to the lack of basic knowledge of the soil's infiltration capacity. Thus, infiltration solutions are presently established only in areas without a risk to the groundwater and domestic water resource, and the surrounding recipients. This limits the use of infiltration in many towns and cities.

Action C23 involves three sub-actions:

- C23.1: Mapping of the infiltration potential in urban development areas
- C23.2: Integrated stakeholder process
- C23.3: Definition of complementary projects

C.23.1 Mapping of the infiltration potential in urban development areas

What:

The Horsens city and its suburbs is the project area for this action, covering the possibilities of infiltration of surface water in urban development areas throughout the municipality's urban development areas.

For the purpose of mapping the infiltration potential in urban development areas, areas will be mapped with high-precision geophysics, which may show in detail the upper 5 to 10 meters of the ground surface, see Figure 50 and Figure 51. In connection with the geophysical mapping, supplementary manual drillings up to 1 to 5 meters depth will be carried out, describing lithology and grain size analyses in detail.

As an extension of the geophysical mapping, infiltration tests cf. Figure 52 are made with different clay types found in urban development areas. The aim is to carry out field studies to a sufficient degree, making it possible to perform a quantitative (statistical) clarification of the individual soils' infiltration capabilities. The results of the executed infiltration tests form the basis for examining to what extent there exists a quantitative correlation between the geological descriptions and the soils' infiltration capabilities.

Similarly, the resistivity measurements from the geophysical mapping will be compared with the results from the infiltration tests, to ascertain whether a quantitative correlation exists between the deposits' electric resistivity and the infiltration capabilities. Based on the soil types' different infiltration capabilities, it will be possible to produce a detailed infiltration potential map for urban development areas.

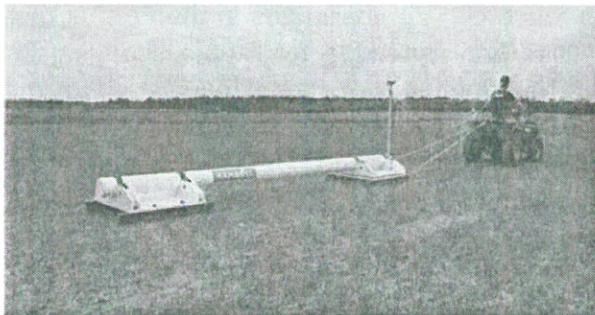


Figure 50: Example of geophysical mapping using DualEM.

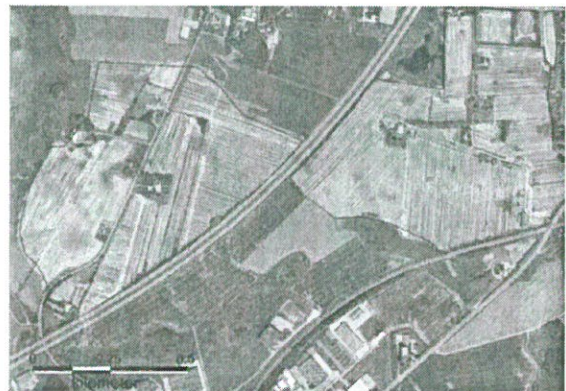


Figure 51: Example of geophysical mapping. Red areas are sandy areas and green areas are clay-dominated areas.

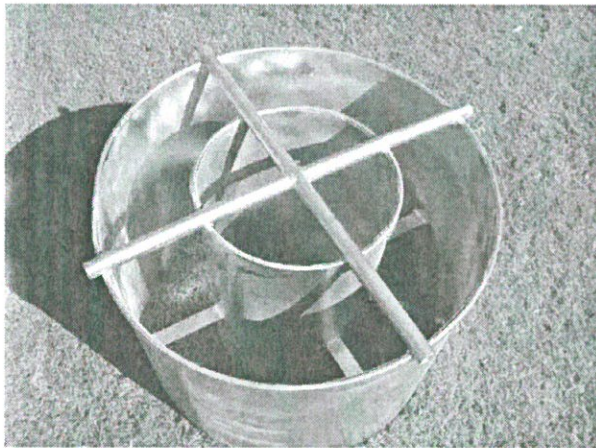


Figure 52: Example of a double ring infiltration test gauge. (www.turf-tec.com)

How:

Action C23.1 includes:

1. Quantitative (statistical) clarification of the individual soil's infiltration capabilities. By finding a quantitative correlation between the individual soil type and their infiltration capabilities, results can be immediately transferred to similar areas, for example, with the use of a soil type map.



2. Quantitative correlation between the geological descriptions from the drillings and the soils' infiltration capabilities. By finding a quantitative correlation between the geological descriptions from drillings and the soils' infiltration capabilities, stakeholders and municipalities have the opportunity in the future to be able to express whether the area's infiltration capabilities are valid based on new and existing descriptions from drillings.
3. Quantitative correlation between the soils' electrical resistivity and infiltration capabilities. By finding a quantitative correlation between the soils' electrical resistance and their infiltration capabilities, stakeholders and municipalities are in the future able to carry out geophysical mapping and thus gain an overview of the area's infiltration potential.
4. Production of a detailed infiltration potential map for urban development areas. In connection with the preparation of a infiltration potential map, a number of guidelines will be written, which describe how the map is made and which data are necessary.
5. The creation of a professional knowledge base for the municipalities' formulation of best practices and guidelines for local management of precipitation in urban development areas. Reports on best practices and guidelines that describe how data shall be used and interpreted. The results will be reported to other municipalities and stakeholders with similar challenges on an ongoing basis, so that experience from the project can be passed on and widely dispersed.

Where: Horsens city and suburbs is project area. However, the methodology developed is relevant for all C2C CC partners. The project area covers approx. half of a total of 490 ha, where Horsens has designated development areas for new homes. See Figure 53.



Figure 53: Overview of the possible areas for mapping (marked in red).

When:

Phase 1

Activities related to the abovementioned bullet points 1-5.

Phase 2

Activities related to the abovementioned bullet point 1-5.

C.23.2 Integrated stakeholder process

What

Relevant stakeholders from public sector (municipal staff and utility company) and private sector (developers, citizens and consultants) will be involved in an integrated stakeholder process, where technical results will be transformed and disseminated through field trips, workshops and subsequent development of description of best practices and guidance for stakeholders on how to best make use on infiltration of surface water in future urban development projects.

How

C23.2 is carried out in collaboration with local stakeholders, landowners, citizens, developers, municipal and utility company employees and knowledge institutions with an interest in, knowledge of and experience on developing new urban areas, sewer and surface water systems

C23.2 will be carried out through:

1. Stakeholder process (landowners, citizens, municipal and utility company employees and knowledge institutions).



2. Review of the results from the current project and how they can be used in the future.
3. Execution of a workshop, where we discuss the advantages, disadvantages, possibilities and consequences of the results from action C23.1.
4. Preparation of recommendations for best practices and guidance for stakeholders related to future working processes for the purpose of mapping the infiltration potential in urban areas.

Where: In specific areas designated for urban development throughout the municipality.

When:

Phase 2

Activities related to the abovementioned bulletpoint 1-4.

C.23.3 Definition of complementary projects

What

Stakeholders involved throughout C23.1 and C23.2 will be invited to share experience, ideas and knowledge on how to use the new techniques for identifying and developing new urban areas using infiltration as primary means of managing surface water. Subsequently, new knowledge and ideas will be combined with other complimentary projects to form the basis of applications for new projects with external co-funding for the Eco-Innovation fund and similar funds.

How

1. Final stakeholder conference, where the results are presented to other municipalities and stakeholders facing similar challenges. In this way, it is ensured that experiences from the project are passed on and widely integrated. The intention is to hold the conference under the auspices of the Danish EnviNa organisation or in similar international fora.
2. Prepare complementary projects based on the results.
3. Initiate complementary projects with external co-financing.

Where: In Horsens and at VIA, Horsens.

When:

Phase 2

Activities related to the abovementioned bulletpoint 1-3.

Phase 3

Activities related to the abovementioned bulletpoint 2-3.

Reasons why this action is necessary:

The project is necessary for the municipalities and stakeholders, as they will acquire a number of tools that may determine accurately, where surface water may be managed locally in future urban development areas. Results will create added value and business development for municipalities and stakeholders, since they will be able to prioritise efforts for managing surface water and thus achieve more sustainable CCA solutions. In addition, the municipalities and stakeholders will acquire concrete knowledge on how a new local area may be screened quickly, efficiently and cheaply for the potential of infiltrating surface water. The project makes it possible to form a solid knowledge base, enabling a choice of more sustainable and holistic CCA for the benefit of society, citizens and the area's biodiversity, as more green solutions may be implemented.

The project's results and guidance will be assessed, partly to be able to be used by other sub-projects under the auspices of C2C CC and to support networking and knowledge sharing across municipalities, utilities and other climate players, and partly to contribute to innovative complementary projects, benefiting a broader group of stakeholders in Denmark and in the EU.

Constraints and assumptions:

C23.1 may be constrained by lack of involvement by local stakeholders. This is dealt with by explicitly presenting problems resulting from climate changes to the local stakeholders, and by showing the knowledge base the project may give to the stakeholders, the timeframe and potential financial advantages that the project offers clear to the stakeholders e.g. by avoiding costs for sewage piping. As far as possible, we will utilise experts from the C2C CC knowledge committee.

C23.2: assumption that stakeholders support the results of C23.1. This is dealt with by ensuring the results and associated consequences are broadly disseminated and clear for everyone.

C23.3 may be constrained by limited funding for a complementary project. We will early in the process engage with relevant representatives from public and private funds, who may find an interest in funding subsequent follow-up activities.

Through a participatory stakeholder process, field trips and workshops, C23 will ensure a timely and integrated local participation in the areas, where urban development and surface water management using infiltration will take place. The work will be broad in relation to new techniques and new approaches (giving added value). Together with experts C23 will produce relevant maps and reports on how and where to infiltrate and give advice on how to manage the processes towards a better management of surface water and infiltration.

Expected results:

C23.1: Defined methodology on the correlation between soil type and infiltration potential to be replicated in Denmark and Northern EU. App. 320 infiltrations tests. App. 250 hectares geophysical mapping. App. 100 hand drillings and soil samples descriptions. Full overview of infiltration potentials in Horsens municipality. Integrated municipal plan in Horsens on how to use infiltration for future urban development.

C23.2: 200 stakeholders actively involved, and knowledgeable about best practices. New guidelines used for planning water management in at least 5 new urban development areas.

C23.3: Funding assured for at least one new project of min 5 million DKK

Cost estimation:



C23.1 will have expenses for external expert consultation in connection with geophysical mapping. It is expected that approx. 18 ha/day can be mapped, which gives a total of 14 days in the field. In addition, it is expected that 320 infiltration tests will be carried out. Expenses for external expert consultation are expected to be DKK 400,000, based on inquiries. In connection with C23.1 it is expected that HORKOM and VIA will contribute by providing advice, execution of drillings, data processing and the interpretation of data. HORKOM will contribute with 100 hours and VIA 1704 hours. In connection with project C23.2. it is expected that HORKOM and VIA will contribute by providing information, reporting and meeting activity in collaboration with stakeholders.

In connection with project C23.3, it is expected that Horsens Municipality and VIA University College will contribute by providing information, reporting, planning of workshops and the final conference. For HEDKOM the total number of person-days per year is based on the basis of the total working hours/days according to national legislation, collective agreements, employment contracts, etc. – budgeted at 214 days per year.

Subsistence costs are based on prior experience and can be further subdivided into Hotel costs, Daily allowances/Payment for meals and local transportation categories, as shown below for this action's subsistence costs items:

Travels	<u>Trip no. 1 for project officer</u>	<u>Trip no. 2 for project officer</u>
<i>Partners</i>	Horsens	Horsens
<i>Cost categories:</i>		
Hotel cost:	0	0
Daily allowances/Payment for meals cost:	60	60
Local transportation costs:	40	40
Total subsistence cost:	100	100

Deliverables:

Action	Outputs
C23.1	1 report on Quantitative (statistical) clarification of the individual soil's infiltration capabilities by soil type mapping. 1 report on Quantitative correlation between the geological descriptions from the drillings and the soils' infiltration capabilities. 1 report on quantitative correlation between the soils' electrical resistivity and infiltration capabilities. 1 report on detailed infiltration potential map for urban development areas of Horsens. 1 guideline with process description of how the infiltration potential map can be prepared. Final report on C23.1

C23.2	Reports on best practices and guidelines for local management of precipitation in urban development areas. Stakeholders workshop. Report, which is published on the C2C CC website. Articles for international periodicals Results will be presented at conferences in Denmark and abroad.
C23.3	Knowledge sharing across municipalities and stakeholders. PPT. Presentations published on the C2C CC website. Complementary project description.

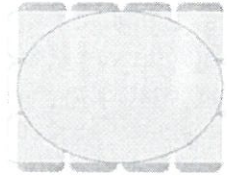
Milestones:

Action	Quantifiable milestones	Date by end of
C23.1.1	Phase 2 Report on quantitative clarification of the individual deposit's infiltration capabilities finalized.	31/12/2019
C23.1.2	Report on quantitative correlation between the geological descriptions from the drillings and the deposits' infiltration capabilities finalised	31/12/2019
	Report on quantitative correlation between the deposits' electrical resistivity and infiltration capabilities done.	31/12/2019
	Infiltration potential map for the urban development areas done.	31/12/2020
	Full overview of infiltration potentials in Horsens municipality finalised.	31/12/2020
	Integrated municipal plan in Horsens on how to use infiltration for future urban development drafted	31/12/2020
C23.2	Phase 2 Meetings with 200 stakeholders done One field trip to selected sites done Stakeholder integration of 200 stakeholders done	31/12/2020 31/12/2020 31/12/2020
	Workshops held and working groups met. Recommendations prepared for stakeholders	31/12/2020 31/12/2020
C23.3	Phase 2 and 3 Final stakeholder conference. 200 participants At least one pilot projects prepared.	31/12/2021 31/12/2021
	At least one project description ready for execution. Final review of the project done	31/12/2021 31/12/2021



C24: Climate history | culture history

Adding value to CCA coping strategies through coupled natural and cultural heritage



The aim of this project is to provide a historically informed and evidence-based dissemination platform for C2C Climate Challenge that facilitates citizen-near adaptation and long-term behavioural change. The project couples existing environmental and cultural historical datasets together in order to provide evidence-based snapshots of past environmental conditions and human responses. In order to create the necessary societal resilience, different coping strategies of past populations may give us concrete ideas for coping with CCA in a modern society. "Old-fashioned" coping strategies may entail a lot of knowledge and wisdom more or less directly applicable today, including such strategies where we adapt to natural conditions rather than fight them by constructing e.g. dykes and concrete barriers.

With a focus on hydrological changes in inland (river, lake) and coastal contexts, C24 connects directly with other C2C CC projects (e.g. C8) and makes use of existing dissemination platforms (e.g. Moesgaard Museum as well as C20, C21) in order to showcase the overall project nationally. At the same time, this project reaches out to a wider international network through workshops and participation in international conferences. Finally, the project will add value to C2C CC overall by translating climate history into components useable also in sustainable growth via tourism.

This project will support a broad understanding of our natural and cultural given conditions and help us to identify sustainable solutions. This action covers all aspects of C2C CC.

Main responsible beneficiary: Aarhus University

Budget: 136.288€

Number of days estimated spent on action in phase 1: 120 Days

Beneficiary responsible for implementation: Aarhus University (AU)

Role of AU

- Is the project manager
- Reports to C2C CC project-leader and cooperates with other C2C CC partners

Relation to cross-cutting capacity building actions (C1-C7)

Activity C24 Climate history | culture history will gain from actions under C1 relating to desk analysis and identification of knowledge gaps and reviews of in the risk maps. Experience will be exchanged on historical flood events between demonstration projects dealing with the coastal cities of Thyborøn, Horsens,

Randers and Juelsminde. A common understanding between stakeholders of sustainable solutions (economically, environmentally, socially and long term) with a focus on land use, cost-effective measures, planning, implementation, maintenance and operation will be shared and developed across actions and facilitated by CDR. Under C1 a workshop will be held to assess synergies and possibilities of integrated solutions for the fjords at the East Coast and the cities at the West Coast.

Under action C2 knowledge on CCA and rivers developed under different actions will be shared. Modelling, interpretations, analysis and data sampling are similar in the different catchments and C24 will benefit in general from this knowledge sharing. Under action C3, in selected areas a detailed local model is set up focusing on groundwater, surface and/or seawater. Models are based on the present data and collections of new data sets e.g. geophysical data and C24 may also benefit from this model.

Under Action C4 Rainwater, C24 may gain from the identification and experience and testing of SUDS within CDR.

Under action C5 specific training courses, workshops and masterclasses, with point of departure in the challenges experienced by the partners will be implemented for the benefit of action C24. Action C7 will aim at gathering useful information and best practices from cross-cutting demonstration activities, also potentially benefitting C24. C24 will connect directly with C8 during C2C CC.

Description (what, how, where and when):

Humans have lived in interaction with nature in the current Region of Central Jutland for over 13,000 years. Over this vast span of time, climatic and environmental conditions have changed dramatically – and people and societies have handled these changes in manifold demographic and technological ways. Environmental proxies (e.g. pollen, isotopes and sediments) from dated layers facilitate the reconstruction of the full spectrum of and baselines for local and regional landscape changes, while archaeological and historical sources document how people have adapted, or failed to do so, to these changes. Under the umbrella terms *environmental history* and *climate change archaeology* can be used for sketching a roadmap for possible future adaptations. This is particularly relevant as these inherently local and regional scenarios can supplement global models for future climate change; and local/regional narratives generate grass-roots citizen adaptation.

How societies have reacted to past climate-driven changes in the hydrological cycle provides a canvas for reflection on how present-day societies may adapt to similar changes predicted to occur under conditions of future climate change. The human presence in Europe has a long shared history and heritage, which is well-documented in often unique archaeological and historical cases. Thinking natural and cultural heritage together can create ecological as well as economic added value measurable through, for instance, the number of visitors to exhibitions and sales and readership statistics of publications generated by the present



project. This project design and outreach strategy could subsequently be exported to and copied by other relevant actors in Europe and elsewhere through knowledge sharing.

C24.1 *Landscape use and settlement patterns in the early Holocene in Central Jutland*

What

This sub-project focuses on how the earliest inhabitants of the Region of Central Jutland have handled changes in the hydrological cycle. For this period (10,000-6200 BCE) an enormous tsunami generated by a submarine landslide off the coast of Norway as well as marked changes in sea-levels and ground water levels are well-documented (figure 1). These environmental changes and their human impacts are well-researched elsewhere in Denmark (Frøer et al. 2015) and northern Europe (Bondevik et al. 1997; Smith et al. 2004), but only poorly known from Central Denmark. This sub-project therefore aims review and evaluate how people have reacted to these hydrological factors. Whilst these past changes are no direct analogues for future climate changes and adaptations, the reactions effected by these past inhabitants of Central Jutland could nonetheless function as a canvas for designing, debating and disseminating future solutions. Key focus areas will be the Region's fjords, islands and rivers, here especially the large inland lakes in the Silkeborg region, which are part of the Gudenå system.

How

C24.1 collates environmental and archaeological data from borings, and excavations performed outside this project, and from the existing Danish sites and monuments register for precise reconstructions of past environments and land-use, especially in the vicinity of water-near archaeological sites (e.g. in the Silkeborg and Herning regions, but also along the coasts). These data will offer temporally deep and local contexts for past and future climate and environmental changes, all with focus on groundwater and sea-level changes, storm surges and tsunami events.

Where:

The work will be conducted at Aarhus University in collaboration with the regionally responsible museums, which following the Danish legal heritage framework are charged with overseeing heritage research in their municipalities.

When

2017-2019: Data review period.

2019-2021: Dissemination period – results of the data review published in technical reports and for public dissemination. International and national conference presentations.

2021-2023: Outreach period – synthesis publication is being produced. This

publication presents both the results of the present action as well as the results of other C2C CC actions, all with an eye towards the future.

C24.2 Storm surges and tsunamis along the Central Jutland coasts in historical, landscape- and geo-archaeological perspective

What

This sub-project takes its starting point in the present and works backward in time. Drawing on meteorological, geological, archaeological and historical records, human settlement along the coasts as well as further inland will be systematically reviewed and translated into elements useable in C2C Climate Challenge outreach and climate tourism (figure 54).

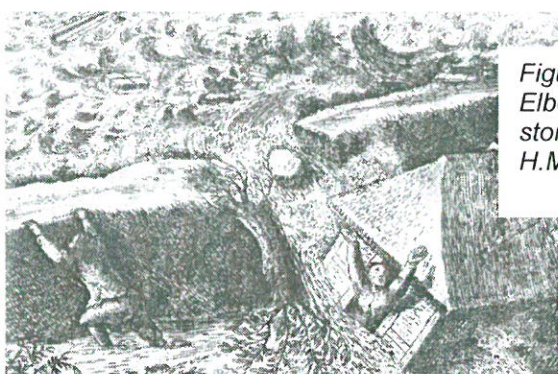


Figure 54: Dyke rupture at the River Elbe in northern Germany during the storm surge in 1661. Engraving by H.M. Winterstein.

Historical records about storm surges and corresponding flood pillars are well-known and well-documented in, for example, South Jutland, the Netherlands and Germany. In contrast, these same source data are much less systematically recorded and analysed in the Region of Central Jutland, but recent archaeological investigations of, for instance, the Nørre Vosborg manor hint at the impacts of storm surges on landscapes and people (Kock 2015).

How:

C24.2 involves the systematic collation of existing material regarding storm surges in the Region of Central Jutland.. This will be the first time, historical and archaeological as well as cartographic material will be presented and analysed together for this region and with a view towards using these data in contemporary discussions about sustainable coastal development. Comprehensive information on existing flood pillars that commemorate storm surge events will be collected (photographically and geo-referenced). Together with written reports and maps these will reflect the coupled natural and cultural heritage of past violent weather events. Dissemination will be through established digital channels for historical and cartographic materials, i.e. www.danmarkshistorien.dk and <http://historiskatlas.dk>. These are resource used extensively by high school students and teachers in particular. In addition, this sub-project will provide



background information for a coast-to-coast climate tourism cycling/kayaking route aimed at climate-interested and environmentally conscious tourists visiting the Region.

Where: AU

When

2017-2019: Review period – systematic review and digitization of information.

2019-2021: Publication period – results of the review are published in technical reports and for public dissemination. International and national conference presentations

2021-2023: Outreach period – synthesis publication is being produced. This publication presents both the results of the present action as well as the results of other C2C CC actions, all with an eye towards the future.

C24.3 *Citizen-near story telling and marketing of coupled culture and climate history*

What:

C24.3 focuses on innovative communication of the coupling between climate history and culture history via established cultural institutions, as well as the marketing of CC2 CC with an eye towards climate tourism. In particular, project C8 will function as a pilot where citizen-driven climate adaption will include an environmental and cultural-historical dimension. The results of the C24 sub-projects as well as other selected projects under the wider aegis of CC2 CC will be presented through exhibitions at CC2 CC's specific show cases – the Geopark Lemvig, the Climatorium and the AquaGlobe (C20, C21). Culture historical museums rarely focus on climate-related issues, past, present or future. Climate adaptation, however, is in part a cultural issue and this sub-project moves climate questions into cultural institutions, which have well-established interfaces with the local public at the local, regional, national and international levels as well as tourists. The aim of this sub-project is therefore to create democratic debate and long-term behavioural changes through communication and knowledge sharing, for instance, in relation to where we place settlements and how we relate to climate-related actions. The sub-project's focus on climate tourism will also strengthen local economies.

How

In line with recent initiatives at various museums internationally to tackle issue of climate change (e.g. Cameron et al. 2013), this project will create exhibitions and presentation materials that can be used to inform and involve citizens and tourists in climate issues in general and specifically in relation to the climate-related challenges and proposed solutions in the Region of Central Jutland. The sub-

project will be executed in collaboration with the Masters degree programme in Sustainable Heritage Management at Aarhus University and will be scaffolded by a series of stakeholder workshops with focus on the coupling between climate history and culture history. Coupled elements of cultural and natural heritage can serve as a source of specific climate-related identity-building and a platform for increasing climate literacy (see <http://cpo.noaa.gov/OutreachandEducation/ClimateLiteracy.aspx>), which in turn strengthens local resilience vis-à-vis future climate challenges. The exhibitions and presentation material will relate specifically to a coast-to-coast climate tourism cycling/kayaking route through the Region.

Where, Geopark Lemvig, Climatorium and AquaGlobe.

When:

2017-2019: Status workshop 1. Status workshop 1. Mapping the possibilities for a coast-to coast climate tourism cycling/kayaking route.

2019-2021: Status workshop 2. Concept development of an exhibition and attendant teaching resources. Production of a tourist brochure.

2021-2023: Status workshop 3. Exhibition and implementation of cycling/kayaking route.

Reasons why this action is necessary:

Danish landscapes are fundamentally cultural landscapes. Ecosystems in the Region of Central Jutland have been under the influence of people for a very long time indeed; they are both natural and cultural at the same time, and they can thus only adequately be understood using both natural science and human science methodologies. Geo-archaeology and environment history contribute to a more precise and temporally dynamic picture of these ecosystems. They thus also contribute to more robust baseline for these ecosystems and to how they may change under conditions of future climate change. It has been suggested that extreme hydrological and meteorological events in particular will occur more often and will become more extreme still in the future (Schiermeier 2011; 2012). But precisely these kinds of extreme events have hitherto been so rare that only a more long-term perspective can reveal how they have impacted the coupled cultural and natural histories in the Region. Previous research has shown that narratives of the local and thereby intimate relationships between climate, environment and culture stimulate similarly local changes in attitude and behaviour (Carter & van Eck 2014).

Cultural heritage is a known source of local, regional and national identity-building, not least in relation to climate and climate change (see Harvey & Perry 2015). Identity and a sense of history thus play a role in local and regional climate adaptation matters. This is illustrated by several case studies throughout Europe, some specifically relating to hydrological issues (Stelljes & Martinez 2013 – see



especially the Timmendorf case study). The implementation of the action's teaching materials will contribute to the C2C CC's overall aim of long-term and citizen-borne climate adaptation.

Constraints and assumptions

We are facing a number of constraints regarding our plans for Phase 2.

Firstly, we have not been able to establish a cooperation with historiskatlas.dk, as we had hoped. This means that a bigger part of our public outreach will shift to [Danmarkshistorien.dk](http://danmarkshistorien.dk).

Secondly, the order of our actions within C24 has been altered. At the time of writing, we are further along with the exhibition and dissemination than we had planned: The first deliverable (via danmarkshistorien.dk) is published and the exhibition in the AquaGlobe (C20) is scheduled to open in late 2018 or early 2019. There has been less focus on climate tourism in Phase I.

Note also that exhibition planning at the Klimatorium (C21) is incipient as this is not scheduled to open before 2020.

Additionally, we may experience a potential workload bottleneck when the currently employed C24 staff contract ends in the summer of 2019. In such an event C24 senior staff would have to increase project contribution or deliverables downscaled according to the resource situation at hand, or additional funds may need to be found within the C2C CC project.

Expected results:

The coupling of natural and cultural heritage provides a platform for disseminating and discussing the challenges, knowledge and solution options, all in a close relationship to the citizens concerned (i.e. local museums, libraries, schools). In this way, coupled natural and cultural heritage adds value to any adaptation initiative, especially when seen in a longer-term perspective where education and knowledge sharing play decisive roles. Research shows that there is a clear relation between local/regional identities and historical and archaeological narratives. This relationship can be employed in achieving long-term behavioural changes via small changes in thought and action (the so-called nudging principle: <http://blog.nature.org/science/2014/04/26/environmental-sustainability-nudges-economics-paul-ferraro/>) at the same time as dissemination activities via museum strengthen the synergy between cultural and natural heritage in the Region.

Cost estimation

The primary expenses in this action are work hours (see the detailed budget) for data review, dissemination/outreach work and Archaeological IT consulting (<http://www.arkaeologi.dk/it/>).

Workshops 1-3.

Production costs for dissemination material (calculated from www.onlineprinters.dk).

Miscellaneous transport and travel costs, calculated after current rules and regulations for public servants (see <http://hr.modst.dk/Service%20Menu/Love%20regler%20og%20aftaler/Circular/2016/001-16%20-%20Satsregulering.aspx>).
Materials for exhibitions (best estimate).

Deliverables:

Action	Deliverables
C24.1 and C24.2	<p>Phase 2 and beyond:</p> <p>Two reports distributed across Sub-projects 1 and 2 (30/10/2019): I) Storm surges and human impacts on the west coast of Denmark as seen through historical maps and records, in Environment & History; II) A record of past storm activity in the eastern North Sea, in Climate of the Past.</p> <p>Three outreach reports distributed across Sub-projects 1 and 2 (30/10/2019): I) Miljøets rolle i Danmarkshistorien, i www.danmarkshistorien.dk; II) Vejrudsigten anno 1258, in Skalk; IV) Past storm activity as seen through historical maps, in www.sciencenordic.com.</p> <p>Note that the specific titles or venues of these deliverables may be subject to change. We aim to publish our deliverables in the aforementioned venues but this is subject to editorial decisions and hence cannot be guaranteed. In the event of rejection, we will aim to publish in similar alternative outlets.</p>
C24.3.	<p>Phase 2 and beyond:</p> <p>One report and one exhibition pamphlet for Sub-project 3 (30/10/2020: Klimahistorie kulturhistorie – merværdi gennem koblingen mellem natur- og kulturarv, in Nordisk Museologi. Exhibition pamphlet: Yesterday – today – tomorrow: Facing the climate challenges of the future.</p> <p>Teaching materials regarding climate and environmental history for high school level (31/10/2021).</p> <p>Climate tourism brochure for the Region (31/10/2021).</p> <p>Exhibition about climate history and culture history in the Region of Central Jutland (31/10/2022).</p> <p>A synthetic popular science book on climate and culture history in the Region of Central Jutland, which portrays the efforts and results of selected actions under the umbrella of C2C CC (31/10/2023).</p>

Milestones:

Action	Quantifiable milestones	Date by end of
C24.1	<p>Phase 1 (2017-2019)</p> <p>Milestone 1.I – Nomination of staff responsible for Sub-project 1</p> <p>Milestone 1.II – data review complete (30/6/2019)</p> <p>Phase 2 (2020-2021)</p> <p>Milestone 2.I – target publications complete</p> <p>Milestone 2.II – conference presentation delivered</p> <p>C2C CC phase 3 (2022-2023)</p> <p>Milestone 3.I – the synthesis over the Region's coupled natural and</p>	<p>31/3/2017</p> <p>30/6/2019</p> <p>31/10/2021</p> <p>31/10/2021</p>

	cultural heritage and the C2C CC contributions published	31/12/2023
C24.2	<p>Phase 1 (2017-2019)</p> <p>Milestone 1.I – Nomination of staff responsible for Sub-project 2</p> <p>Milestone 1.II – digitisation of historical maps and records complete</p> <p>Phase 2 and beyond</p> <p>Milestone 2.I – target publications complete</p> <p>Milestone 2.II – conference presentation delivered</p> <p>Milestone 3.I – the synthesis over the Region's coupled natural and cultural heritage and the C2C CC contributions published</p>	<p>31/3/2017</p> <p>31/12/2018</p> <p>31/10/2021</p> <p>31/10/2021</p> <p>31/12/2023</p>
C24.3	<p>Phase 1 (2017-2019)</p> <p>Milestone 1.I – Nomination of staff responsible for Sub-project 3</p> <p>Milestone 1.II – Workshop 1: Coupling of cultural and natural history in the Region</p> <p>Phase 2 and beyond</p> <p>Milestone 2.I – Workshop 2: The role of cultural heritage in climate adaptation</p> <p>Milestone 3 – Climate history brochure for the Region complete</p> <p>Milestone 2.I – Workshop 3: Museums and climate adaptation</p> <p>Milestone 2.II – Exhibition opens</p>	<p>31/3/2017</p> <p>1/6/2019</p> <p>1/6/2021</p> <p>31/10/2021</p> <p>1/6/2022</p> <p>31/10/2022</p>

