LIFE 2015 INTEGRATED PROJECTS

CLIMATE ACTION

LIFE15 IPC/DK/000006 – EU LIFE IP C2C CC

Part C

LIFE Integrated Projects 2015

Climate Action

Stage 2 – Full proposal

TECHNICAL APPLICATION FORMS

Part C – detailed technical description of the proposed actions

Important notes:

- **All calculations and detailed cost breakdowns necessary to justify the cost of each action should be included in the financial forms F. In order to avoid repeating the financial information (with the risk of introducing incoherencies), Part C should only contain financial information not contained in the financial forms (e.g. details explaining how the cost of an action has been estimated).**
- **All forms in this section may be duplicated, so as to include all essential information.**
- **Each action described should have a clear indication of its physical target (e.g., action 1 will take place in area "X" and/or will target species "Y"). Whenever this is relevant, the location of these actions should also be identified on one or several maps which must be provided in annex.**
- **Any action that is sub-contracted should be just as clearly described as an action that will be directly carried out by the beneficiaries.**

DETAILS OF PROPOSED ACTIONS

A. Preparatory actions (elaboration of management/action plans, obtaining licences and permits, trainings, etc.)

Beneficiary responsible for implementation: C2C project management (PM)

Role:

- To carry out preparatory actions
- To coordinate with C2C CC beneficiaries and stakeholders
- To have dialogue with national ministries and agencies

A1. Legal barriers to integrated CCA, current CCA integration and policy recommendations

Budget: 17.130€

Number of days estimated spent on action in phase 1: 40 Days
What:

One of the major barriers for implementation of CCA plans can be found in the legal framework for municipalities', wastewater companies' and citizens' rights and obligations. This action has a double purpose: on the short run, to provide decision makers of partner municipalities with (equal) knowledge on legal barriers and past practice, and, on the longer run, to generate policy recommendations to legal changes. Both objectives are prerequisites to better CCA implementation: optimized information will make it possible for municipalities to better implement actual plans, whereas changes to existing regulation will optimize implementation in the longer run.

Since regulation of CCA is a relatively new phenomenon, legal barriers can be found within all spheres of the hydrological circle: sea and fjords, rainwater, groundwater, as well as lakes and rivers. Contending issues cover: who should pay for CCA? What are municipalities/wastewater companies/citizens allowed/obliged to do? Does CCA conflict with regulation in other (e.g. environmental) areas?

Regarding sea and fjords, holistic solutions against storm surges are hindered by inexpedient division of responsibilities between citizens and authorities; conflicting view of nature vs. efficient adaptation, multi-level governance, municipalities' conflict of role as owner vs. regulator, etc. In addition, coastal regulation is very complex, which is a burden to CCA projects.[1]

Regarding rainwater, a major issue concerns the responsibilities and possibilities of the wastewater companies in participating in CCA projects in the municipalities. The newest legal regulations enabled wastewater companies a new co-financing role in CCA projects,

[1] Rambøll, 2015 pp. 31 ff

but these regulations suffer significant limitations, which have proven an intricate challenge for the companies, while their incentives to initiate new projects appear hamstrung by municipally conditions of a political and technical nature. Hence, many wastewater companies still use the traditional or the quality project model for financing CCA related projects.

Regarding lakes and rivers, CCA is not yet legally part of the WFD and the river basin management plans. Some CCA means are not coherent with the river basin management plans, e.g. in relation to the hydrological impact of a watercourse, and the balance between watercourse ecology and CCA. However, several means can be implemented with synergies to both CCA and watercourse ecology e.g. wetlands and meadows, and within the frames of the river basin management plans.

Regarding groundwater, CCA in regard of SUDS conflicts with groundwater protection in regard to infiltration of rainwater from roofs and roads and potential pollution of the groundwater resource, which hinders implementation of SUDS in areas with vulnerable groundwater resource. In regard to flooding caused by rising groundwater level, CCA means are only in the very beginning to be defined in the Danish context, and legislative conflicts may occur during the IP life time.

This action feeds directly into E3.1 and indirectly to all C and D actions.

How:

1. Conduct a thorough desk analysis of the legal framework, review all relevant documents relating to the water sectors, and gather information related to challenges in other EU countries' legal systems
2. Prepare a presentation on this extensive topic to be presented at a seminar in June 2017 (cf. E3.1)

Where:

The premises of the C2C CC secretariat

When:

Phase 1: 1/1/2017-31/3/2017

Reasons why this action is necessary:
This preparatory action is necessary as it provides crucial information to the consortium on legal barriers, CCA integration and on possible policy recommendations. The C2C CC partners need this information as background knowledge in order to work towards successful integration of CCA into the planning process and to accommodate any potential issues on this.

Constraints and assumptions
Any significant constraints are not expected for this action.

Expected results:
The expected results are a comprehensive understanding og the legal framework on CCA, the water sector and relevant practices of other EU countries' legal systems, and capacity building of C2C CC partners on how to navigate national legislation on CCA.

Cost estimation:
Based on working days, will salary of 47 € per hour and 347347,5 € per day per senior employee and 35 € per hour and 259 € per day per junior employee. External assistance is based on prior experience.

Estimation of the costs for the total project management staff is based upon prior experience from other similar projects. The previously mentioned CDR staff assigned the action will correspond to the budget categories of academic senior and academic junior, where their more specific tasks described above further subdivides them into additional costs categories. The days assigned to each the academic senior and academic junior category types in the budget are considered to cover the staff assigned for the actions mentioned above and the actual costs will be defined in the employment phase.

Deliverables:

Action	*Deliverables*
A1.1	A memo sent to the beneficiaries explaining what the main findings of the research is and how the project management unit plans to present this in a clear and concise way at the seminar (E3.1)
A1.2	PowerPoint presentation

Milestones:

Action	*QuantifiableQuantifiable milestones*	*Date by end of*
A1.1	Desk research and interviews are conducted before this date	31/5/2017
A1.2	PowerPoint presentation is ready	31/5/2017

A2. Analyse state-of-the-art of current mainstreaming of CCA into local planning and possibilities for cross-sector cooperation

Budget: 17.130€

Number of days estimated spent on action in phase 1: 40 Days

What:

Danish municipalities are obliged to integrate and mainstream CCA into local planning. As a result of very different experiences with climate change, political attention, and capacities at their local level, municipalities have developed very different approaches to mainstreaming. Consequentially a significant need for obtaining knowledge of what constitutes best practice for mainstreaming CCA exists. It is therefore relevant to analyse which approaches the municipalities use, and how this affects the mainstreaming of CCA plans into their local planning. CDR has created a CCA template, which can also be used in this regard to further raise the level of CCA planning in the region.

Municipalities face major coordinating challenges in several sector areas: Within the environmental sector, challenges arise in coordinating the local plans and strategies.

Secondly, in the coordination of the environmental area's plans and strategies with other sectorial areas. Some municipalities even apply a trial-and-error approach to using local plans as a toolkit to further CCA integration, which might be suboptimal. Lack of interdisciplinary and inter-sectoral cooperation is another challenge, which inhibit CCA mainstreaming. This is especially the case in larger municipalities having extensive specialised units and personnel with diverse professional background. It creates a lack of unified perspective and an environment infused with multiple – and often conflicting – interests. This especially materialises in abstract strategic planning, and less so in concrete projects. An understanding of how cross-sector cooperation is dealt with will provide a strategy (including tangible toolkit) for dealing with this and to ensure that cooperation with other sectors is ensured and prioritised in C2C CC. Beneficial possibilities for cross-sector cooperation remain potentially great and further analyses of CCA mainstreaming and cooperation could prove advantageous for applying best-practices in future CCA mainstreaming.

This action feeds into C1-C24

How:

1. Gather best practices at local, national and European level in order to present information on how CCA is being mainstreamed into local planning (desk research). Research will focus on Denmark and countries with a comparable climate and political environment. Issues of particular interest are among others:

    - Cross-sector co-opertion and network/cluster formation
    - Mainstreaming (formalised) into local regulation vs. informal cooperation fora as a means of co-creation among stakeholders
    - Ad hocism (CCA projects)

2. Research cross-sector cooperation and the challenges, which are found in this area
3. Create a presentation to be used at the seminar in June 2017 (cf. E3.1) informing the consortium about the information and conclusions of the research

Where: The premises of the C2C CC secretariat

When:

Phase 1: 1/1/2017-31/12/2017 (this activity will take place throughout the project period, however, the main work load is placed in the first year of the project)

Reasons why this action is necessary:
Danish municipalities face many obligations and challenges in regards to CCA. Many of the C2C CC partners are municipalities, and as the overall objective of C2C CC is to support the full implementation of the municipal CCA plans, it is crucial to gain an understanding of these challenges at an early point in the IP's lifetime.

Constraints and assumptions
No significant constraints are expected for this action.

Expected results:

The results are a comprehensive understanding of what successful CCA mainstreaming entails and how to incorporate cross-sector cooperation. Capcity building of CCA partners and stakeholders on how they mainstream their CCA actions into other planning.

Cost estimation:
Based on working days, will salary of 47 € per hour and347,5€ per day per senior employee and 35 € per hour and 259 € per day per junior employee. External assistance is based on prior experience.

Estimation of the costs for the total project management staff is based upon prior experience from other similar projects. The previously mentioned CDR staff assigned the action will correspond to the budget categories of academic senior and academic junior, where their more specific tasks described above further subdivides them into additional costs categories. The days assigned to each the academic senior and academic junior category types in the budget are considered to cover the staff assigned for the actions mentioned above and the actual costs will be defined in the employment phase.

Deliverables:

Action	*Deliverables*
A2.1	An overview of best practices in relation to CCA mainstreaming at local, national and European level
A2.2	A strategy on how to work with cross-sectoral cooperation
A2.3	A PowerPoint presentation

Milestones:

Action	*QuantifiableQuantifiable milestones*	*Date by end of*
A2.1	The desk research is conducted before this date	31/12/2017
A2.2	The strategy on cross-sectoral cooperation is drafted and ready to be presented at the forthcoming seminar (cf E3.1)	31/05/2018
A2.3	The PowerPoint presentation is ready	31/05/2018

A3. Collect existing data analyses and reports about the region as basis for integrative CCA planning and combine data in a common database

Budget: 17.130€

Number of days estimated spent on action in phase 1: 40 Days

What:

This background knowledge will help provide an indication on how to enable new planning and governance in the region, and it will provide best practices from other countries, e.g. the Rivers Trust project from the UK (an approved LIFE IP from 2014) and on relevant topics such as water areas/themes in connection with the River Basin Management Plans. Furthermore, a thorough understanding of all relevant EU directives, policies and strategies needs to be obtained by the project management unit, so it understands the context in

which the project operates. All cross-cutting capacity building actions and demonstration projects will need access to this information in an easy and accessible way and the accumulated information will therefore be made available in a database on the online platform (cf. E2.1), which can be accessed from the project's website via the intranet for the project partners.

This action feeds into C5.1.1 (*New paradigm and a common regional strategy integrating municipal CCA plans*) and it is important to ensure that all the sub-projects/demonstration projects have access to up-to-date knowledge in the area.

How:

1. Conduct desk research
2. Conduct interviews with regional and municipal officials

Where: At the premises of the project management unit

When: Phase 1: 1/1-2017 – 31/07/2017

Reasons why this action is necessary:
It is crucial to collect existing data analyses and reports about the Central Danish Region in relation to integrative CCA planning to ensure that the project management unit and all partners have the necessary knowledge.

Constraints and assumptions
No significant constraints are expected for this action.

Expected results:
Comprehensive data analyses and reports that together with regional and municipal officials' opinions and experiences with CCA planning provide basis for integrative planning in the region.

Cost estimation:
Based on working days, will salary of 47 € per hour and347,5€ per day per senior employee and 35 € per hour and 259 € per day per junior employee. External assistance is based on prior experience.

Estimation of the costs for the total project management staff is based upon prior experience from other similar projects. The previously mentioned CDR staff assigned the action will correspond to the budget categories of academic senior and academic junior, where their more specific tasks described above further subdivides them into additional costs categories. The days assigned to each the academic senior and academic junior category types in the budget are considered to cover the staff assigned for the actions mentioned above and the actual costs will be defined in the employment phase.

Deliverables:

Action	*Deliverables*
A3.1	A database showing information from previous data analyses and reports
A3.2	A document showing both quantitative answers from the interviews, e.g. in statistics, and qualitative answers in full text

Milestones:

Action	*QuantifiableQuantifiable milestones*	*Date by end of*
A3.1	Desk research is conducted before this date	31/03/2017
A3.2	Interviews are conducted before this date	31/03/2017

A4. Interview municipal and utility officials

Budget: 21.065 €

Number of days estimated spent on action in phase 1: 20 Days

What:

After the initial desk research and review of current mainstreaming of CCA into local planning, the project management unit will interview municipal and utility officials in order to understand how these work with - and around - the legal barriers to integrated CCA planning. The PM will schedule the interviews at the officials' workplaces, and will schedule at least one interview per C2C CC municipality and per water utility. The interviewees will help identify where policy/legislation is a barrier to CCA planning and they are also able to make recommendations on methods to address these barriers. The interviews will be qualitative in nature in order to obtain as much information as possible from the interviewees. After all interviews are conducted, the answers will be analysed and when relevant translated into quantitative data. The conclusions from this research will be presented at the forthcoming seminar, cf. E3.1.

This action feeds directly into E3.1 and indirectly into C1-C24

How:

1. Conduct interviews with municipal and water utility officials
2. Analyse the interviewees' answers and convert these into quantitative and qualitative data
3. Present the research and conclusions at the forthcoming seminar (cf. E3.1)

Where: This activity takes place throughout the region of Central Denmark.

When: Phase 1: 1/4/2017-31/5/2018

Reasons why this action is necessary:
The initial desk research described in the previous A-actions are mainly focused on desk research, however, after information about legal barriers and existing and current mainstreaming of CCA has been reviewed, it is necessary to meet with and interview municipal and utility officials in order to understand how these work with the legal barriers to integrated CCA planning

Constraints and assumptions
All interviewees will need to allocate time for the interviews, however, in order to ensure as many as possible can take part in these, the duration of the interviews will be kept at approximately 30 min. It is therefore assumed that all relevant officials can take part in the research.

Expected results:
Quantitative and qualitative insight and overview of municipal and water utility officials' way of working and experiences with CCA integration, and presented to C2C CC as background information of current practice.

Cost estimation:
Based on working days, will salary of 47 € per hour and347,5€ per day per senior employee and 35 € per hour and 259 € per day per junior employee. External assistance is based on prior experience.

Estimation of the costs for the total project management staff is based upon prior experience from other similar projects. The previously mentioned CDR staff assigned the action will correspond to the budget categories of academic senior and academic junior, where their more specific tasks described above further subdivides them into additional costs categories. The days assigned to each the academic senior and academic junior category types in the budget are considered to cover the staff assigned for the actions mentioned above and the actual costs will be defined in the employment phase.

Deliverables:

Action	*Deliverables*
A4.1	A script used for conducting the interviews
A4.2	A document providing an overview of the answers (quantitative and qualitative)
A4.3	A PowerPoint presentation used to disseminate the information

Milestones:

Action	*QuantifiableQuantifiable milestones*	*Date by end of*
A4.1	The interview script is drafted	15/04/2017
A4.2	The document is finalised providing an overview of the interviewees' answers	31/05/2018
A4.3	The presentation is done for the seminar cf. E3.1	31/05/2018

A5. Start dialogue with Local Government Denmark (LGDK) and relevant ministries and agencies

Budget: 10.598 €

Number of days estimated spent on action in phase 1: 20 Days

What:

Local Government Denmark (LGDK) is the interest group of Danish municipalities and it therefore important to keep it informed on C2C CC objectives to ensure, that it provides support to a regional project involving almost 20 % of all Danish municipalities. LGDK is furthermore an important forum when it comes to replication and disseminating information about the project and how the results can be replicated in other parts of Denmark.

In Denmark, the relevant ministries for the C2C CC project are:

- the Danish Ministry of Energy, Utilities and Climate
- the Ministry of Environment and Food of Denmark
- the Ministry of Business and Growth Denmark

Two government agencies are primary stakeholders in C2C CC, i.e. the Danish Coastal Authority and the Danish Nature Agency. These are both agencies of the Ministry of Environment and Food of Denmark.

How:

1. Start dialogue with LGDK (continuous activity throughout the project period). Pinpoint contact persons and hold meetings to ensure the full backing of the municipalities' organisation in a project, where the overall objective is to support the full implementation of municipal plans.
2. Start dialogue with relevant public authorities (continuous activity throughout the project period). Hold meetings with the abovementioned ministries, including the corresponding relevant agencies to present the progress and more technical aspects of the project (e.g. C1-C24). In addition, these meetings are important forums for creating awareness and disseminating information about achieved milestones and results.

This action feeds into C1-C24 and F actions.

Where: This action takes place throughout Denmark as LGDK and the ministries are located in Copenhagen.

When: 1/1/2017-31/12/2022

Reasons why this action is necessary:
It is relevant – and necessary - to have the backing of the municipalities' organisation and the public authorities in Denmark when it comes to dissemination and progress reporting to external stakeholders. Despite the fact that this is a regional project and that some of these stakeholders are not included as primary stakeholders in C2C CC, it is important to include them as CCA is an issue which needs to be raised at the highest administrative level, and not merely at municipal and/or regional level.

Constraints and assumptions
It is assumed that C2C CC will have the interest of the public authorities in Denmark and that these stakeholders can see the value of supporting it and potentially assisting with dissemination activities. As no other region in Denmark is conducting such an extensive CCA project, the consortium expects a lot of focus to be given to the Central Danish Region.

Expected results:
The results of preparatory actions are an insight and overview of the legislative and practical barriers and challenges for CCA implementation. Officials within LGDK and relevant national ministries and agencies are pinpointed and a line of dialogue is established to ease implementation of CCA. Capacity building of C2C CC partners and stakeholder on how to navigate legislation and praxis.

Cost estimation:
Based on working days, will salary of 47 € per hour and347,5€ per day per senior employee and 35 € per hour and 259 € per day per junior employee.

Estimation of the costs for the total project management staff is based upon prior experience from other similar projects. The previously mentioned CDR staff assigned the action will correspond to the budget categories of academic senior and academic junior, where their more specific tasks described above further subdivides them into additional

costs categories. The days assigned to each the academic senior and academic junior category types in the budget are considered to cover the staff assigned for the actions mentioned above and the actual costs will be defined in the employment phase.

Deliverables:

Action	*Deliverables*
A5.1	A memo is sent round to the C2C CC partners stating the names of the contact persons and what meetings are foreseen in the first year
A5.2	A memo is sent round to the C2C CC partners stating the names of the contact persons and what meetings are foreseen in the first year

Milestones:

Action	*QuantifiableQuantifiable milestones*	*Date by end of*
A5.1	Initial contact is made with LGDK and the first meeting is set up	31/03/2017
A5.2	Initial contact is made and the first meetings are set up	31/03/2017

C. Concrete implementation actions

This section will present the 24 actions (7 crosscutting capacity building actions and 17 demonstration actions).
Table 4 provides an overview of the C-actions, the responsible associated beneficiaries and which other actions, the individual action is linked to.

Table 1: Overview of the C-actions

Action	Action short name	Partner name	Primarily linked to actions
Cross-cutting capacity building actions			
C1	Sea and Fjords	CDR	C8, C9, C10, C11, C12, C14, C16, C17, C18, C21, C24
C2	Lakes and Rivers	CDR	C10, C12, C13, C14, C15, C16, C19, C20, C21, C24
C3	Groundwater	CDR	C8, C10, C15, C17, C18, C20, C23,
C4	Rainwater	CDR	C10, C14, C15, C16, C17, C19, C20, C22, C23, C24
C5	Governance	CDR	C8, C9, C11, C12, C13, C14, C15, C16, C17, C18, C19, C24
C6	Tools	CDR	C10, C11, C13, C14, C17, C18, C19, C22, C24
C7	Innovation	CDR	C15, C20, C21, C22, C23, C24
Regional actions dealing mainly with the open land			
C8	Håb til Håb	HEDKOM	C1, C3, C5, C24
C9	Thyborøn Channel and the Western Limfjord	LK, HbK, MK, SKK, STK, TK, VHK + LVS, MF, SKV, STF, TV, VESTF, VV	C1, C2, C5
C10	The Grenaa Catchment	NDK, SDK	C1, C2, C3, C4, C6
C11	Randers Fjord	NDK, RK	C1, C2, C5
C12	The River Gudenå	SIK, FK, HEDKOM, Horsens, RK, SFV, SK-KOM, VK	C1, C2, C5
C13	The River Storå	HK, HbK	C2, C5, C6
Regional actions dealing mainly with urban areas			
C14	Horsens Town Centre	Horsens	C1, C2, C4, C5
C15	CCA in Hedensted og Tørring	HEDKOM	C2, C3, C4, C5
C16	Climate Ribbon	Rk	C1, C2, C4, C5, C7
C17	Thyboron City and Harbour	LK, LVS	C1, C3, C4, C5, C6
C18	Citizen driven CCA in Juelsminde	HEDKOM	C1, C3, C5,
C19	SUDS as recreational elements	SAK	C2, C4, C5, C6

Cross-cutting innovative actions			
C20	Aqua Globe	SFV	C2, C3, C4, C7, C21
C21	Climatorium	LVS	C1, C2, C7, C20
C22	Permeable coating	VIA	C4, C6, C7, C23
C23	Potentials for increased infiltration	VIA	C3, C4, C7
C24	Climate history	AU	C1, C2, C3, C4, C5,C7, C8

***ACTION C1*: Sea and Fjords**

Beneficiary responsible for implementation: Central Denmark Region

Budget: 132.723 €

Number of days estimated spent on action in phase 1: 150 Days

Role: C2C CC project management (CDR) take on the role as a facilitator, coordinator and networking body of the CCA activities.

Relation to CCA plans:
14 out of the 21 municipalities as well as 4 risk management plans mention flood risk from the sea and fjords as a major challenge in their CCA plans (cf. Figure 1). In the region, two cities are appointed to be risk-prone from the sea or fjords with reference to the EU floods Directive, these being Randers and Juelsminde. In Randers the flood risk is related to sea level rise, storm surges and combined events between river and fjord. In Juelsminde the risk is related to sea level rise and storm surges. Besides these two areas, the land facing the western part of the Limfjord is already experiencing flooding from storm surges regularly, especially during autumn and winter storms.

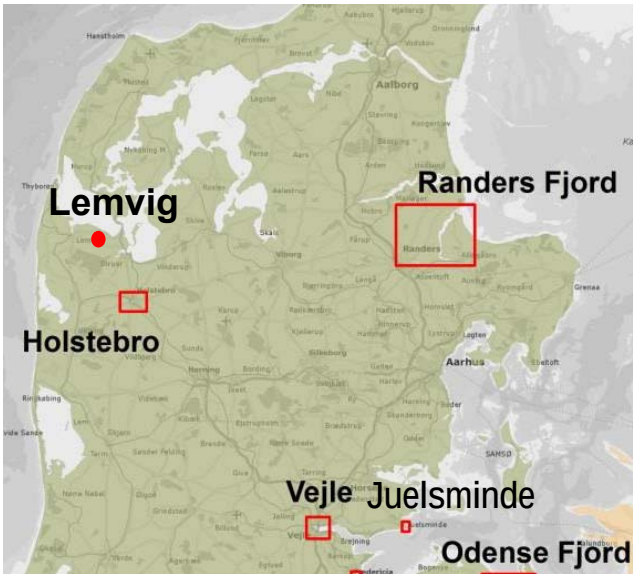


Figure 8: Risk Management plans under the EU Floods Directive in Central Denmark Region. The city Vejle is situated just south of Central Denmark Region, in South Denmark Region.

Linked to Complementary Actions
CCA in coastal urban areas: Urban development and construction project on CCA of an urban area facing the sea. Realdania's forthcoming programme focuses on coastal urban areas, and a project within the region will support the IP by making an urban area resilient towards flooding from the sea. [Funded by Realdania].

Description (what, how, where and when):
The region has approximately 1000 km of coastline and is experiencing increasing challenges related to storm surges. The largest event occurred in relation to the December

storm in 2013 (in Denmark the storm was named Bodil), with the highest registered water level in Lemvig with 195 cm above normal and just 10 cm from flooding a recently established floodwall in Lemvig (cf. Figure 9). The increasing power of the storms due to higher sea temperatures are already experienced in Denmark and among the region's coastal areas. Sea level rise will only increase the risk of flooding of coastal habitats and livelihoods.

The objective of this action is: To increase the coastal resilience taking into consideration the environmental state and marine biodiversity and to enhance urban resilience.

Figure 91: Lemvig floodwall during the December Storm, December 2013.

C1.1 The CCA challenges of the coastlines:

What:

Many of the cities in the eastern part of the region are facing the sea of Kattegat, the landscape is formed by the ice age and is characterized with fjords and/or small river deltas. These cities experience similar challenges in handling coastal flooding. Municipalities are not always using the same climate scenarios in their risk maps, and thus may plan for preventive actions differently, e.g. two neighboring municipalities may both plan to establish dikes along the coast, however, not following the same climate risk scenario. There is a need to create an overview of the used climate risk scenarios and planned actions, and to establish fora for the municipalities to coordinate both design measures for preventive action and timing of implementation. The coordination of east coast plans and actions has specific attention in the IP (cf. actions C8 and C11).

At Thyboron Canal and Western part of the Limfjord the challenges are unique due to the location of an emergency harbor in Thyboron for ships in distress with a need for access to The North Sea, through Thyboron Canal. The canal is impacted by erosion and sedimentation from the increased number and size of storms, and the maintenance of the canal impacts the water ecology of Western Limfjord. This west coast area has specific attention in the IP (cf. actions C9 and C17).

The challenges are different at the West Coast, the Danish Coastal Authority has for years had the responsibility for coastal protections in this area, spending millions of Euros on sand feeding along the coast, and establishing and maintaining dikes and sluices to protect towns and land. This area thus has less attention in the IP.

How:

1. Desk analysis and identification of knowledge gaps; CDR will review the CCA and risk management plans and gather knowledge in similarities and differences in the risk maps and planned actions. Knowledge across the CCA plans and risk management plans on the challenges and planned actions to handle increased storm surges and sea level rise have not yet been gathered. Related to this action are demonstration projects C8, C10, C11, C14 and C18 dealing with the cities of Juelsminde, Horsens, Randers and Grenaa. Experiences of these projects will benefit other coastal cities at the east coast, as well as benefit the five actions.

2. CDR facilitates common tenders and procurements, and gather national and international inspirational experiences to be disseminated at common meetings. Dialogue with partners on which capabilities and experiences which may provide some common benefits and contribute to tackling the challenges.

3. Study tour: Bustrip to Germany and The Netherlands to study CCA solutions on coastal challenges. CDR has good experience in facilitating and organizing similar study trours with visit to a number of important CCA sites and organizations responsible for implementing actions. Other Relevant cross-cutting actions (C2-C7) may benefit from a study your, which may easily cover other important aspects of CCA from lakes and rivers to innovation.

4. Workshop: Creation of 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. Relevant actions (C8, C9, C10, C11, C14, C17, C18) are challenged by the C2C advisory committee and CDR facilitates the dialogue.

5. Workshop: Developing and testing different organizational and management models for integrating and sustaining collaboration between stakeholders: citizens, associations, organizations, authorities and businesses with the aim of raising the quality of stakeholder collaboration and integrated coastal zone management.

6. Workshop: To assess synergies and possibilities of integrated solutions for the fjords at the East Coast CDR will host a one day workshop for the municipalities to discuss how to coordinate future actions related to flooding along the east coast, and how to integrated this coordination in future CCA- and risk management plans.

7. Gathering of best practice experiences, dissemination and preparation for replication. Extra efforts are made for replication to other regions (nationally and internationally) and to other CCA associations (e.g. Vand I Byer and KLIKOVAND)

8. At the end of each phase, an evaluation and assessment with focus on the needs on future integrated cross partner actions within will be conducted. This done to secure the direction and processes are carried out in the right way.

Where: CDR

When:
Phase 1: Activity 1-3 and 8
Phase 2: Activity 4-5 and 8
Phase 3: Activity 6-7

C1.2 Interaction between rivers and coastline

What:
The catchment areas of the fjords at the east coast of the region cause challenges with flooding in the coastal towns located at the mouths of rivers and in the bottom of the fjords. The challenges arise especially in coupled events combining heavy rains and storm surges. Solutions may be found in a combination of measures. Dikes and sluices may trap water from the catchment and cause flooding behind the coastal protections. Solutions to retain surface water upstream such as large wetlands may prevent floodings from heavy rains. A combination of solutions may have multiple purposes Actions C9, C10, C11, C12 and C13 may benefit from this action.

How:

1. CDR will facilitate knowledge sharing meeting for the project groups of action C9, C10, C11, C12 and C13 during the start-up of the actions. Experiences are drawn from the project 'Water from the country side' (Vandet fra landet) and international projects such as the Dutch project "Room for the river" project (www.ruimtevoorderivier.nl/meta-navigatie/english/room-for-the-river-programme/)
2. An afternoon workshop for all partners and municipalities in the region on the results and experiences drawn from the projects.
3. Dialogue on the establishment of a permanent Danish integrated river-coastline network among municipalities and other stakeholders. Focus on organization, objectives and funding.
4. At the end of each phase, an evaluation and assessment with focus on the needs on future integrated cross partner actions within will be conducted. This done to secure the direction and processes are carried out in the right way.

Where:
CDR – location not decided, meeting rooms of CDR or the Municipalities, alternatively conference facilities organized through procurement agreements of CDR.

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

Reasons why this action is necessary:
Within CDR, major areas are affected during storm surges, which due to climate change are increasing in intensity and frequency. Tabel 5 and figures 10-13 shows the affected

areas of a 100 year stormsurge event in 2050. There is a risk that each municipality define and construct solutions for coastal protections without regards to neighboring municipalities and/or sustainability and long term effects. Capacities within this field are in most municipalities lacking as it is a relatively new challenge, whereas the municipalites have the potential to gain from eachothers experiences and work together on gathering external expertise.

Table 5: Extent in m^2 and km^2 of a 100 year storm surge event for selected areas in 2050

Location	**m^2**	**km^2**
Western Limfjord	215634746	216
Thyborøn	74371965	74
Randers Fjord	99885696	100
Juelsminde	9518353	10

Figure 10: The flooded areas of the Western part of the Limfjord in a 100 year event in 2050 (The Danish Coastal Authority, NIRAS, 2015).

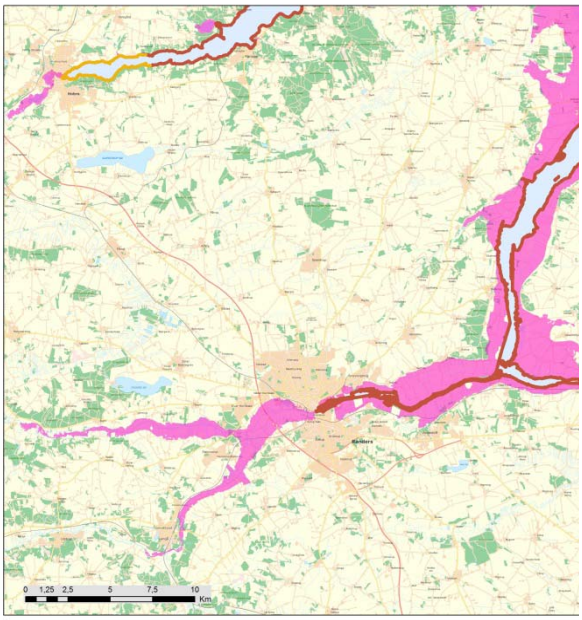


Figure 11: The flooded areas of Randers Fjord in a 100 year event in 2050 (The Danish Coastal Authority, NIRAS, 2015).

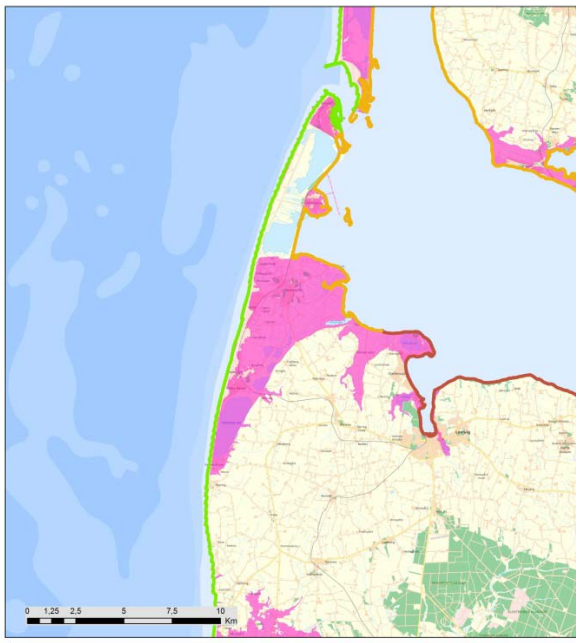


Figure 12: The flooded areas of Thyboron in a 100 year event in 2050 (The Danish Coastal Authority, NIRAS, 2015)

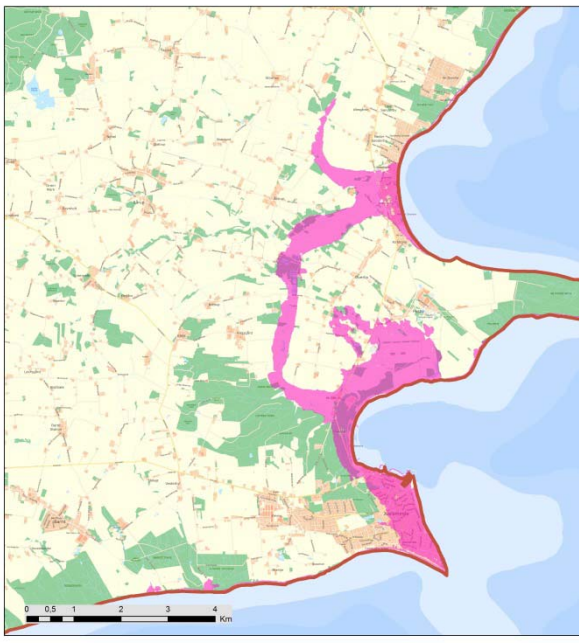


Figure 13: The flooded areas of Juelsminde in a 100 year event in 2050 (The Danish Coastal Authority, NIRAS, 2015).

Constraints and assumptions

One constraint is that the actions (C8, C9, C10, C11, C14, C17, C18) will not follow the same time schedule, whereas some activities of C1 may not be of same relevance for all actions. This is accommodated by action C1.1.2 and following knowledge sharing meetings and workshops to secure sufficient capacity building.

Expected results:
C1.1.
Phase 1: The results of C1 provides insight in the needs of the partners in regard to knowledge, analyses and tools on coastal issues. Capcity building of at least 25 professionals on national and international best practice on coastal protection. One study trip with at least 25 professional to the Netherlands and Germany to increase the inspiration on best practice. Development of common tenders andadjustment of

Phase 2. Phase 2: Awareness rising and capacity building of at least 25 professionals on holistic approaches and synergies between sustainability and coastal protection measures. Show casing and development of novel and innovative stakeholder organization- and governance models involving app. 25 professionals. Adjustment of Phase 3.

Phase 3: Identify solutions together with at least 25 professionals for coastal protection from inside and outside the partnership. Suggestions for how to raise the level of coastal protection in CCA plans. Insight in other regions working with sea and fjords relevant for replications of C8, C9, C10, C11, C14, C17, C18.

C1.2: Phase 1: Capacity building of at least 25 professionals on combined scenarious on Rainfall and storm surges. Phase 2 and 3: Information and etablishment of a capacity building network for and among the partners on CCA and coastal challenges (to be continued after the end of the IP) 25 professionals involved.

Cost estimation:
Based on working days with salary of 47 € per Hour and 347,5 € per day per senior employee and 35 € per hour and 259 € per day for junior employee.

Workshops and meetings includes budgets for lunch coffee and conference venue 75 € per participant
Workshops includes preparations in advance and hours spend during workshop and after the event for output material
Workshop transport is calculated via an average of 100 km and 0,487 € kr. per km

Deliverables:

Action	**Deliverables:**
C1.1	**Phase 1:** Report on the desk analysis of knowledge gaps Minutes and presentations of meetings and workshops accessible on www.c2ccc.eu Evaluation of the meetings (digital form) Specifications on the tender materials Study tour dissemination material to be used before and after the study tour Common tender material to be used in the partnership **Phase 2:** Presentations on sustainable approaches to coastal protections Presentations on new governance and involvement models Minutes and presentations of meetings accessible on www.c2ccc.eu Evaluation of the meetings (digital form) **Phase 3:** Minutes of meetings accessible on www.c2ccc.eu Evaluation of the meetings (digital form) One note on replication of the findings in the project
C1.2	**Phase 1:** Minutes of meetings accessible on www.c2ccc.eu Evaluation of the meetings (digital form) **Phase 2 and 3**:

	Minutes of meetings accessible on www.c2ccc.eu Evaluation of the meetings (digital form) Note on the continuation of a CCA and coastal challenges network after the IP incl. recommendations on purpose, organisation and financing.

Milestones:

Action	*QuantifiableQuantifiable milestones:*	*Date by end of*
C1.1	**Phase 1:** One Desk analysis of knowledge gaps One Study tour arranged and implemented Specifications of the tender materials One commonc tender material to be used in the partnership Recommendations for changes in phase two **Phase 2:** One Workshop on sustainable approaches to coastal protections One Workshop on new governance and involvement models **Phase 3:** One Workshop on synergies One noten on replication and gathering of experience	 01/08/2017 01/06/2018 01/12/2017 01/02/2018 01/12/2018 01/06/2019 01/06/2020 01/12/2021 01/10/2022
C1.2	**Phase 1:** One Knowledge sharing meeting One Recommendations for changes in phase 2 **Phase 2:** One Workshop on results **Phase 3:** One Final evaluation	01/10/2017 01/12/2018 01/12/2020 01/12/2022

ACTION C2: Rivers and lakes

Beneficiary responsible for implementation: Central Denmark Region

Budget: 141.130 €

Number of days estimated spent on action in phase 1: 155 Days

Role: CDR take on the role as a facilitator, coordinator and networking body of the CCA activities.

Relation to CCA plans:
9 of the 21 municipalities as well as the 2 risk management plans mention issues related to lakes and rivers in their CCA plans (cf. Figure 1).

Linked to Complementary Actions

1. *Watercourse restauration:* Actual restauration of watercourses supplementing C2C CC by retaining water flow upstream and improving biodiversity. Complements C3. [Funded by the Danish AgriFish Agency under the EAFRD 2014-2020]

Description (What, how, when and where):
The objective of this action is: To increase the resilience of land alongside river banks taking into consideration the environmental state and biodiversity and to enhance urban resilience.

This action has a twofold purpose. Firstly, to secure knowledge sharing, inspiration and capacity building across the actions dealing with lakes and rivers within C2C CC. The following actions deal with river systems in different ways: C10, C11, C12, C13, C14 and C16. These actions will individually develop knowledge on CCA and rivers within different aspects, which can benefit the other actions. Furthermore, the actions can gain from each other's thoughts and processes, whereas continuous contact between the actions will encourage knowledge sharing. This is underlined by the fact that modelling, interpretations, analysis and data sampling are similar in the different catchments. Secondly, to draw on specific aspects across C10, C11, C12, C13, C14 and C16, which will benefit the CCA agenda nationally as well as within the EU. These aspects are currently the highly debated themes of 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. In regard to the latter, Denmark is traditionally a country with a long agricultural history and an ongoing national debate deals with the delicate balance between agricultural development and the environment..

C.2.1 Experiences with modelling large catchments:

What:
This action takes its point of departure in gathering and sharing knowledge between the C2C CC river projects (action C10, C11, C12, C13, C14 and C16) to secure that the projects gain from each other. Today modelling of rivers are often based on the models of

Danish Hydrological Institute (DHI), which have largely divided modelling systems in rivers, sewer systems, coastal flooding and groundwater. These models are not easily integrated in a holistic model of the hydrological cycle. In the projects of C10, C11, C12, C13, C14 and C16, the need for integrated assessments are evident and it is important to knowledge share about the experiences of the approaches, methods, data sampling, storage and modeling. In order to make integrated analyses it may be relevant to involve water sector ICT businesses on modeling watercourse flow on catchment level.
Many of the catchment models has the same need for forecasting different scenarios. Therefore there is a need to work on developing an overall public offering to be used by the different projects (C10, C11, C12, C13, C14, C15 and C16)
A screening tool for overall risk on catchment level is developed in C6.2. To implement the use of the tool there will be initiated some activities related to the tool.

How:
The following sub-actions have the purpose to gather experiences, share knowledge between action and create a common tender to be used by the actions C10, C11, C12, C13, C14 and C16:

1. An initial consultation workshop between the project partners of action C10, C11, C12, C13, C14 and C16 on the background knowledge of the respective projects and their initial plans for watercourse modelling. Discussion of different approaches and unknowns with participation and input of the 'Advisory Committee'.
2. An interview process to initiate the common tender process
3. Preperation of a public tender on modelling of catchments
4. A workshop when the modelling of C10, C11, C12, C13, C14 and C16 are in process, with the main purpose to discuss the challenges and how to overcome the challenges with e.g. data, methods, and models.
5. A workshop on knowledge sharing on results and initial discussions on possible solutions.
6. Process to ensure that the screening tool presented in C6.2 is giving the right answers to be prepared for the tender process
7. Interactive 3D decision support tool on the water flow in catchment areas across municipal borders.
8. A workshop presenting the Interactive 3D decision support tool on water flow in catchment areas.
9. A workshop discussing need for future monitoring.
10. At the end of each phase, an evaluation and assessment with focus on the needs on future integrated cross partner actions within will be conducted. This done to secure the direction and processes are carried out in the right way.

Where:
SDK, NDK, RK, HbK, HK, Horsens, HEDKOM, SK-KOM, SIK, FK, and VK.
The 3D decision support tool is developed to cover the whole region.

When:
Phase 1: Activities related to bullet 1-6 and 10
Phase 2: Activities related to bullet 7, 8 and 10
Phase 3: Activities related to bullet 9

C2.2 Warning system

What:
The public resilience to sudden events like flooding could increase significantly by providing access to information and forecasted data. Therefore there is a need to transform the existing and collected data to a format which may be distributed to the potential affected citizens. By alerting citizens and giving them information on how to act in a given flood situation they may act and prevent damage to their values. Development of forecasting systems with ICT businesses based on models and meteorological forecasts to ensure resilience act as key elements in this activity.

How:

1. Gathering of experiences of other relevant projects' use of warning systems incl. Aarhus Municipality.
2. Workshop presenting the knowledge and experience within the field of early warning systems open to public
3. Initiate the development of forecast systems with ICT businesses based on models and meteorological forecasts. The forecasting will be integrated in one of the catchments involved in C2C CC
4. Partner workshop on the topic 'Warning systems, civil protection and contingency planning'At the end of each phase, an evaluation and assessment with focus on the needs on future integrated cross partner actions within will be conducted. This done to secure the direction and processes are carried out in the right way.

Where:
Regional activities in CDR

When:
Phase 1: Activities related to activities1-2 and 4
Phase 2: Activities related to activities 3-4

C2.3 The role of land use management and wetland restoration in CCA

What:
Often the most cost effective way to flood-prone urban areas in the context of CCA is by retaining great amounts of water outside the cities, because the construction here is less costly than in the cities. Agriculture involve the largest land owners in DK (About 60% covered by agriculture) and it is therefore essential to cooperate with farmers when doing CCA outside or adjacent to urban areas. Cooperation and thereby CCA may result in the implementation of projects of different nature including restoration of streams and establishment of wetlands. Drainage can be a challenge for agriculture in flat, wide river valleys, because of the slower water flow in the river, which increases the risk of critical high water levels and flooding. However, agricultural land facing the river banks may have less value for the farmers due to poor harvest, whereas there is a potential for farmers to lease land for CCA to the utilities and municipalities (however, not yet investigated in Denmark). CCA outside cities in demarcated areas often will benefit downstream agriculture and cities. Furthermore, wetlands remove nutrients such as nitrates and phosphorus, as well as degrade pesticides, and may thus be a beneficial mean to secure river ecology. A national political agreement further increases the implementation of wetlands as a measure to lower nutrient outwash from agricultural areas (Agreement on

Food and Agricultural Policy). C2C CC will encourage the partnership to include the wetlands as a CCA measure. The actions will also draw on the experiences of the Danish project: “The farmer as a water manager”, a project looking at the synergies (instead of the barriers) between CCA, river ecology and farming.

How:

1. Dialogue with the Secretariat of Utilities (Forsyningssekretariatet) in regard to possibilities for utilities to lease agricultural land in case of extreme flood events. Linked to preparatory action A1.
2. Dialogue with the Danish Agency of Nature on the implementation and possibilities of funding related to the newly approved Agreement on Food and Agricultural Policy which includes mini-wetlands as means for removal of nutrients (and CCA).
3. Develop business models incorporating city safety and compensation of farmers
4. Screen for possible wetlands to support CCA and raising funds through “Fødevare og Landsbrugspakke” (Food and Agricultual Policy).
5. Gathering of state-of-the art knowledge on the synergies between agriculture, CCA and wetlands by the Advisory Committee’.
6. Test and demonstration of conceptual design in one of the catchments included in the project. Testing the proposed business models and synergies.
7. At the end of each phase, an evaluation and assessment with focus on the needs on future integrated cross partner actions within will be conducted. This done to secure the direction and processes are carried out in the right way.

Where:
CDR

When:
Phase 1: Activities related to activities 1-2 and 7
Phase 2: Activities related to activities 3-5 and 7
Phase 3: Activity related to activities 6

C2.4 Impacts of CCA on freshwater ecology

What:

CCA in DK includes separation of rain water and waste water. Rain water is often discharged to recipients as streams and lakes, which includes a risk of increased exposure of the ecosystem.

Ecosystems consist of a number of biotic and abiotic elements. The biotic elements are composed of populations, manufacturers, consume and decomposers. The abiotic elements covering temperature conditions, oxygen level and light. As an example temperature differences due to increased discharge of rainwater can result in deterioration of living conditions and reproduction of trout. Another issue associated with CCA is the discharge of hazardous substances. Discharge of varying amounts of rainwater into streams and lakes containing various contaminants like metals, oil substances, pesticides and nutrients can potentially have a negative impact on the ecosystem as the abiotic factors may change in the recipient. The effect of varying amounts of rainwater containing hazardous substances can vary from acute toxicity to slow accumulation in the food chain. Discharge of hazardous substances can potentially change the competitive relationship and living conditions of plants and fauna, and ultimately foster unwanted species. The

discharge of rainwater to recipients is regulated by the Water Framework Directive (WFD) and by Danish law (Danish environmental protection law and waste water order) which seek to minimize impacts on the ecosystem. Discharging rainwater to any recipient requires a discharge permit, which contains specific requirements related to e.g. hydraulics and toxic substances.

However, little knowledge is available on the long term effects of CCA on freshwater ecology, but research and knowledge from practice is currently developing. This action will collect data across the actions related to lakes and rivers: C10, C11, C12, C13, C14 and C16, but also to selected actions related to rainwater, as the source of the discharges originates from SUDS and the utilities' rainwater pipes (C4.1, C4.2, C4.3, C19, C22).

How:
Gather knowledge through:

1. Gathering of the actions' C10, C11, C12, C13, C14 and C16, technical reports
2. State-of-the art research through the Advisory Committee' partners
3. 1 partner workshop on the topic 'Impacts of CCA on freshwater ecology'
4. At the end of phase 2, an evaluation and assessment with focus on the needs on future integrated cross partner actions within will be conducted. This done to secure the direction and processes are carried out in the right way.

Where:
CDR

When:
Phase 2 (year 2019-2020)

Reasons why this action is necessary:
This action accommodates the pressing need of coordination and knowledge sharing across local authorities with similar challenges. Since the structural reform in 2007, the responsibility of water and environment lies with each individual municipality. Previously, the responsibility and knowledge related to the whole catchment area were based at the counties, which have now ceased to exist. New arenas of catchment based coordination and planning are emerging, not at least in the spin-off of the river basin management plans under the WFD. However, CCA is not yet included in this process. This action will contribute to rebuilding catchment based planning and will aid the future integration of CCA within the implementation of the WFD. The action contains comparative analysis and modeling in different basins. By tendering from a common pool and prepare specifications in the procurement through interdisciplinary collaboration, processes are optimized and the work carried out becomes more efficient.
Further, the optimization of corporation between up-stream land owners and flood risk threatened cities down-stream may encourage sustainable long lasting solutions via new public-private partnerships and business models for preventive CCA actions.

Constraints and assumptions
The actions of C10, C11, C12, C13, C14 and C16 will not be implemented concurrently in their respective processes. Thus it may be a challenge to plan inspirational meetings and workshops at times, benefitting all parties. However, as all the actions will start up in Phase

1, initial steps such as new approaches to integrative modelling of the catchments (action C2-1) may benefit all.

Expected results

C2.1:
Phase 1: Three workshops on knowledge sharing and capacity building on integrative modelling of water courses between the partners of action C10, C11, C12, C13, C14 and C16 (Involving 120 professionals). An interactive 3D decision support tool on the water flow in catchment areas across municipal borders (same as action C6.2), used by 10 municipalities. Common tendering material to be used in the individual catchements. Adjustment of Phase 2. Phase 2: Two workshops on knowledge sharing between the partners of action C10, C11, C12, C13, C14 and C16 on their proposed solution in the respective catchment areas (Involving 80 professionals). Phase 3: One Workshop discussing need for future monitoring (Involving 35 professionals).

C2.2:
Phase 1: State-of-the art knowledge on warning system practice as input to tool development. One workshop supporting capacity building among all partners with knowledge on 'Warning systems, civil protection and contingency planning' (100 professionals benefitting). Adjustment of Phase 2. Phase 2: 1 ICT businesses develop a forecast system based on models and meteorological forecasts.

C2.3:
Phase 1: Push for new CCA solutions to retain water upstream cities. Dialogue with two ministries initiated. Adjustment of phase 2. Phase 2: three different business models for incorporating city safety and compensation of the farmers (Used by 15 municipalities). 5 Municipalities apply for funding for wetland projects. Newest knowledge on the synergies between agriculture, CCA and wetlands. Adjustment of phase 3. Phase 3: One test and demonstration of conceptual design in one of the catchments included in the project. Testing the proposed business models and synergies.

C2.4: Phase 2: Capacity buidling of 35 professionals build up among all partners with knowledge on 'Impacts of CCA on freshwater ecology'.

Cost estimation:
Based on working days with salary of 47 € per Hour and 347,5 € per day per senior employee and 35 € per hour and 259 Euros per day for junior employee.

Workshops and meetings includes budgets for lunch coffee and conference venue 75 Euros per participant
Workshops includes preparations in advance and hours spend during workshop and after the event for output material
Workshop transport is calculated via an average of 100 km and 0,487 € kr. per km

Deliverables:

Action	Outputs
C.2.1.	Phase 1: Activity 1+4. Minutes and presentations of meetings accessible on the webpage www.c2ccc.euActivity 2 +3. An interactive 3D decision support tool on the water flow in catchment areas across municipal borders (same as C6.2). Evaluation of the meetings (digital form)Activity 10: Phase 1 report Phase 2: Activity 5. Minutes and presentations of meetings accessible on the webpage www.c2ccc.eu Activity 10: Phase 2 report
C.2.2.	Phase 2:

	Activity 1, 2+4: Workshop material on 'Warning systems, civil protection and contingency planning' accessible on www.c2ccc.eu Activity 2: 1 forecast system based on models and meteorological forecasts available for the public Activity 4: Phase 1 and phase 2 report
C.2.3.	Phase 1-2: Activity 1 and 2: 1 Note on new concept for utilities to pay farmers to retain water upstream cities, and thus save costly investments in the cities. Activity 8: Phase 1 and 2 report Activity 5: 1 report on different business models to ensure win win solutions between the agriculture and urban areas. 7: Action Report on the synergies between agriculture, CCA and wetlands
C.2.4.	Phase 2: Activity 1+2+3: 1 report on 'Impacts of CCA on freshwater ecology'. Activity 4: Phase two report

Milestones:

Action	*QuantifiableQuantifiable milestones:*	*Date by end of*
C.2.1 – C2.4	Phase 1: 4 interviewsion model tender	01/03/2017
	Report on specificationssications for the tender	01/09/2017
	Four workshops will be arranged (one every half year), 160 participants	01/07/2017; 31/12/2017; 01/07/2018; 31/12/2018 01/06/2018
	Report on experience of warning system compiled	31/12/2018
	Investigation on possibilities of areas that can be flooded and possible funding of the investment	
	Phase 2: Three diferrent business models investigated and developed	31/12/2019
	Four workshops will be arranged. 160 participants.	01/07/2019; 31/12/2019; 01/07/2020; 31/12/2020
	ForecastForecast model developed	31/12/2020
	Report on description of effects on fresh water ecology	31/12/2019
	Phase 3: One Workshop, 35 participants	31/12/2021
	Test and demonstration of business model in one catchment area	31/12/2022

***ACTION C3*: Groundwater**

Beneficiary responsible for implementation: Central Denmark Region

Budget: 131.591 €

Number of days estimated spent on action in phase 1: 160 Days

Role: C2C CC project management (CDR) take on the role as a facilitator, coordinator and networking body of the CCA activities.

Relation to CCA plans:
18 of the 21 municipalities mention challenges related to groundwater in their CCA plans (cf. Figure 1).

Linked to Complementary Actions

1. *"WaterCoG":* A project around the North Sea involving eight beneficiaries from DK, NL, SE and UK. The focus is on improved water governance in the private and public sector and includes pilots in the region. Testing and demonstrating new management tools. The WaterCoG and C2C CC will have strong synergies in relation to water management, planning and stakeholder involvement. Complements C0. (funded by InterregVB).
2. *"TOPSOIL":* Focusing on issues related to rising groundwater levels and related climate change implications. Includes beneficiaries from DK, DE, NL, BE and UK and will add European aspects on groundwater to C2C CC. Complements C4 (funded by InterregVB).

Description (what, how, where and when):
Climate change in Denmark is expected to lead to increased rainfall in autumn and winter, and less during summer, causing increased near-surface groundwater levels, especially during autumn and winter. An increase in groundwater levels varies across the regional geography and depends on e.g. geology, distance to the sea, land use, drainage and elevation of the area. This challenge is new, and municipalities are uncertain about how to deal with the problems of high groundwater levels. First, there is a lack of knowledge - where can we expect the groundwater to rise? How do we measure the changes? Secondly, there is a lack of measures - what is the right thing to do in the areas prone to rising groundwater levels?

Figure 10: Investigations on soil conditions

Figure 11: A groundwater flooded area in the eastern part of CDR

The objective of this action is to increase the knowledge and resilience towards rising near-surface groundwater optimizing the use of surplus groundwater.

C3.1 Interaction between rainwater and rising groundwater level

What:

To support the described tool in section C6.1 there is a need to identify the needs and challenges in the municipalities. The challenges has a geographical variation. Groundwater levels in coastal areas are linked to sea level rise and hydraulically connections. Further, low lying areas inland are interacting with the river and lake systems. Work around the tool on groundwater is focused on gathering data and conducting desk analysis in order to define knowledge gaps for understanding the near-surface groundwater and bridge knowledge-gaps by involving applied knowledge and science. In advance, an examination of the need will be conducted to ensure that the tool is developed to support the challenges in the municipalities. After and during the development of the tool, sessions focusing on teaching and adaptation of the tool will be carried out.

How:
Activities:

1. Sessions and workshops with municipalities and "Advisory committee' experts on groundwater and modelling to ensure the groundwater tool will be a usefull tool for the municipalities, to ensure all relevant data is captured and the challenges gathered. In advance of the workshop, the municipalities will be consulted to target the workshop.
2. Preperation of a public tender on modelling groundwater levels as described in the action C 6.1.
3. Halfway workshop where a supplier presents preliminary model tool results
4. Educational sessions for staff at municipalities to implement the groundwater tool, understanding results and following consequences.
5. Identification of areas in the region threatened by groundwater flooding by using the groundwater tool (same as action C6.1).
6. Work on using the tool including training sessions to fine tune the tool
7. At the end of each phase, an evaluation and assessment, which focus on the needs on future integrated cross partner actions, will be conducted. This is done to secure the direction and processes of the actions are carried out in the right way.

Where:
CDR

When:
01/01/2017 - 31/12/2022

Phase 1: Activity 1, 2 and 7
Phase2: Activity 3, 4, 5 and 7
Phase 3: Activity 6

***C3.2* Advanced local adapted investigations and hydrogeological models:**

What:

In selected areas a detailed local model is set up focusing on groundwater, surface and/or seawater (e.g. action C8, C10, C12, C17). Models are based on the present data and collections of new data sets e.g geophysical data. In the context of CCA it is rather new to have detailed geological and geophysical mappings and models and the use of them on local scale. There is an interest to examine how precise the tools are, and how they can be used in e.g forecasting planning and involvement of stakeholders. Furthermore, the benefits of running detailed mapping and local scale hydrological models in comparison to the developed tool described in C6.1 will be investigated in order to make recommendations for what type of modelling is preferable in different settings. In addition, the complementary InterReg project "TopSoil" will be investigating the threat of rising groundwater level in an area north of Herning, where this action will draw on the modelling methodology and results of Topsoil.

How:

The action will test and demonstrate tools to map groundwater levels and examine the use of advanced local adapted hydrogeological models by the following activities:

1. Examine the tools available and make test and demonstrations in local areas in corporation with the "Knowledge Commitee" and the complimentary project TopSoil.
2. Examination of advantages of local scale and large scale models in a regional context
3. Workshop with a focus to compare the large scale and local scale model use in a CCA context in close cooperation with the TopSoil project
4. Formulate guidelines on when to use a detailed model and when a coarse model is efficient
5. At the end of each phase, an evaluation and assessment with focus on the needs on future integrated cross partner actions within will be conducted. This done to secure the direction and processes are carried out in the right way.

Where:

CDR, with focus on action C8, C10, C12, C17 and TOPSOIL

When:

Phase 1 (2017-18): Activity 1 and 5
Phase 2 and beyond: Activity 2, 3, 4 and 5

***C3.3* Reuse of excess groundwater:**

What:

This sub-action will bring in practical inspiration to management of surface-near groundwater from other EU countries (e.g. the Netherlands, Germany or Belgium) and also draw on the results of the complimentary project TopSoil. C3.3. will examine the use of excess groundwater for e.g irrigation, heating or cooling. This is especially relevant in areas where e.g. the heating costs are high and allow for alternative solutions such as the use of excess groundwater, or where the challenges with high groundwater levels are so high, that remedial measures are necessary despite the running costs. This action calls for the involvement of heating utilities, industries, research institutions and municipalities. It is

important to note, that this action will primarily deal with the near-surface groundwater, as it is the upper levels which cause challenges of rising groundwater levels. Action C3.3. will thus not have environmental impacts on the groundwater resource extracted for drinking water. Furthermore, the use of excess groundwater may have the potential to store groundwater and discharge to watercourses in periods with normal or low flow capacity (and avoid discharge in periods with high flow capacity).

How:
C3.3. involves the following activities:

1. Gather information on possible conflicts with rules and regulations on use of excess water and related tax systems and make recommendations available for relevant stakeholders.
2. Local workshops in relevant areas to identify win win solutions
3. Regional workshop targeting stakeholders (farmer, energy industry, local citizens) from the region – brainstorming on possible future measures.
4. Gathering material from the e.g. Netherland, Northern Germany, the U.K and southern Denmark on how to tackle present and future groundwater levels in a sustainable way
5. Study tour to relevant countries learning on their management systems releated to groundwater flooding.
6. At the end of phase 2, an evaluation and assessment with focus on the needs on future integrated cross partner actions will be conducted. This done to secure the direction and processes are carried out in the right way.

Where:
CDR and study tour to relevant countries

When:
Phase 2 and 3: Activity 1 to 6

Reasons why this action is necessary:
Rising groundwater levels are a not well-lit factor in relation to climate change. Cities experience increased challenges with rising groundwater levels e.g. with flooded basements during autumn and winter time. In the countryside rising groundwater levels cause saturated soils, which in case of long-term rains impact the water levels and flow of watercourses and cause flooding downstream in cities and on agricultural land. There is a great need to define and develop sustainable solutions.

Constraints and assumptions
The constraints of action C3 are mainly related to sub-action C3-1 and C3-3. C3-1 is depended on the developed tool in action C6.1 and whether the requests of the municipalities to the functions of the tool can be technically fulfilled. In regard to action C3-3, solutions to use excess groundwater for alternative and innovative purposes may have possible conflict with the existing tax system on water consumption. C2C CC will in that case be in dialogue with the Danish Ministry of Environment and other relevant ministries in order to change the system.

Expected results:
C3.1: Phase 1: Knowledge on the requests and needs on regional groundwater modelling of the municipalities. Tender specifications on local needs to be implemented in the tool C6.1. Adjustment of Phase 2. Phase 2 and beyond: User feedback from the municipalities to modify the tool to local needs and common tendering material to be used in the individual catchments. Capacity building of municipal officials and training materials. Interactive maps to be used for local adaptation strategies (same as action C6.1). Final modification of the tool to local needs and training in the use of the tool. Ensuring that changes are implemented for future needs. Adjustment of the Phase 3.

C3.2: Phase 1: Identification of relevant tools to use when maping groundwater levels locally. Adjustment of phase 2. Phase 2: Capacity building of relevant professionals on 'local scale and regional scale groundwater modelling'. Capacity building of at least 25 professionals on groundwater modelling and scale issues. Recommendations on the use of local and regional scale models. Adjustment of phase 3.

C.3.3: Phase 2: Identification of conflicts built in the present tax system on energy and water consumption. Stakeholder input from at least 50 professionals on relevant use of excess groundwater in the region and other areas. Adjustment of phase 3. Phase 3: Regional recommendations to tackle future groundwater flooding challenges based on regional ideas and experiences from other countries. European inspiration on excess groundwater through study tour with 30 professional attending.

Cost estimation:
Based on working days with salary of 47 € per Hour and 347,5 € per day per senior employee and 35 € per hour and 259 Euros per day for junior employee.

Workshops and meetings includes budgets for lunch coffee and conference venue 75 Euros per participant
Workshops includes preparations in advance and hours spend during workshop and after the event for output material
Workshop transport is calculated via an average of 100 km and 0,487 € kr. per km

Study tour expenses are based on a busrental and the eperiences with similar arrengements

Deliverables:

Action	Deliverables
C3.1.	Phase 1: 1+2. Minutes from the workshops. Specifications on the tendering of the tool C6.1 7: Phase 1 report Phase 2: 3-6. Minutes and workshop material. Output maps of groundwater flood prone areas distributed in the whole of CDR. Maps are adjusted to the local conditions. Training material made and distributed for the users.
C3.2.	Phase 1: Report on the available tools on groundwater mapping including relevant test and demonstrations 5: Phase 1 report Phase 2 and beyond: 2+3: Workshop report on the results discovered. General report on the potential needs for local models in groundwater flood prone areas based on the results from the local and regional modelling. 4: Guideline on local scale and regional scale modeling. 5: Phase 2 report
C3.3.	Phase 2 and beyond: 1. Report - Identifying conflicts built in the present tax system on energy and water consumption. 2. Local reports containing Ideas for relevant use of excess groundwater in other areas. 3.-4. Report on relevant use of excess groundwater on a regional and local scale. 5. Report on study tour 6: Phase 2 report

Milestones:

Action	*QuantifiableQuantifiable milestones:*	*Date by end of*
C3.1- C3.3	Phase 1:	
	Specifications on tendering for tool C6.1 developed	01/10/2017
	One tender workshop, 10 participants	01/10/2017
	DescriptionD of available tools for groundwater mapping	31/12/2018
	One mapping workshop, 25 participants	31/12/2018
	Phase 2: Outline of groundwater flood prone areas on a regional basis	31/12/2019
	One regional workshop, 25 participants	31/12/2019
	Training material developeddeveloped for use on groundwater levels	31/12/2019
		31/12/2019
	Report on locall use of excess groundwater	31/12/2020
	Report on conflicts with existing tax system and legislation	
	WorkshopW on conflicts with existing tax system and legislation, 50 participants	31/12/2020
	Phase 3: Report on relevant use of excess groundwater and the constraints and barriers	31/12/2021
	Study tour with 30 professionals	31/12/2021

ACTION C.4: Rainwater

Beneficiary responsible for implementation: Central Denmark Region

Budget: 148.094 €

Number of days estimated spent on action in phase 1: 158 Days

Role: C2C CC project management take on the role as a facilitator, coordinator and networking body of the CCA activities.

Relation to CCA plans:
19 of the 21 municipalities' CCA plans as well as one risk management plan mention rainwater as a major problem and the use of SUDS as a means to retain and reduce rainwater run off (cf. Figure 1).

Linked to Complementary Actions
Municipal and Water Utility CCA projects: the municipalities and the region are to mobilize and invest at least 16 mill. € on CCA projects[2] within the project period. Likewise, the Danish utilities are to spend app. 135 mill. €[3] annually on climate investments[4] over the next 25 years. C2C CC will contribute with added value and influence the municipal CCA plans and waste water plans and the utilities' future construction projects [Financed through taxes and water fees]. Tax and water fee financed CCA projects support the overall goal by making the region more climate resilient. However, it is also the aim of C2C CC to influence these projects towards more green and flexible solutions serving more purposes. There is a need for increased knowledge among the utility companies on the possible means and tools to be used when dealing with natural infiltration of rainwater.

Description (what, how, where and when):
Handling rainwater and extreme rainfall occurs mostly locally. However, experiences of problems and solutions can be shared between the municipalities and utilities, on technical as well as on organizational and process implementation challenges. Furthermore, incidents with extreme rainfall is the most experienced effect of climate change in Denmark, and thus also the challenge with the largest knowledge base. A large proportion of the knowledge base is placed in Greater Copenhagen area, were extensive cloud bursts have initiated a climate adaptation strategy incl. hundreds of local initiatives to cope with the heavy rain falls. The activities in this action, therefore, aim at bridging the knowledge gap within urban hydrology (E.g. surface groundwater interactions) and in water quality when rainwater is managed on the surface (instead of in the sewer).

***C4.1 Urban Hydrology* and quantity**

What:
Towns and cities in CDR are planning to use SUDS as a part of the means to deal with cloud bursts. Though there are many unknowns within the use of local infiltration such as: What is the capacity in sealed paving areas? What is the capacity in the surrounding unpaved areas? How does the level of the groundwater table impact the possibility of leaching and infiltration?

[2] Based on: 19 municipalities and 1 regional authority each spending approximately 135,000 EUR per year in 6 years.
[3] Approximately 27 mill. EUR per regional authority per year.
[4] Danish Association of Water Companies (DANVA) (2015). "Dansk Vand Magasin #3 juni 2015", DANVA. p. 32-34. (in Danish).

There is a need to gather and collect the experiences from CDR and other areas like greater Copenhagen to define experiences with hydrological conditions to implement SUDS and the requirements of maintaining the SUDS after installation. Further to identify knowledge gaps within implementation of SUDS seen in a urban hydrological system. The identification will include experience of the setup models (C10, C12, C17) and testing of SUDS within CDR. Related to this action are demo-projects C14, C15, C19 and C23. Cross boundary experiences and guidelines will create a solid base for moving forward in a sustainable way and avoid sub optimization.

How:
C4.1 will include the following activities:

1. Collect and gather knowledge and experiences with capacity and SUDS and required conditions for a successful implementation. Learn from experiences in Greater Copenhagen area on how to tackle the excess rain water and the retention capacity in the natural hydrological system in an urban area.
2. Workshop on the hydrological system based on models setup in CDR and experiences from e.g. Copenhagen area. A special focus on the capacity in the soils and open spaces in the towns and cities.
3. Workshop on relevant water retention systems to be introduced in the towns as measures to prevent flooding. Workshops will involve businesses and producers as well as owners of the surface and sub surface facilities (cf. C7)
4. Gathering information on relevant tools to deal with retention of water in an urban environment based on relevant studies in C2C CC.
5. Workshop on new findings on water retention and water quantity
6. At the end of each phase, an evaluation and assessment with focus on the needs on future integrated cross partner actions within will be conducted. This done to secure the direction and processes are carried out in the right way.

Where:
Workshops will take place in CDR

When:
Phase 1: Activity 1, 2 and 6
Phase 2: Activity 3 and 6
Phase 3: Activity 4 and 5

C4.2 Knowledge on SUDS' effectiveness in water treatment and maintenance

What:
SUDS are increasingly implemented by the municipalities and waste water utilities to manage rainwater on surface. The SUDS elements are varied and range from rainwater basins to urban green elements (cf. figure 12). Synergies are many with regard to green infrastructure, urban liveability etc. However, knowledge on discharge of toxic substances such as heavy metals like Ni, Cu and oil components like PAHs are not fully understood. Research is ongoing within this topic. Some research results point to accumulation of most substances in the basin sediments, which through maintenance can be removed and replaced by clean sediments. There is a need to gather existing knowledge from e.g. urban SUDS, rainwater basins along roads and on the demand of SUDS maintenance.

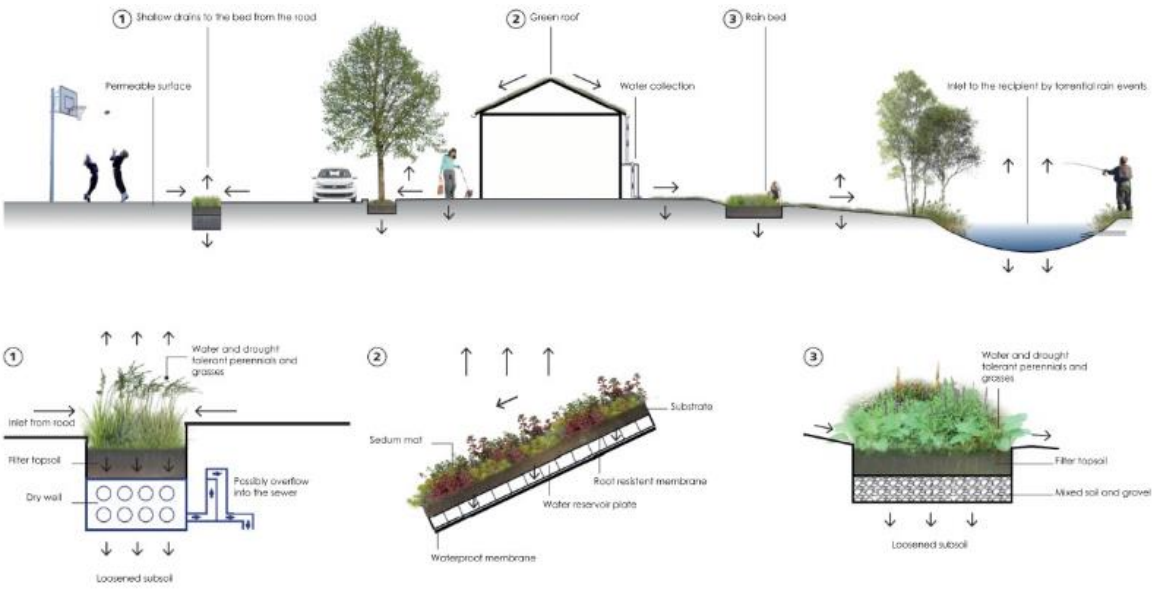


Figure 12: Illustration of SUDS in an urban area (source: NIRAS).

How:
The following activities are part of C.4.2:

1. Gather existing knowledge and practice within the EU e.g. research results, assessment reports and current practice on SUDS, their ability for retaining polluting components and the demand for maintenance. The study will include knowledge gaps, uncertainty and need for further testing and demonstration.
2. Workshop on the present knowledge in water quality in relation to SUDS
3. Involve industries and research institutions to bridge knowledge gaps
4. Arrange workshop in the field of water quality and SUDS inviting stakeholders within industry, research institutions, municipalities, utilities, NGOs as well as citizens (cf. C7)
5. Gather the experiences within C2C CC in the field of permeable pavements (results from C22) and on alternative SUDS constructions (e.g. experience from complementary projects carried out by the utilities) and actions C14, C15, C19 and C23.
6. Test and demonstrate relevant SUDS technologies in corporation with relevant businesses, utilities and authorities. (cf. C7)
7. At the end of each phase, an evaluation and assessment with focus on the needs on future integrated cross partner actions within will be conducted. This done to secure the direction and processes are carried out in the right way.

Where:
Workshops will be arranged in CDR. Workshops will be carried out in cooperation with existing networks like Water in Urban areas and KLIKOVAND. Test and demonstration will be carried out in CDR.

When:
Phase 1: Activity 1, 2 and 7
Phase 2: Activity 3, 4 and 7
Phase 3: Activity 5 and 6

C4.3 Citizen involvement

What:
When rainwater is managed on surface, many actors are involved, including businesses, industries and single house owners, In Denmark these land owners are to pay for handling rainwater (up to a 5 year event) on their private estate, whenever rainwater is to be managed separately from the sewage. This is implemented throughout Denmark, and house owners are involved in two circumstances: 1) decoupling rainwater from sewage by either establishing a two string system (a sewage pipe and a rainwater pipe) or 2) managing rainwater on surface using SUDS. The house owner has to pay for the separation on his/hers property, which is costly and typically around 50,000 DKR (ca. 6,700 €) per property for establishing a two string system. Furthermore, to solve flooding down-stream or in low lying areas, retention is to be implemented up-stream, meaning that house owners, who do not suffer from flooding, are to retain rainwater to secure citizens down-stream.

Traditionally, citizen involvement has been voluntary for people e.g. in urban development projects, CCA adds the dimension of 'must' involvement followed by a requirement of payment. This often results in dissatisfied citizens, complaints and sometimes also conflicts. However, managing rainwater on surface involve possibilities of increasing liveability and urban biodiversity in a neighbourhood, whereas competences in citizen involvement processes is needed by the municipalities and waste water utilities.

How:
1. Collect and gather the experience in CDR and other regions of Denmark on the involvement process in decoupling sewage and rainwater systems. What has been successful and what needs to be adjusted.
2. Gathering good and bad examples of SUDS on private estate including experiences from the citizens
3. Workshop arranged with the purpose of evaluating experience on sewage separation and the involvement of stakeholders from different areas. Sessions involving citizens from different areas from CDR and including their views on managing rainwater on their own property. Session will be carried out in the areas in C2C CC working on separation of sewers but involves citizens from different areas within the C2C CC project (Actions C14, C15, C19, C23).
4. Sessions on regional basis to inspire local authorities and utilities on how to deal with rainwater on private property based on results from the pilot studies in C2C CC and experiences from other areas like greater Copenhagen
5. At the end of each phase, an evaluation and assessment with focus on the needs on future integrated cross partner actions within will be conducted. This done to secure the direction and processes are carried out in the right way.

Where:
CDR and Horsens (C14), Hedensted (C15, C23) and Samsø (C19).

When:

Phase 1: Activity 1, 2, 3 and 5

Phase 2 and beyond: Activity 4 and 5

Reasons why this action is necessary:
CCA in Danish towns and cities all have a component of local infiltration and retention. During the last 5 years, wastewater utilities have spent billions on implementing separate sewer systems to manage the increased amount of rainwater to avoid overflow of sewage. There is a need to learn from experiences within the field of SUDS and to identify the knowledge gaps for successful implementation of SUDS, which includes sustainable water quantity and quality in the urban areas. Knowledge within this field needs to be gathered and distributed.
Further innovation in cooperation with the manufacturers of the installations are needed to make solutions fit the demands of the market. A close cooperation and involvement with the citizens is essential to ensure a sustainable implementation of CCA. Further meaningful implementation pushes the society towards more ownership in the field of CCA.

Constraints and assumptions
Collaboration with businesses are needed. These businesses need to be identified in a process. CDR is hosting a lot of manufacturers of water solutions. In the application we assume that the businesses are interested in joining the project and learn from the experiences.

Expected results:
C4.1: Phase 1: Overview on state of the art on dealing with water in urban areas related to water quantity and SUDS. Capacity building and knowledge sharing of app. 50 officials from local authorities. Phase 2: Capacity building on relevant SUDS systems to be implemented as water retention systems in urban areas (Workshops arranged for 50 partners). Phase 3: Capacity building of utilities and authorities of SUDS used in C2C CC in urban areas, including specifications and detailed descriptions of the pros and cons. Distribution and implementation of knowledge around the C2C CC findings within SUDS and Water quantity for 200 participants.

C4.2: Phase 1: Overview of experiences and state of the art with SUDS in relation to water quality and the need for more knowledge.Capacity building and knowledge sharing via overview on the challenges and experiences on maintenance of SUDS systems on workshop with 50 professionals attending. Phase 2: Capacity building of businesses in relation to SUDS via engagement and innovation pull from the experiences on need for development on SUDS systems and demands on maintenance. This will be done via bilaterale meetings and workshops with an estimation of 100 professionals engaged. Phase 3: Presentation of new tools meeting the demands of a modern SUDS facility on workshop with around 30 professionals attending.

C4.3: Phase 1: Capacity and knowledge sharing via Danish learnings on involvement of stakeholders in work on separation of sewer systems. Citizens learning across boundaries in CDR. Phase 2: Involvement of and inspiration of local authorities and utilities on how to deal with involvement of stakeholder in cases of dealing with rain water on their own property (Involving 75 professionals)

Cost estimation:
Based on working days with salary of 47 € per Hour and 347,5 € per day per senior employee and 35 € per hour and 259 Euros per day for junior employee.

Workshops and meetings includes budgets for lunch coffee and conference venue 75 € per participant
Workshops includes preparations in advance and hours spend during workshop and after the event for output material

Workshop transport is calculated via an average of 100 km and 0,487 € kr. per km

Deliverables:

Action	Deliverables
C4.1.	Phase 1: 1. Evaluation report on the capacity of SUDS and the limitations set by the local hydrology, geology and other framing conditions. 2. Minutes and output material from the workshop. Accessible on www.c2ccc.eu 6: Phase 1 report and recommendations for phase 2 Phase 2: 3: Output report and material on relevant SUDS to be used. Accessible on www.c2ccc.eu 6: Phase 2 report and recommendations for phase 2 Phase 3: 4+5. A report on SUDS used in C2C CC and possible SUDS systems to be introduced as means to prevent flooding from heavy rain events. Distributed in the whole of CDR and accessible on www.c2ccc.eu
C4.2.	Phase 1: 1., 2. and 3. Workshop output report on the experiences and state of the art with SUDS in relation to water quality and the knowledge gaps and experiences on maintenance. Accessible on www.c2ccc.eu 5: Phase 1 report and recommendations for phase 2Phase 2: Engagement of relevant producers of SUDS and giving them relevant learnings to be built in in future products 5: Phase 2 report and recommendations for phase 3 Phase 3: A report on learnings in the field of SUDS in urban areas in relation to water quality and presentation of the newest and most modern SUDS products. Closely linked to 4.1. Accessible on www.c2ccc.eu
C4.3.	Phase 1 1+2+3: Report on the learnings within stakeholder involvement in relation to sewage separations and SUDS. Accessible on www.c2ccc.eu 5: Phase 1 report and recommendations for phase 2 Phase 2: 4. Training and inspirational material for the authorities and utilities to inspire the citizens on the possible solutions. Accessible on www.c2ccc.eu

Milestones:

Action	*QuantifiableQuantifiable milestones:*	*Date by end of*
C4.1- C4.3	Phase 1: Evaluation report on use of SUDS quantity	01/03/ 2018
	Workshop on quantity elements and SUDS , 50 participants	01/03/2018
	Overview report on state of the art SUDS knowledge in relation to water qualitative aspects including knowledge gaps. Overview of learnings within SUDS and stakeholder involvement and ownership, 100 participants	31/12/2018
	Phase 2: Report on overview on relevant SUDS as tools for water retention	01/06/2019
	Involvement, engagement and delivery of knowledge gaps and needs to producers and manufacturers of SUDS , 30 participants	01/06/2019
	Training and inspirational material for authorities and utilities on how	31/12/2020

	to involve local land owners in implementing SUDS, 75 participants Phase 3: One report on overviewo on SUDS experience in C2C CC Distribution of knowledge and implementation Evaluation on the SUDS experiences within C2C CC.	01/06/2021 31/12/2021 31/12/2021

ACTION C5: Governance

Beneficiary responsible for implementation: CDR

Budget: 190.560€

Number of days estimated spent on action in phase 1: 175 Days

Role: CDR take on the role as a facilitator, coordinator and networking body of the CCA activities.

Relation to CCA plan
14 of the CCA plans and three of the risk management plans mention the importance of cooperation in relation to CCA.

Linked to Complementary Actions

- "Plowing Free Denmark - a green twist of agriculture towards conservation agriculture" Aarhus University The action supplements C5 by changed agricultural practice to reduce flooding. [Accepted for full application in May 2016, VELUX Foundations].
- *"WaterCoG":* A project around the North Sea involving eight beneficiaries from DK, NL, SE and UK. The focus is on improved water governance in the private and public sector and includes pilots in the region. Testing and demonstrating new management tools. The WaterCoG and C2C CC will have strong synergies in relation to water management, planning and stakeholder involvement. Complements C5. [Funded by InterregVB].
- *Citizen awareness:* Outreach and communication to strengthen citizens' awareness to act on climate change. In cooperation with researchers, teaching staff and children. Complements C5. [Funded by Regional Development Funds].

Description (what, how, where and when):

The aim of C5 is building capacity for a new CCA governance paradigm stressing integrated planning and accommodating the entire hydrological cycle. The objective is to increase resilience through capacity-building, strengthened network governance and cross-border coordinated planning.

C5.1 New paradigm and a common regional strategy integrating municipal CCA plans

What:
The aim of this action is to gather best practices related to integrative planning, which may be used as inspiration to develop a new paradigm for integrative CCA planning practice with emphasis on sustainability and capacity development; first of all among the partners of C2C CC, and secondly to feed into the international agenda on integrative CCA planning with state-of-the-art knowledge.

The first part of the action will gather knowledge on integrative planning within the water and environment sector, including experiences from the Danish river basin management plans (under the Water Framework Directive), other EU supported projects (e.g. catchment based approach in Usserød River (Usserød Å[5]), which is a LIFE Environment project).

[5] www.catchmentbasedapproach.org & http://ec.europa.eu/environment/life/project/Projects/index.cfm?fuseaction=search.dspPage&n_proj_id=4268

This knowledge is specifically applied in C2C CC through actions C9, C10, C12, C15, C18, C19, C24 and through the C2C CC consortium and network. It is however relevant for all C2C CC actions. It is further applied in the formulation a common regional strategy that supports future coordination and integrative planning of the municipal CCA plans. This strategy will be a voluntary document with no official legal authority. However, as there is a broad mutual understanding between the municipalities of the need for a common approach and strategy, this document may form a strong basis for future collaboration and activities across administrative borders. The strategy will also serve as documentation of the collaborative process and a basis for applying for funding for future integrative projects. Following, the experiences of the review of best practice, state-of-the-art demonstration projects are gathered in a report and will serve to give recommendations for local governments in general.

How:
The following activities will be conducted:

- Collaboration with research institutions on state-of-the-art in integrative planning
    - Expert consultations to raise awareness on the importance of integrative planning and to motivate programme actions to have a holistic approach and to analyze the opportunities of synergies between CCA, climate change mitigation, biodiversity, nature, tourism/recreation, agriculture, and environmental issues.
    - Review of European reports and project experiences related to integrative planning in the water and environment sector incl. experiences from the EU LIFE IP project Rivers Trust in England.
- Interviews with Danish Ministry of Environment on the network management of the River Basin Management plans and with Aalborg University, Aarhus University and KLIKOVAND on the experiences on network governance of CCA in Denmark.
- Study tour to Germany and The Netherlands to study organizational and practical solutions on CCA and coastal challenges.
- Training course in integrative planning processes and network governance for officials
- Common regional strategy:
    - 6 catchment based workshops with C2C CC partners to define cross-cutting issues and activities and to decide on a common framework for integrative planning.
    - Development and formulation of a common regional strategy on CCA with the outset in integrative planning and network governance.
    - At least one of the 6 C2C CC thematic partner seminars (stormøde) has adopted integrative planning as a common theme.
- At the end of each phase, an evaluation and assessment with a focus on the needs on future integrated cross partner actions within C2C CC will be conducted. This done to secure the direction and processes are carried out in the right way.

Where: CDR and Study tour.

When:
Phase 1: Activities 1-3 and 6
Phase 2 and beyond (2019-2022): Activities 4, 5, 6

C5.2 Networking and knowledge-sharing

What:

CDR's approach to networking and knowledge-sharing is illustrated in Figure 13. The backbone of this approach is dialogue, and CDR invites all relevant stakeholders to participate in networking activities and to contribute to defining mutual challenges in order to create a common understanding of the core matters. Stakeholders are different and have varying interests, and often specific issues must be clarified, analysed or explained before the network is able to decide on common solutions to the mutual challenges. This foundation for decision making is procured by the CDR by dealing with the best national consultants and international knowledge institutions. On this basis, the network defines a common strategy, and jointly determines who are able to contribute what, in order to reach the common objectives. CDR is able to take on leadership because of the region's impartiality and with point of departure in the regional development strategy (Regional Udviklingsplan (RUP)), which emphasizes sustainable development.

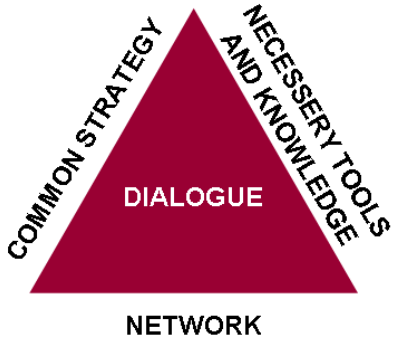


Figure 13: CDR's approach to networking and knowledge sharing.

How:

Activities

- In corporation with the advisory committee and steering group, a workshop every year will be held with a special focus not covered by the other initiatives and actions.
- At the end of each phase, an evaluation and assessment with focus on the needs on future integrated cross partner actions within will be conducted. This done to secure the direction and processes are carried out in the right way.

Where:

CDR and collaborative research institutions

When:

Phase 1: Activities 1-2

Phase 2 and beyond: Activities 1-2

C5.3 Use of the Advisory Committee

What:

The Advisory Committee includes, amongst others, experts in planning processes and network governance. Experts will aid the demonstration actions in how to act in processes

with many actors. This action builds upon theoretical schools relating governance theory to the development from government to governance and further to network governance, and it draws on experiences from the projects “Water in urban areas” and “The farmer as a water manager”.

Several of the actions of C2C CC are characterized by many partners or many stakeholders e.g. The Western Part of the Limfjord (C9) consist of a partnership between 7 municipalities and 7 utilities, and The River Gudenåen consist of a partnership between 7 municipalities and 1 utility. Furthermore, CCA projects consist many more actors and professionals than public authorities are accustomed to handle. These actors are among others different departments within their own organizations, utility companies, land owners (e.g. citizens and farmers) and NGOs. There is thus a need to build capacity in how to govern integrative development processes in this multi-stakeholder framework.

How:
Phase 1:

1. Six individual workshops between the Advisory Committee and the actions C9, C10, C11, C12, C13 and C14.
2. Call service, where the partners can call the Advisory Committee for advice.
3. One half day seminar with expert presentations on theoretical aspects and partner presentation with initial experiences.

Phase 2 and 3:

4. Repetition of Phase 1.

Where:
Central Denmark Region

When: 2017-2021

C5.4 Capacity-building of officials and water professionals on CCA, stakeholder involvement and civil protection

What:
This action involves many capacity building activities with the aim to improve the prerequisites for implementing the CCA plans among especially the municipalities and their respective utilities. Activities are focused on topic specific training courses, workshops and masterclasses, with point of departure in the challenges experienced by the partners. Training courses serve the purpose to provide officials with competences to carry out actual tasks e.g. on how to involve citizens when implementing local SUDS. Workshops will focus on mutual exchange of ideas and experiences between C2C CC actions and related projects. Masterclasses take their point of departure in one or more municipalities’ concrete challenges and needs and the possible solutions identified by C2C CC partners.

Some of the challenges already expressed by the partners are among others stakeholder and citizen involvement, issues related to rise in groundwater level, issues related to larger and more frequent storms and coastal management, local contingency planning and cross-border contingency planning.

How:
All workshop and network activities arranged by the project management of C2C CC will be evaluated by the participants (cf. D1), special attention is paid to wishes and needs for training courses within specific subjects. According to the feedback of the C2C CC partners courses may also be arranged on ad hoc basis.

Phase 1:

1. CDR develops a capacity development programme for the C2C CC partnership to be held in Phase 2 and 3 on the basis of the evaluations and dialogue with partners.

Phase 2 and beyond:

2. Training courses:
    - 1 training course on stakeholder and citizen involvement
    - 1 training course on emergency/contingency planning and roles of citizens and stakeholders during emergencies
    - At least three additional courses according to needs.
3. Workshops:
    - Evaluation workshop organised as an Experience (ERFA)-meeting on the progress of the municipalities' emergency/contingency plans and activities.
4. Master classes:
    - At least 1 masterclass among municipalities and local emergency centres on their respective emergency/contingency plans.

Where:
CDR – location not decided, meeting rooms of CDR, the Municipalities or at the universities, alternatively conference facilities organized through procurement agreements of CDR.

When:
Phase 1: Activity: 1
Phase 2 and beyond: Activities 2-5

Reasons why this action is necessary:
As also stated in Form B section 1.1. the present gaps and shortcomings that hinder effective implementation of the plans are at least threefold. Firstly, the cross-sectoral nature of CCA, which demands a new governance paradigm stressing integrated planning accommodating the entire hydrological cycle. Secondly, lack of knowledge, knowledge sharing and capacity building on commonly shared issues and solutions among local authorities hinders integrated CCA planning. Thirdly, the difference in level of ambition and implementation between the prosperous and less prosperous municipalities decrease resilience especially among the less prosperous.

Constraints and assumptions
There are no significant constraints in implementing the mentioned governance actions, as CDR has extensive experience in organizing and facilitating workshop and course activities. However, one constraint may be related to securing the quality of a workshop e.g. that the scope meets the need of the municipalities. CDR has and will continue to have thorough dialogue with the partners of C2C, where expressed needs and wishes for capacity building and knowledge sharing of the partners will be met. It is expected that new needs will occur during the project period. Another constraint may relate to choosing the right lecturers for a course who possess sufficient knowledge andare good facilitators. In this regard CDR will involve the network of the Advisory Board, the partners and CDR itself.

Expected results:
C5.1: Phase 1: Awareness on the importance of integrative planning and motivation for working with multi-functional, sustainable and holistic solutions. Capacity building on international and national experiences with network governance. Participation of at least 100 partners and stakeholders at C2C CC workshops in at least two workshops/networking arrangements. Phase 2 and beyond: 1 common CCA strategy to guide the individual CCA plans to incorporate sustainability, whereas at least 15 C2C CC partners have contributed to the development of the common CCA strategy. Participation of at least 100 partners and stakeholders at C2C CC workshops.

C5.2: Networking and knowledge-sharing of at least 200 persons (4 persons from each partner and an additional number of stakeholders) in an annual workshop through phase 1 and phase 2.

C5.3: The Advisory Committee build capacity among C2C CC partners on how to manage processes with many actors and stakeholders. Improved network governance processes specifically in actions C9, C10, C11, C12, C13 and C14. At least 300 participants from C8-C24 participates in 6 initial workshops between the Advisory Committee and the actions. Call service used twice a month, where the partners can call the Advisory Committee for advice, 1 half day seminar with expert presentations on theoretical aspects and partner presentation with initial experiences.

C5.4: Phase 1:The capacity building development programme will ensure that the officials improve their ability to work holistically with CCA and in close collaboration with relevant actors and stakeholders. Phase 2 and beyond: The capacity building activities will result in better designed and performed CCA plans and actions. 30 participants per course is expected, corresponding to at least 150 participants in the two courses on stakeholder and citizen involvement and emergency/contingency planning, and additional courses according to needs. At least 60 participants attending the evaluation workshop emergency/contingency plans and activities. At least 50 selected participants attending master classes

Cost estimation:
Based on working days with salary of 47 € per Hour and 347,5 € per day per senior employee and 35 € per hour and 259 Euros per day for junior employee.

Workshops and meetings includes budgets for lunch coffee and conference venue 75 € per participant
Workshops includes preparations in advance and hours spend during workshop and after the event for output material
Workshop transport is calculated via an average of 100 km and 0,487 € kr. per km

Deliverables:

Action	*Deliverables:*
C.5.1.	Programme, presentations and evaluations from all meetings/workshop, available at www.c2ccc.eu Newsletter, information at website and press releases for each meeting Inspiration material on experiences and recommendations for future practice in Danish and English. Published in 200 copies and available at www.c2ccc.eu Study tour report
C.5.2.	Programme, presentations and evaluations from all annual workshops, available at www.c2ccc.eu

C.5.3.	Phase 1, 2 og 3: Newsletter on the activities of the Advisory Committees available at www.c2ccc.eu Small videos on the experiences, benefits and recommendations of the C2C CC actions available at www.c2ccc.eu Reports on expert consultations Phase 3: Peer reviewed journal article on the experiences of network governance in C2C CC. 1 guideline for network governance based on the experience in C2C CC
C.5.4.	Phase 1: A capacity development programme for training courses, workshops and master classes available at www.c2ccc.eu Phase 2 og 3: Course and workshop materials available at www.c2ccc.eu

Milestones:

Action	*QuantifiableQuantifiable milestones:*	*Date by end of*
C.5.1	Phase 1 Report on Expert consultations and two workshops, 100 participantsReview report of European reports and projects Interviews with Danish ministries, networks and universities, 10 interviews Study tour to Germany and The Netherlands to study organizational and practical solutions on CCA and coastal challenges, 25 participants One evaluation and assessment Phase 2 Training course in integrative planning processes and network governance, , 200 participants 6 catchment based workshops with C2C CC partners to define cross-cutting issues and activities and to decide on a common framework for integrative planning (all six workshops) Development and formulation of a common regional strategy on CCA with the outset in integrative planning and network governance. At least one of the 6 C2C CC thematic partner seminars (stormøde) has adopted integrative planning as a common theme. One evaluation and assessment report	31/12/2017;31/12/2018 31/03/2017 01/07/2017 31/10/2017 31/12/2018 31/12/2019 01/07/2019 01/01/2021 01/01/2022 01/01/2022
C.5.2	Phase 1 Two annual workshops, 200 participants eachPhase 2 Four annual workshops, 200 participants each	31/12/2017; 31/12/2018 31/12/2019, 31/12/2020; 31/12/2021: 31/12/2022

C.5.3	Phase1 Six workshops (all six workshops), 200 participants total Functional callc service up and running, where the partners can call the Advisory Committee for advice One half day seminar with expert presentations on theoretical aspects and partner presentation with initial experiencesPhase 2 and 3: 2 times six workshops(six workshops every two years), 400 participants total Call service, where the partners can call the Advisory Committee for advice (to be continued from phase 1) One half day seminar every two years	31/12/2018 01/07/2017 31/12/2017 31/12/2020; 31/12/2022 31/12/2020; 31/12/2022
C.5.4	Phase1: Capacity development programme for the C2C CC partnership Phase 2 and beyond: Five training courses, 150 participants Evaluation workshop organised every two years, 60 participants Masterclass , 50 participants	31/10/2017 31/12/2022 31/12/2020; 31/12/2022 31/12/22

ACTION C6: Tools

Beneficiary responsible for implementation: Central Denmark Region

Budget: 655.704€

Number of days estimated spent on action in phase 1: 10 Days

Role: Central Denmark Region will take on the role as initiator of developing common crosscutting tools which can be used by the 21 municipalities and the water utilities in C2C CC.

Description (what, how, where and when):
The objective of this action is to increase resilience through enhanced decision-making processes.

Relation to CCA plans:
In all the CCA plans there is a demand on an increased level of knowledge, and in particular tools to address specific challenges such as high groundwater tables. During workshops held to prepare the C2C CC project, the municipalities underlined the importance of developing tools to increase the knowledge on groundwater changes locally. Furthermore, there have been a general interest in making a surface/stream water module, which may model the effect of changes.

Linked to Complementary Actions
"WaterCoG": A project around the North Sea involving eight beneficiaries from DK, NL, SE and UK. The focus is on improved water governance in the private and public sector and includes pilots in the region. Testing and demonstrating new management tools. The WaterCoG and C6 will have strong synergies in relation to benefitting from the tools developed. [Funded by InterregVB].
"TOPSOIL": Focusing on issues related to rising groundwater levels and related climate change implications. Includes beneficiaries from DK, DE, NL, BE and UK and will add European aspects on groundwater to C2C CC. Complements C6.1 in relation to produced knowledge on the topsoil. [Funded by InterregVB].

Description (what, how, where and when):
In C6 there is a special emphasis on building up tools to be used across the whole of the CDR region.

C6.1 High resolution groundwater-surface water model for Central Region Denmark

What:
The purpose of this action is to develop a coupled groundwater-surface water model which covers the entire region and provides an integrated description of the entire water cycle in Central Denmark Region with an unprecedented level of detail. The resolution of the model should be high enough to provide a reliable prediction of areas prone to waterlogging and inundation, whether flooding is caused by groundwater or surface water. A model will be able to quantify the effects of adaptation measures, not only at the place where the action is implemented but also on downstream or neighbouring locations. The model will support local activities as it will be the common foundation for analysis of climate change and CCA in local areas, e.g., in urban areas where even higher resolution is needed, and where special anthropogenic interactions should be considered. Hence, results from the model will

be available for all activities undertaken in the actions and will ensure a common basis for all activities. The model will be available for all municipalities. The design of the tendering process and training is worked on in action C3.1

How:
Activities:
Phase 1:

1. A model is developed on the basis of the national water resources model, which has proven to produce reliable results for groundwater resources and protection, but suffers the level of detail to describe the near surface water levels. Hence, the national model (500 m resolution) is further developed in the Central Denmark Region on a number of aspects. The resolution of the model is improved to 100 meters scale. High precision digital elevation data should be used to specify the land surface. A new description of natural and artificial drainage (drainage pipes and channels) should be implemented. All input data to the model should be modified to match the 100 meters discretization.
2. The model should be calibrated against an extended database of hydrological observations including near surface observations of groundwater levels that are specifically collected as part of the project.
3. The model should be forced by results from selected climate models to ensure that the inherent climate projection uncertainty is represented by the model. The climate model data will be downscaled and bias corrected prior to being used as data for implementing physical plans and structures.
4. Subsequently, the model will transfer to an operational phase where it will serve and support the activities in the different actions, predicting results for present and future climate scenarios on e.g. groundwater levels, interaction between groundwater and surface water, and discharge of fresh water from river catchments (e.g. the River Storå, the River Gudenå, and the River Grenå, etc.).
5. Climate sensitivity will be mapped by feeding the model with a number of design storms, each defined by intensity-duration-frequency curves representing specific return periods. Hereby, it is possible to identify areas where the groundwater table will rise above a certain threshold (e.g., 1 meter) for a given design storm.

Phase 2 and 3:
In the subsequent periods, climate vulnerability is mapped and partners in the project can obtain results from the model on aspects relevant to local activities

Where: Central Denmark Region

When:
Phase 1: Activities 1-5
Phase 2-3: Implementation of the model in different localities

C6.2 Regional screening assessment tool of flood risk from rivers and the sea

What:
Climate changes increase precipitation, every day and extreme rains respectively, and increase the run offs into streams and rivers leaving especially low lying areas in risk of flooding. There is a need for a tool that visualizes and assesses the risk of flooding and illustrate the effect of potential solutions.

By the use of the best available tool (BAT) on the market, an illustrative river model is set up for the streams and rivers of the region. The tool should be developed as a web-based tool developed for screening potential flooding from cloud bursts, rivers and sea level risings. It should be based upon well-known principles for water flow, water level and flooding based on Manning's formula, and specific cross sections (cf. figure 14). The innovativeness of this action is to combine the web-based tool with a river model jointly with a statistical model for combined events of storms and heavy rains in future climate scenarios. The model for the region should be based on existing digital data for streams and rivers inclusive cross sections (cf. Figure 14 (right side)), underpasses and vegetation. The model should include water flow and water level at delta areas, which should make it possible to simulate coupled events by different run off scenarios (defined by water flow) and storm surges (defined by water level). Input data are: existing knowledge on run off in catchment areas, and the implementation of a statistical model. The statistical model should look at future climate time series, where especially coupled events between water flow and sea level are interesting.

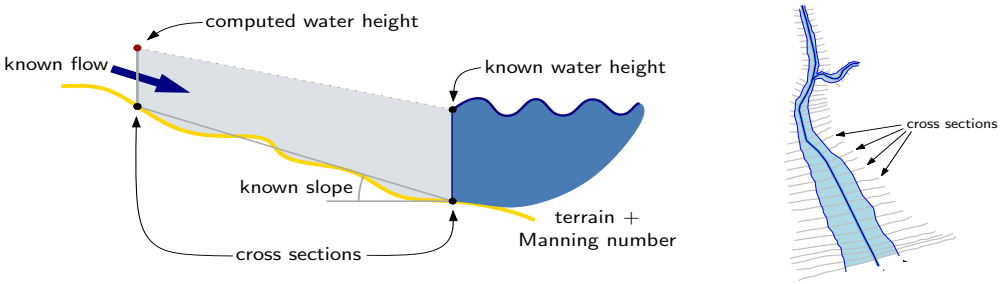


Figure 14: Illustration of the principles of the web-based tool.

How:
Activity:

1. The tool will provide the municipalities with an interactive 3D screening and decision support tool, which gives a knowledge base for a more focused dynamic hydraulic modelling

Where: Central Denmark Region

When:
Phase 1: Activity 1
Phase 2 and beyond: The tools is of use for the municipalities

C6.3: Warning systems
What
Early warning systems are in the beginning of being build up in Denmark. The systems can be advanced models coupled to weather and climate scenarios or simple warnings based on the weather forecast. They all have in common that they inforce the resilience capacity

via digital warnings. Warnings can be coupled to web pages, mobile phones or other digital platforms. In C2C CC there is a need to increase the use of warning systems.

How:
Activities:

1. Explore the known warning systems in DK and in other countries dealing with water management and warning systems
2. Recommend test and demonstrations
3. Test and demonstrate simple and advanced warning systems

*Where: C*entral Denmark Region

When:
Phase 2 and 3

Reasons why this action is necessary:
Knowing the scale and extension of a flooding event is essential for local and regional contingency plans to become effective. On a regional level, DEMA (The Danish Emergency Management Agency) has a broad range of manpower and equipment ready for preventing flooding from the sea, rivers, groundwater and cloudbursts, and municipalities, utilities and private owners have additional manpower and equipment, but to make the best use of the different resources in a timely manner, it's essential to know where to react in due time. An combination of weather prediction models, hydraulic models and warning systems are important to make the contingency management plans function in practice. The two tools, C6.1 and C6.2, are needed in CRD in order to create the knowledge base for planning for future impacts from rising groundwater level and flooding from rivers. Combined with warning systems these may by relatively small efforts increase the resilience capacity of CDR.

Constraints and assumptions
Constraints related to C.6.1. are mainly related to the demanded computer power, since the developed groundwater-surface water model has a high resolution and covers a large area. Therefore, computer requirements may be limiting for the analysis that is possible to carry out with the model. It is assumed that the existing warning system in Denmark under DEMA may function as a functional platform for the implementation of a flood warning module for the system, and that DEMA's regional staff and municipalities may find an interest in the model and tools developed for predicition.

Expected results:
C6.1: Phase 1:A model is developed, 2 municipalities have applied the tool and use the results in decision making and spatial planning. Phase 2 and 3:All CDR municipalities have applied the tool and use the results in decision making and spatial planning.

C6.2: Phase 1:A screening tool is developed and tested. Phase2 and 3: 15 municipalities have applied the tool and use the results in decision making and spatial planning.

C6.3: Phase 2 and 3: Known warning systems in DK and in other countries are explored. Simple advanced warning systems with flood prediction are tested and demonstrated. DEMA and 5 municipalities have applied an extended warning system module for flood prediction.

Expected results linked to expected complementary actions

WaterCoG will demonstrate new tools to improve flood resilience and water governance. TOPSOIL's results support C3 and C6.1 on the interlinkages between climate change and groundwater and brings in European experiences.

Cost estimation:

Based on working days with salary of 47 € per Hour and 347,5 € per day per senior employee and 35 € per hour and 259 € per day for junior employee.

Workshops and meetings includes budgets for lunch coffee and conference venue 75 € per participant

Workshops includes preparations in advance and hours spend during workshop and after the event for output material

Workshop transport is calculated via an average of 100 km and 0,487 € kr. per km

Deliverables:

Action	*Deliverables:*
C6.1	A High resolution groundwater-surface water model Report on model construction. Report on model calibration. Report on climate projections and climate impacts. User guideline for the model
C6.2	An interactive 3D decision support tool on the water flow in catchment areas across municipal borders Technical background report User guideline for the tool.
C6.3	Report on known warning systems in DK and abroad Test and demonstration of warning systems DEMA and 5 municipalities have adapted the new improved system

Milestones:

Action	*QuantifiableQuantifiable milestones:*	*Date by end of*
C.6.1	Groundwater-surface water model constructed	01/07/2018
	Observation data collected and groundwater-surface water model calibrated	31/12/2018
	Projection of the impact of climate change using a representative set of climate model results	01/04/2019
	All CDR municipalities have applied the tool and use the results in decision making and spatial planning	31/12/2022

C.6.2.	3D decision support tool is constructed Testing completed All CDR municipalities have tested the tool and useresults in decision making and spatial planning	01/07/2018 31/12/2018 31/12/2022
C6.3	Exploring and testing of warning systems done DEMA and 5 municipalities have tested an extended warning system module for flood prediction	31/12/2022 31/12/2022

ACTION C7: Innovation

Beneficiary responsible for implementation: Central Denmark Region

Budget: 438.167€

Number of days estimated spent on action in phase 1: 182 Days

Role of Central Denmark Region as main responsible

- Facilitator, coordinator and networking body of the CCA activities.
- Coordinates activities with partners, such as Central Denmark EU Office, and stakeholders, such as private companies, universities and NGO's
- Coordinates with other C actions on innovation such as C.20, C.21, C.22 and C.23

Linked to Complementary Actions

To support C7.4, Central Denmark Region will be applying ERDF (via Growth Forum CDR) for funding to support its efforts to boost export of water solutions globally. The project is called 'Smart Water Cities' and integrates environmental and societal challenges into business opportunities in emerging city markets for water management and water supply solutions. The expected sum is: 1.600.000 €

Description (what, how, where and when):

C2C CC innovation action gathers and makes use of a number of business related activities which take place in C1-C7 and within the actions C8-C24. Besides, this action has a number of own activities to promote sustainability of C2C CC. On the long run, resilience is increased by generating jobs and green investments in the region, and this action takes its point of departure in a strong regional emphasis on business development and public-private cooperation in general and in the water sector in particular. It also promotes the development of sustainable and high-quality coastal, nature and business tourism.

C7.1 Networking and knowledge-sharing as a backbone for innovation

What:

This activity creates a number of informal forums to unite important stakeholders within water businesses serving several purposes. First of all to show case climate change and water technologies. Secondly, to gather useful information and best practices from cross-cutting and demonstration activities - e.g. C.4 on SUDS, C.3 on technological development to solve problems with rising groundwater level incl. means to reuse excess water, C.16 on city development in Randers, C.22 on permeable pavements, C.6 on development of flood models for early warning systems, etc. Furthermore, these forums will set the stage for discussions between public owned water companies and companies to discuss public private cooperation and enhance innovation.

Water clean tech companies e.g. Dansand, Grundfos and Kamstrup, and engineering and consultancy companies such as NCC and NIRAS will be involved in relevant innovation projects and cooperation fora.

How:

1. Informal annual/biannual network meetings (01/06 2017, 01/06 2018, 01/2019) where water related companies, universities and relevant NGO´s will be invited to discuss business opportunities as a result of the findings in C2C CC.
2. Master classes, where an organisation presents a challenge, instead of presenting the good experiences and results. Presentation of major challenges or a dilemmas e.g. issues related to flooding of basements in an urban area due to rising groundwater form the basis of the cross-disciplinary master class. In the master class, companies, experts, municipalities and utilities work together in a workshop-like set-up on how to solve specific "wicked problems". This provides the companies with detailed inside knowledge on already experienced challenges and needs, and it provides the municipalities and utilities with different aspects on proposed solutions.

Where:
Central Denmark Region

When:
Phase 1: Activity 1 and 2
Phase 2 and beyond: repetition of activity 1 and 2

C7.2 Counselling of innovative industries on applying for EU funding

What:
This activity intends to ease water companies' access to various forms of finance in order to enhance innovation and to secure greater export of water solutions (as identified by EU initiative EIP on Water[6]). Many CDR companies are unaware of EU funding possibilities, the reason why CDR engaged actively in one of the first Action Groups, FINNOWATER[7]. Action C.7.2 builds on two pillars: awareness-raising and support to companies with innovative water solutions.

How:

1. Development of information material on EU support and funding possibilities to be sent to companies, relevant networks (regional as well as national e.g. DANVA (the Danish association of water companies), and municipal business promoters.
2. Individual counselling - and where needed coaching – of companies by Central Denmark EU Office.

Where:
Central Denmark Region, locally at companies at times, when they are available

When:
Phase 1: Activity 1 and 2
Phase 2 and beyond: Activity 1 and 2 will continue unchanged in subsequent phases

[6] EIP on Water Strategic ImplementationPlan
[7] http://www.eip-water.eu/FinnoWater

C7.3 Train start-up companies on business development within ecosystem services

What:
CCA in CDR closely relates to nature restauration, tourism in general as well as business tourism (C20 and C21). Many rivers and lakes will eventually prosper from greater fishing possibilities and change of forestry, and several actions deal with integrating nature based experience and tourism (C.8, C.9, C.11, C.12, C.16). However, Danish companies and authorities are not in the habit of including ecosystem services as part of their business development. But interest is widespread, also in industrial associations, and C2C CC wants to promote this development further. Experience from other regions show that investments on ecosystem services related to better environment, nature conservation and conditions for e.g. sportsfishing, may have a positive effect on emerging new business, such as the "pike-factories" in Region Zealand[8].

How:
- Interviews with relevant companies on potential for ecosystem services development and develop training material to support them
- Meeting – virtual or real – with the EIB to assess possible projects for NCFF funding
- Coaching of companies

Where:
Central Denmark Region

When:
Phase 2 and beyond

C7.4 Support export of Danish water solutions

What:
C2C CC will be show-casing water solutions and CCA solutions to a Danish and European public in order to generate more awareness and export possibilities. Furthermore, as CDR has years' of experience within exporting water solutions to Asian countries through the Danish Water Technology Hub – Danish Water Technology House – placed in Singapore helping Danish SME enter the south-east Asian markets. C.7.4 is targeted the further strengthening of this collaboration and coordination between water stakeholders in the Central Denmark Region and global markets.

How:
1. Strenghten collaboration and coordination between Danish water sector stakeholders
2. Establish and promote a strong Water Hub in Central Denmark Region run by an external player

Where:
Central Region Denmark

When:
Phase 1
Phase 2 and beyond

[8] http://fishingzealand.dk/en/

Reasons why this action is necessary:
In spite of Central Denmark Region having a large share of the water clean-tech companies in Denmark (55 out of 219), due to a lack of coordination, the presence of the newest knowledge and best available technologies (BAT) are not utilized – not in the Region, not in Denmark. According to the Confederation of Danish Industry (DI), Danish BAT within water could double by 2025 compared to the present level. There is thus an unused potential for capacity building and innovation within the region among the municipalities, the utilities, water companies and research institutions.

Constraints and assumptions
There are no significant constraints in implementing this action. CDR has extensive experience in organising and facilitating workshop and course activities and cooperating with private enterprises. On their part, companies will find the offer to get acquainted with EU funding positive and possible financing of innovation projects.

Expected results:
C7.1: At least three innovation projects arise on the basis of triple helix approach.

C7.2: 6 workshops on best practice and/or topical issues. Advising 10 companies on EU funding, following 4 applications submitted for EU funding.

C7.3: Contact to 10 potential stakeholders with an interest in ecosystem services, at least 2 applications for funding (EU or national) submitted, Interviews of 30 clean-tech water companies.

C7.4: Increase exports within Danish BAT within water in Central Denmark Region by at least 25% by 2022.

Cost estimation:
Based on working days with salary of 47 € per Hour and 347,5 € per day per senior employee and 35 € per hour and 259 € per day for junior employee. Workshops and meetings includes budgets for lunch coffee and conference venue 75 € per participant. Workshops includes preparations in advance and hours spend during workshop and after the event for output material
Workshop transport is calculated via an average of 100 km and 0,487 € kr. per km. 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	**Trip to DK. Advising of clean tech / water firms.**
Partners / *Cost categories:*	**CDEU**
Hotel cost:	554
Daily allowances/Payment for	238

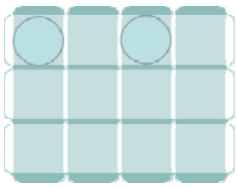
meals cost:	
Local transportation costs:	0
Total subsistence cost:	792

Deliverables:

Action	*Deliverables:*
C.7.1	Report with best practice cases
C.7.2	Information material on EU support and funding possibilities Four applications for EU-funding
C.7.3	Two applications for funding (EU og national)
C.7.4	Report describing potentials for Danish Water Hub and a comparison of water exports before and after C2C CC

Milestones:

Action	*QuantifiableQuantifiable milestones:*	*Date by end of*
C7.1	Annualreports on six workshops on best practice and/or topical issues	31/12/2017 31/12/2018 31/12/2019; 31/12/2020; 31/12/2021 31/12/2022
C7.2	Information material on EU support and funding possibilities available for partners 10 companies have received advice Four applications for EU funding submitted4 annual statuss reports	31/12/2017 21/12/2020 31/12/2018; 31/12/2018; 31/12/2019; 31/12/2020; 31/12/2022
C7.3	Interviews of 30 clean-tech water companies performed Two applicationsa for EU funding submitted	31/12/2018 31/12/2018; 31/12/2020
C7.4	Report on supportsfor export	31/12/2029



C8: Håb til Håb

Development of the Coastal land between Glud Håb and Håbet

The project focuses on involving stakeholders, politicians, administration, the wastewater utility, etc. in an effort to create a common understanding of the CCA challenges in order to make long-term sustainable choices. It is primarily linked to governance within sea & fjords and rainwater.

Main responsible beneficiary: Hedensted Municipality Budget: 238.788€

Number of days estimated spent on action in phase 1: 94 Days

Beneficiary responsible for implementation: HEDKOM

Role of HEDKOM:

- Is the project manager
- Cooperates with Aarhus University providing climate and culture historical consultation services (financed through C.24) and Hedensted Waste Water Company on the complementary project,
- Engages and involves politicians, citizens, citizens' organisations, etc.
- Reports to C2C CC project-leader and cooperates with other C2C CC partners

Relation to CCA plans

The action is part of Hedensted CCA municipal plan, which aims to prevent the consequences of climate changes, where major exiting assets are threatened (p. 21), taking into consideration guidelines for lowland areas and wetlands, as well as guidelines for technical installations.

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

Activity C8 Håb til Håb 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 C18 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, 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 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 C8 will benefit from this model. Under ation C5 specific training courses, workshops and masterclasses, with point of departure in the challenges experienced by the partners will be implemented for the benefiot of Action C8 and other

actions. C24 focuses among other things on innovative communication of the coupling between climate history and culture. Project C8 will function as a pilot where citizen-driven climate adaption will include an environmental and cultural-historical dimension.

Linked to Complementary Actions

C8 is linked to a complementary action by Hedensted Waste Water Company. It is commonly known that sewer systems must be maintained and renovated, but at the same time, there is a fear that solutions will be short-termed and not sufficiently sustainable. Hedensted Waste Water Company is responsible for the maintenance of the sewer, and will inter into cooperation with Hedensted Municipality and involved stakeholders in order to base decisions on the scenarios that are developed during the C2C CC project. In this way, decision on introducing certain sewer systems do not hinder innovative solutions in the long run. 3.4 mio. € has been allocated to this activity.

Description (What, how, where, and when)

What

The C.8. project focuses on involving stakeholders – citizens, politicians, administration, the waste water company, etc. – in an effort to create a common understanding of the CCA challenges in the project area in order to make long-term sustainable choices. Furthermore, the project underlines the need for growth and development and, of course, climate proofing the project area, preparing scenarios for how the area can develop, taking first step(s) from idea to action.

People have lived in the coastal area between Juelsminde and Snaptun since the beginning of the current warm period (Holocene). The coastal settlements are a particular feature of the area, and today the area is one of the most attractive outdoor leisure areas in Hedensted Municipality. Together with Juelsminde, it is the centre for costal tourism in the municipality.

Much of the river valleys are cultivated. The natural areas consist of cliff forests, meadows (mostly peatland) and marshland connected to watercourses. In terms of geology, the area contains moraines, freshwater peats and organic silts, and marine saltwater formations.

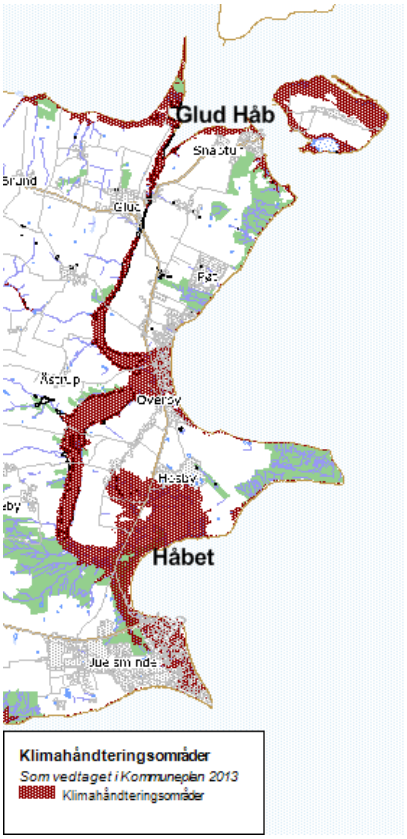


Figure 25: CCA areas in the municipal plan

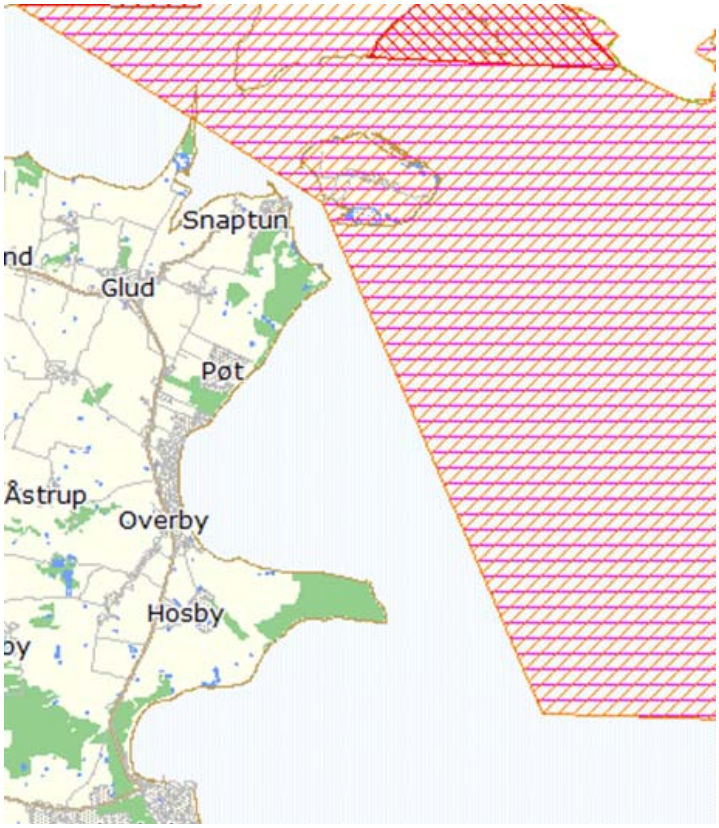


Figure 3: NATURA2000 areas at Horsens Fjord and the sea

Figure 17: The project area (the area threatened by seawater and freshwater flooding is shown in blue)

The area is close to a migration path for birds following the route along Jutland's coast. The area is close to one of the most important resting grounds for seabirds in Habitat Site no. 52, “Horsens Fjord, havet øst for og Endelave” (Horsens Fjord, the sea to the east and Endelave).

The challenges from changed climate consist of higher sea levels and greater volumes of water being transported from several watercourses in the coastal hinterland. Today, two sluices regulate the relationship between draining fresh water to the sea and the flow of saltwater from the sea to the hinterland.

It has a long-term impact on the assets in the widespread holiday home areas, on the continued possibility for cultivating agricultural areas using crop rotation, and the possibility of maintaining and developing a good ecological condition in the watercourses. There is approx. a 15 km watercourse, which has a base elevation of 0 or lower. It is also a complex task to simultaneously protect settlements from flooding, develop the area as an outdoor leisure and tourist area and ensure good ecological conditions in the watercourse and in the countryside. Taking action also increases the storage of carbon and reduce the emissions of carbon from peatlands, or create new resting and breeding areas for seabirds and wading birds, to compensate for the salt-affected meadows, which will disappear when the sea level rises.

The Hedensted Municipal Plan 2013-2025 fixes guidelines for lowland areas, laying down potential flooding areas as CCA areas. In the open countryside, these areas may only be changed to nature areas, wetlands and recreational areas. This means that with conversion, it strengthens the area's natural, so that the water environment plan's goals are maintained and that it becomes possible to remove nutrients.

The challenges that the area faces in particular: A more natural interplay between the coast and the coast's hinterland, and optimal cohesion between investments in good water environment and natural assets, in CCA, in CO_2 reduction and in the development of the area. Furthermore existing challenges include for example: finding solutions for the lowest lying holiday homes; dealing with wastewater and rainwater in an area affected intermittently by saltwater and rainfall effects, ensuring a good lifetime for the main traffic routes and other infrastructure, which complement the Municipality Plan 2013–2025, describing that new infrastructure like roads, etc., will be built to withstand raised sea levels; and ensuring accessibility for emergency services to Juelsminde.

C8.1 *Developing of scenarios – descriptive as well as prescriptive*

What
To form the basis for subsequent decision-making and as an important element of the awareness raising and involvement of the citizens, three descriptive challenge based scenarios will be developed: 1) if doing nothing, 2) if the area between sea and watercourse is opened and follow nature's and the climate's developments, or 3) close the area using sluices and dikes, so as to pump fresh water out into the sea. The scenarios are based on historical and Quaternary geological data, as well as on an assessment of the future environmental developments. These scenarios also build on the analysis on climate cultural history, made by Aarhus University, because it mobilises citizens' interest in the area.

How:
The action will include the following activities:

Phase 1
Based on previous data, setting up three data loggers in the watercourse system for collecting data on the water level and salinity, as well as a trial with an “open sluice” to get an indication of the effect of any eventual dismantling of the sluices, the three scenarios are prepared.

How:

- AU and an external consultant is involved in the designing of the descriptive scenarios, securing a continuity of the common knowledge and understanding of the area and is a method to keep focus for the municipal administration.
- The descriptive scenarios and the climate history are visualised and presented to the public (see C.8.2).

Phase 2 and beyond
Each scenario will contain: a long-term development goal (What will it look like in the future? How will the area be experienced? What will it mean for selected stakeholder groups? How may tourism be affected and can the cultural heritage narrative make the area more attractive?), project ideas (to test new solutions), detailed proposal for a first stage.

In 2nd phase and beyond, dialogue continues among stakeholders (cf. C8.2) on the three descriptive scenarios in order to secure consensus about the eventual CCA approach. Knowledge, results, and the project's progress will be disseminated (at the internet, at themed meetings, and field tours with land associations). During these phases, Aarhus University will continue the dialogue on the future cultural environment and the storytelling of the project area. The climate story serves a dual purpose – it mobilises local interest, and it brands the area and attracts more tourism. During Phase 2, the chosen descriptive scenario will be elaborated into a number of development scenarios with solutions to choose from.

Where: The scenario development shall take place in project area.
When:
Phase 1: Activities 1 and 2
Phase 2 and beyond:

C8.2 *Citizens’ engagement*

What:
A number of activities targeted citizens and stakeholders take place during the project period (and beyond). Citizens must be made aware of the consequences of the(ir) choices and empowered to take the right decisions. This activity deals with the proper engagement of citizens stakeholders in the process.

How:
Phase 1
To reach a common understanding of the CCA challenges, stakeholders and citizens are invited to join in discussions and make field trip to areas with similar problems to investigate solutions that may serve as inspiration. In this way, stakeholders get a deeper understanding of the area and learn about the world around them.

Concrete activities are:

1. 2 field frips and excursions among stakeholders to investigate best practices of how the challenges are handled elsewhere (e.g. for agriculture, enterprises, summer houses, etc.),
2. 1 – 2 workshops and working groups

Phase 2 and beyond
Discussions among stakeholders and citizens continue in order to prioritize and to reach the eventual decision on how best to implement CCA. As Phase 1 was very focused on awareness raising, later activities are focused on the proper decisions.

Where: destinations of the excursions tbd., workshops will take place in the project area.
When:
Phase 1: activities 1 and 2
Phase 2 and beyond: to be specified later

C8.3 *Political discussion and decision-making*
This action deals with the transition from scenarios to concrete decisions on how CCA can be carried out in a complex area in an interplay between knowledge about culture, nature, biodiversity and carbon sequestration. Whereas C8.2 was targeted stakeholders and their interests, this activity involves the political level and broader perspectives.

How:
Phase 1
Political discussions and survey of the challenges.

1. Hold a final conference, where the City Council discusses scenarios with citizens and stakeholders and creates local project groups.
2. Political deliberations in the City Council, with a choice of the most suitable scenario for the area's development by by 2022.

Phase 2 and beyond

3. Prepare complementary projects based on the proposal for "test projects" and "first stage projects".
4. Initiate the complementary projects with external co-financing, if required.

Where: HEDKOM

When:
Phase 1: activity 1 and 2
Phase 2 and beyond: activity 3 and 4

Reasons why this action is necessary:
The action is necessary to handle the complexity of such a large area with so many effects in a municipality, where resources are not plentiful. Furthermore, there are many possibilities and scenarios, and it can be difficult to move from ideas to scenarios and via decisions to concrete actions. In general, to keep up a dialogue on the long run between citizens, politicians, and other stakeholders to take sustainable solutions is difficult, but the

C8 method is to involve all parties in an innovative process, empower stakeholders to take part in the right solution, and be part of the story of the local climate history.

Constraints and assumptions
There is a risk that stakeholders do not want to discuss the challenges and options and will not participate in the process. However, this will be dealt with by making the negative outcomes from climate challenges clear – thus, the scenarios. Furthermore, when the City Council has to decide, if stakeholders have not been involved, there is no basis for a decision. This is dealt with by ensuring the selected scenarios are highly clarified and clear. Finally, it must be ensured that the City Council and the stakeholders can endorse the pilot projects, which will be dealt with by creating an open and involving process.

Expected results:
C8.1: Phase 1: Thorough awareness among stakeholders in the project area (and beyond) of the consequences of climate change – on nature, biodiversity, tourism and landowner interests; Knowledge on the climate history of the area. Phase 2 and beyond: Thorough discussion on concrete scenarios, their implications and eventual solution. 800 hectares (net), 3500 hectares (brut) land screened.

C8.2: Thorough knowledge among stakeholders on how CCA is handeled in similar areas. Discussion among stakeholders on appropiate – and eventual – solutions to the challenges. 2,000-3,000 stakeholders involved in the process.

C8.3: Phase 2: Political engagement in the climate change challenges – in the City Council and outside. A choice of CCA solution, which is sustainable and takes into consideration the intersts of the stakeholders.

Cost estimation:
Expenses for direct personal costs are based on person days for HEDKOM personel based on present salaries and pensions, etc. 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. Expenses for external expert help is based on prior experience with external assistance to local projects in HEDKOM. This external help is necessary to help HEDKOM deliver the modelling. Estimations for expenses in Phase 2 and beyond take the same point of departure. No costs are allocated AU, as C24 will provide analyses etc. to C8 as part of its project.

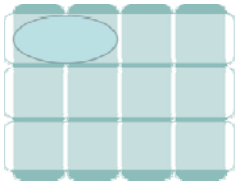
Deliverables:

Action	Deliverables
C8.1	Phase 1: Report on threet descriptive scenarios for the area's development with different actions. Report on recommendationsr on the area's development for the City Council. Report on Cultural heritage description Phase 2 and beyond: Development efforts divided into stages. Detailed proposal for first stage. Visualisation examples.

	1-3 scenarios for the area's development. Test project, which test new solutions. An account of the area. At least one pilot project, which shows the option for action and the clearness of the effect. At least one project description ready for execution
C.8.2.	Phase 1: Report of each excursion and minutes Report from workshop
C.8.3.	Phase 1 Report from citizen-politician workshop on descriptive scenarios Minutes on decisiond from City Council meeting Phase 2: Project ideas selected and deselected Project ready to be executed

Milestones:

Action	QuantifiableQuantifiable milestones	Date by end of
C8.1	Phase 1: Three overall descriptive scenarios finalised Cultural heritage description finalised One riskr and value map finalised Phase 2 and beyond: 1-3 concrete scenarios for the area's development finalised Visualisation of examples of projects from at least three project ready Areas and projectp ideas selected Pilot project details prepared At least one projectp ready for physical construction construction	 31/12/2018 31/12/2018 31/12/2018 31/12/2020 31/12/2020 31/12/2021 31/07/2022 31/12/2022
C.8.2.	Phase 1: Report on stakeholders analysis and stakeholder s mapping ready	 31/12/2019



C9: The Thyborøn Channel and the Western Limfjord

The project deals with a major problem at the western part of the Limfjord; rising sea level combined with changes in the Thyborøn Channel morphology leads to a situation in the Western Limfjord in which, within less than 50 years, water levels due to storm surges will increase up to 60 cm higher than equivalent levels of today, having almost insurmountable effects technically and economically. The project has 4 sub-projects: thorough mapping of the area, cooperation models with emergency management, innovative financial plans, and preparation of conceptual design for the project area. This project is primarily linked to governance within sea & fjords an rivers.

Main responsible beneficiary: Lemvig Municipality Budget: 1.158.508€

Number of days estimated spent on action in phase 1: 625 Days

Beneficiaries responsible for implementation: The project engages a total of 14 partners around the western Limfjord, of whom 7 are Municipalities: Lemvig Municipality (LK), Holstebro Municipality (HbK), Morsø Municipality (MK), Skive Municipality (SKK), Struer Muncipality (STK), Thisted Municipality (TK), and Vesthimmerland Municipality (VHK) and 7 are utilities: Lemvig Vand og Spildevand A/S (LVS), Morsø Forsyning A/S (MF), Skive Vand A/S (SKV), Struer Forsyning A/S (STF), Thisted Spildevand A/S (TV), Vestforsyning A/S (VESTF), Vesthimmerland Vand A/S(VV).

Role of LK

- Is the project manager for the implementation of the action
- Is the Secretariat for the project team, consisting of one representative from each of the 7 municipalities and of the 7 utilities. The project team coordinates the activities across municipalities.
- Engages other partners, primary and secondary stakeholders in the project, such as Danish Coastal Authority, The Limfjord Council, CDR, the Fire Department of North West Jutland (Nordvestjyllands Brandvæsen), the Emergency Management Unit North Jutland (Nordjyllands beredskab), Thyborøn Harbour
- Coordinates with complementary projects (to begin with: Lemvig Vand, partner)
- Monitors project progress, reports and cooperates with C2C CC Project Management

Relation til CCA plans

- LK CCA plan p 25
- TK CCA plan p 29
- MK CCA plan p 21
- VHK CCA plan p 12
- SKK CCA plan p 71
- STK – CCA plan under elaboration
- HbK (indirectly, p 9)

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

Action C9 Thyborøn Channel and the Western Limfjord 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 Juelsminde, 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, 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 C9 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 benfit of action C9. 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 C9 and other actions.

Linked to Complementary Actions

C9 is linked to a complementary action focusing on sewer system maintenance and innovation in LK. Future investments in renewing sewer systems at the coastal areas are varied, but essentially very expensive. Therefore, LVS is cooperating closely with the C9 action to secure optimal investments. The C2C CC project will feed data and analyses into the decision-making of the wastewater company. 2,9 mio € is allocated to this complementary action.

Description: What, how, where, when

C9. deals with a major problem at the western part of the Limfjord, uniting municipalities, national agencies, NGO's, etc in a common pursuit of greater resilience of the area, multilevel governance and capacity-building. Rising sea level combined with changes in the Thyborøn Channel morphology leads to a situation in the Western Limfjord in which, within less than 50 years, water levels due to storm surges will increase up to 60 cm higher than equivalent levels of today[9]. Such water levels will eventually have a completely destructive effect on the cities, ports, coastal stretches, dykes, etc. of the area. Climate profing the cities and the installations of the western Limfjord will technically and economically be an almost insurmountable task to do locally. The project has four sub-projects: thorough mapping of the area, cooperation models with emergency management, financial plans, and preparation of conceptual design for the project area.

[9] The Danish Coastal Authority: "Thyborøn Channel and Western Limfjord" from august 2012

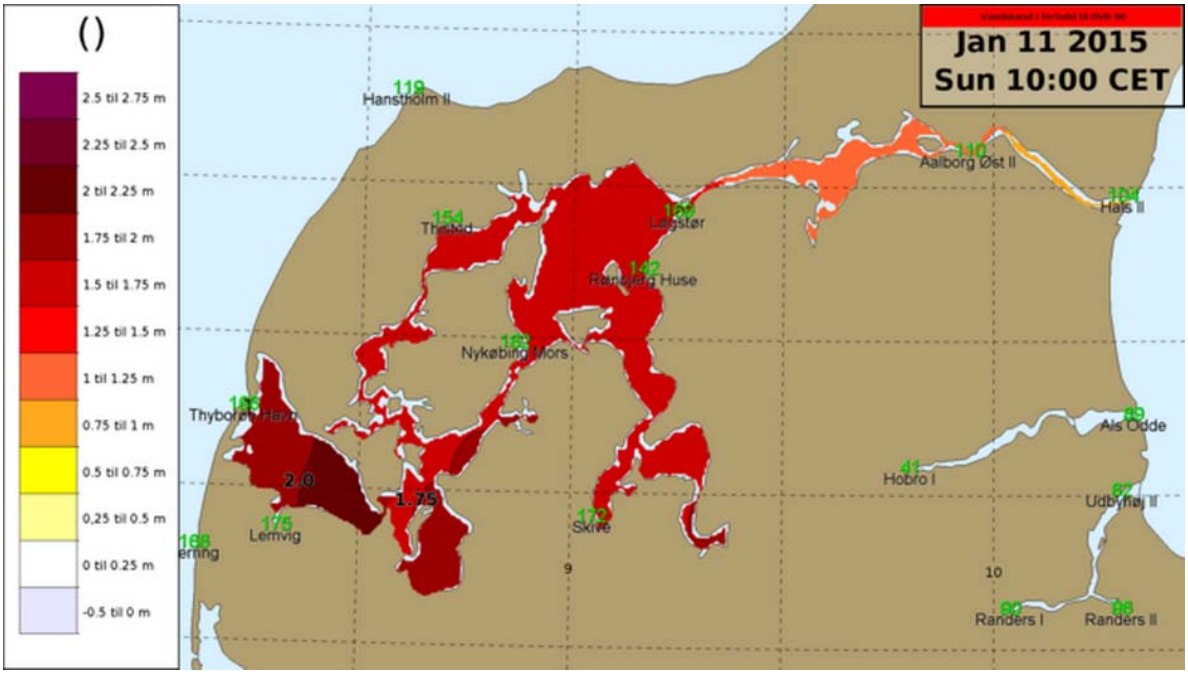


Figure 18: Storm surges of the December Storm 2015 (In Danish Bodil) in the Western Limfjord.

C9.1 *Mapping of (secondary effects of) the project area*

What
Based of the review from 2012 by the Danish Coastal Authority (and as a further investigation into the consequences of the CCA challenges), all significant secondary effects on the marine environment, biodiversity and business development in the Limfjord and its surrounding rural areas are mapped. This mapping, which takes place in Phase 1, feeds into C9.4 as well as for knowledge-sharing among C2C CC partners.

How
Phase 1

1. Analyses of derived effects such as the implications on the marine environment of the Limfjord, the biodiversity of the Limfjord and its catchment areas, the implications for the commercial ports' business opportunities and for the utilities' coastal infrastructure.
2. Identification and engagement of more relevant stakeholders.
3. Based on the mapping, an in-depth analysis of positive and negative secondary effects of the proposed solutions of the Coastal Authority's report will form the basis for the political decision-making of a common, regional solution to the climate challenge.
4. Two seminars for the relevant decision-makers to discuss results of analyses and mapping.

Where: The project area
When: Phase 1: activities 1 - 4

C9.2 *New forms of cooperation with emergency management*

What:
CCA is an ongoing balancing act to achieve the optimum level of protection. A permanent protection against extreme events that occur very, very rarely is not cost-effective. A clear plan for preparedness, however, is. The purpose of C9.2 is to identify optimal, permanent protection of the Western Limfjord and at the same time be prepared to deal with extreme events. Both authorities and civilians must be empowered to handle extreme events.

How:
Phase 1

1. In cooperation with the two regional emergency management units (civil protection) - North and South of the Western Limfjord, respectively, a project team will be established and will prepare analyses of the ideal level of protection for urban communities and other areas along the coast.
2. The joint building (the project team and the emergency management units) of a capacity – professional as well as civilian – to handle storm surges.
3. Jointly (the project team and the emergency management units) to build a cross-border emergency management system for handling of storm surge events above the permanent level of protection.

Where: The project area
When: Phase 1 and Phase 2

C9.3. *Financial planning*
CCA projects need agreement on financing. The responsibility for – and the financing of – CCA in coastal areas belongs in principle to the private property owner. However, in case a CCA project is in the public interest, national and local coastal protection authorities can implement and finance it. If a regional CCA solution to Thyborøn Channel is to be found, concrete ideas as how to finance it must be put on the table. Thus, C9.3 is targeted the elaboration of one or more proposals for funding that can be the starting point for political negotiations. This activity takes place in phase 2.

How
Phase 2
In cooperation between municipalities, utilities, the insurance companies, the Danish Coastal Authority, and other parties having an economic interest in climate protection, a number of funding model options will be developed. The development of financial models based on e.g. utility principles can speed up the process and thus the timely CCA across Denmark. Inspiration found in other, similar European regions (e.g. the Netherlands and Northern Germany). These proposals for financial models will be discussed at the 5th seminar for decision-makers and stakeholders.

Where: In the seven municipalities (partners) in the project
When: Phase 2

C9.4. *Requirement specification for conceptual designs*

What:
To secure a possible establishment of the installations at Thyborøn Channel, one or more conceptual designs will be prepared. The requirement specification for the conceptual designs will reflect the work carried out in the preceding sub-actions. This activity takes place after the 1st phase.

How
Phase 2 and beyond

1. The project team prepares requirement analyses to conceptual design based on C9.1 - C9.3.
2. An architectural competition is held in which architects and consulting engineering firms are invited to deliver conceptual designs that deal with the CCA and, simultaneously, add value in other areas. Conceptual designs may also include ongoing CCA in the form of, e.g. reducing the Channel's cross sectional area as new technology and more knowledge about CCA needs emerge.
3. Against this background, the implemented design competition, which should lead to a number of projects, providing CCA solutions as well as value added in other areas.
4. In the last year, there will be focus on the planning of a possible construction phase.

Where: The project area
When: Phase 2 and Phase 3

Reasons why this action is necessary:
Rising water levels in the Limfjord due to storm surges is a burning platform for municipalities, utilities, and, not least, citizens along the coast of the Western Limfjord. Today, many millions of euros are invested in development projects in coastal towns at the Western Limfjord. The great uncertainties about future water levels due to storm surges lead to individual and thus sub-optimal CCA solutions. Socio-economical gains from a joint regional solution are potentially very large. C9 will help achieving C2C CC overall objective by crafting a regional strategy on CCA of urban communities at the western shores of the Limfjord. The project will support the networking and knowledge sharing across municipalities, utitlities and other climate stakeholders regionally, nationally and internationally. The project will build capacity to withstand and manage future storm surges.

Constraints and assumptions
C9.1 presumes cooperation with NGOs, knowledge institutions and leading professionals. To deal with possible resistance, contacts with secundary stakeholders have already been made. The 14 partners also have direct access to professionals in the field of EIA. C9.2 requires close cooperation between the emergency management unit, municipalities, and utilities. Such cooperation already exists. However, due to structural reform (2016), the emergency management units have been merged into larger units. The project team will therefore work to ensure a continued good and even closer cooperation between these new units, municipalities and utilities. C9.3 requires a political will to look for alternative funding models. This is dealt with by engaging all of the 7 municipalities as project partners on the basis of political decisions. The Technical Committees and the City Councils as well

as the Boards of the utilities will be informed and involved in the subproject on a regular basis. C9.4 requires a political decision-making process, before starting the preparation of conceptual designs. Politicians will be informed and involved throughout the project - right up to the ultimate goal.

Expected results:

9.1: Phase 1: The major stakeholders are envistigated as a basis for future action. Insight in significant secondary effects of a regional CCA solution by Thyborøn Channel. The socio-economic review aids decision-making for a political decision on which CCA solution to be worked on with.

9.2: Phase 1: An analysis of the optimal, permanent protection for submission to policymakers and stakeholders. Strengthening of the professional and the civilian capacity to handle storm surge events, and a cross-border emergency and contingency plan for handling storm surge events significantly increase resilience.

C9.3: Phase 1: One or more financial models will support that the optimal CCA project is to be implemented.

C9.4: Phase 2 : The conceptual designs address the climate challenge in the Western Limfjord and contribute with added value for the coastal communities and the habitat areas.

Cost estimation:

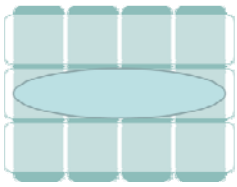
Expenses for direct personal costs are based on person days for the 7 municipalities' and the 7 utilities' personel based on present salaries and pensions, etc. These expenses are used for in-house analyses and assessments, as far as possible, and for meetings with stakeholders, citizens, national agencies etc. Expenses for external expert help is based on prior experience with external assistance and necessary for all activities. Expenses cover the initial analyses of secondary effects of CCA solutions to the project area as well as the work on better emergency planning in cooperation with stakeholders – primary as well as secondary, etc. During Phase 2 and beyond, expenses will cover partners' and stakeholders' work on the financial model as well as the work on a conceptual design for the eventual CCA solution at Thyborøn Channel.

Deliverables:

Action	Deliverables
C9.1	Phase 1: A survey of major stakeholders and significant secondary effects of a regional CCA solution by Thyborøn Channel. Deadline 31. Dec 2017 a socio-economic review, which may form the basis for a political decision on which climate solution to be worked on with. Deadline 31. Dec 2018
C9.2.	Phase 2: An analysis of the optimal, permanent protection for submission to policymakers and stakeholders. Deadline 30. June 2019 An analysis on the strengthening of the professional and the civilian capacity to deal with the storm surges at the Western Limfjord. Deadline 31. December 2019 A cross-border emergency preparedness plan for handling of storm surges. Deadline 30. June 2020
C9.3.	Phase 2: A review of proposals for financing models that can support that the optimal CCA project can be implemented. Deadline 31. Dec 2020
C9.4	A number of conceptual designs addressing the CCA in the Western Limfjord and add value. Deadline 30. June 2021

Milestones

Action	QuantifiableQuantifiable milestones	Date by end of
C.9.1	Phase 1:	
	Minutes from kickoffk Meeting with the entire project team.	31/02/2017
	One agreement with an Advisor on the development of the mapping of key stakeholders	31/02/2017 30/04/2017
	Final stakeholder mapping report.	31/12/2017
	1st Seminar for the relevant decision-makers.	31/02/2018
	One agreement with an Advisor on the development development of socio-economic statement	31/03/2018 31/12/2018
	Final statementavailable.	31/02/2019
	2. Seminar for the relevant decision-makers.	
C.9.2.	Phase 2:	
	ProjectP team established with the participation of emergency management units North and South of the Western Limfjord.	30/06/2018
	One agreement with an Advisor on the preparation of analysis of the optimal, permanent protection level for submission to policymakers and stakeholders.	30/09/2018
	One agreement with an Advisor on the assistance for building professional and civil capacity to deal with the storm events at the Western Limfjord	31/12/2018
	One agreement with an Advisor on assistance for the preparation of a cross-border emergency preparedness for handling of storm surge events	31/03/2019
	Analysis of the optimal level of protection available.	30/06/2019
	3rd Seminar for the relevant decision-makers.	30/09/2019
	A review of the strengthening of the professional and the civilian capacity to deal with the storm events are available.	31/12/2019
	4th Seminar for relevant decision makers.	31/03/2020
	A cross-border emergency management for handling of storm surge events.	30/06/2020.
C.9.3.	Phase 2:	
	The establishment of the project team with the participation of insurance companies' association	31/03/2019
	Conclusion of Advisor agreement on assistance with the preparation of proposals for financing models	30/06/2020
	A number of proposals for funding are available. 31. March 2021. 5th Seminar for relevant decision makers.	31/12/2020
C9.4	Phase 2	
	ConclusionC of Advisor Agreement for assistance with preparation of requirement specifications for climate solution by Thyborøn Channel.	30/09/2020
	Architectural competition published.	30/06/2021
	At least three conceptual designs addressing CCA challenges in the Western Limfjord and contribute with added value are available.	31/12/2021
	6th Seminar for the relevant decision-makers.	28/02/2022



C10: The River Grenaa Catchment

In the towns alongside the watercourses of Kolindsund and Grenaa, climate change have major implications – not least in relation to the areas used for agricultural production and in the meadow areas along the river basins. Taking into account the present land use, future climate changes (more precipitation, greater quantities of water in catchments, rising groundwater, rising water level in Kattegat and – possibly – salt water intrusion), as well as cost-benefit and societal analyses, a number of realistic CCA scenarios will be analysed to provide a robust and valid basis for political decision-making. This action is primarily linked to developing tools within the whole hydrological circle.

Main responsible beneficiary: Norddjurs Municipality Budget: 1.064.250€

Number of days estimated spent on action in phase 1: 285 Days

Beneficiaries responsible for implementation: Syddjurs Municipality (SDK) and Norddjurs Municipality (NDK)

Role of NDK

- Is the project-leader
- Works with stakeholders: Aqua Djurs, Syddjurs Spildevand, other wastewater companies, landowners, drainage associations, NGOs etc.
- Serves a Steering Committee (composed of Syddjurs and Norddjurs project-leaders, technical directors and politicians) and a Monitoring Group (composed of wastewater companies, Kolidsunds Venner, drainage associations, possibly politicians)
- Feeds into homepage and project portal to ensure local ownership and political consensus
- Reports and cooperates with C2C CC PM and other C actions

Relation to CCA plans

- Norddjurs CCA plan: (Kolindsund mentioned pp. 23-24, 26, 30-31, 37)
- Syddjurs CCA plan: http://www.syddjurs.dk/sites/default/files/PDF/KPT07.pdf (Kolindsund mentioned pp. 9, 11 og 12)

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

Activity C10 The Grenaa Cathment 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, C11, 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 C10 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 benfit of action C10.
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 C10 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 C10 will benefit from this model.
Under Action C4 Rainwater, C10 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, 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 C10 directly.

Linked to Complementary Actions

As of now, C10 is not linked to complementary actions, but the preparation of complementary projects are inherent in activities (cf. C10.3).

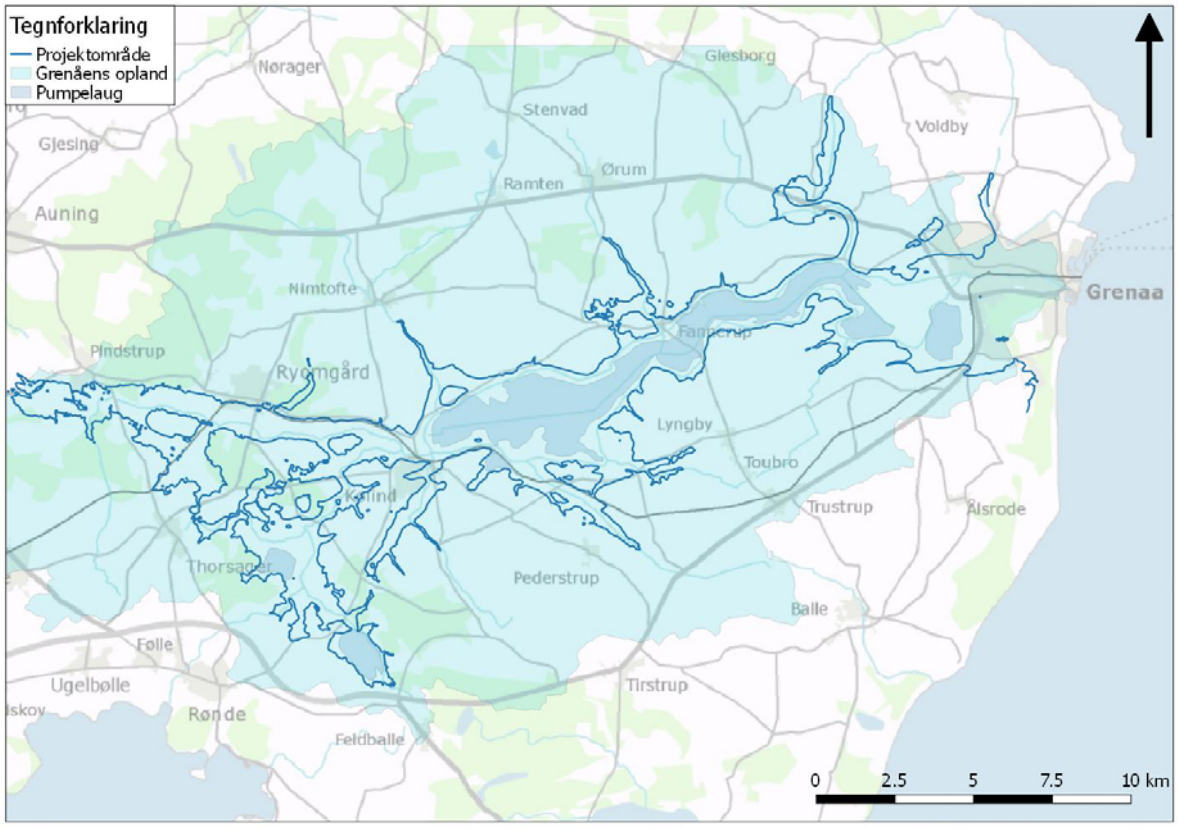


Figure19: The catchment area of River Greenaa

Description (what, how, where, when)

What:
When preparing the CCA plans, analyses of the Grenaa Catchment revealed major challenges related to water management: surface water, groundwater and seawater. The project area covers 466km^2. The challenge is particularly complex due to the size of the area, and different – conflicting – interests. The river estuary of the River Grenaa is the city of Grenaa, which is challenged by the future rising sea levels and water flows from the various catchments, leading to floods and problems with water supply.

In the towns alongside the watercourses of Kolindsund (the sound of Kolind) and Grenaa, climate change have major implications – not least in relation to the areas used for agricultural production and in the meadow areas along the river basins (also areas upstream of Kolindsund).

Taking into account the present land use, future climate changes (more precipitation, greater quantities of water in catchments, rising groundwater, rising water level in Kattegat and – possibly – salt water intrusion), as well as cost-benefit and societal analyses, a number of realistic CCA scenarios will be elaborated and analysed to provide a robust and valid basis for political decision-making. Where relevant, these scenarios will be extrapolated 25, 50, and 100 years to take into account future climate developments.
Among others, the following elements will be included:

- Risk assessment
- Climate-proofing of the city of Grenaa, the Kolindsund and other infrastructure in the project area (minimizing flood risk, controlled flooding, unsanitary conditions as a consequence of the overflow of the waste water systems)
- Technical requirements for climate protection in relation to agricultural production
- Implications of possible salt water intrusion for the agricultural production and the supply of drinking water
- Improved CO_2 score due to CO_2 retention from reintroducing wetlands
- Assessments of societal values (existing nature, outdoor recreation, settlement, and other recreational values)

Phase 1 deals with the collection of data for the hydrological model, setting up of expert/citizens forums and the creation of a website, whereas phase 2 and beyond deals with the calibration of the hydraulic model, setting up the solution scenarios, economic assessment of scenarios, qualification of the model and scenarios by organizing workshop, choose solution through economic assessments, and develop a comprehensive proposal for solutions for the project area.

C10.1 *The set-up of a hydrological model*

What:
To understand the hydrological processes in the River Grenaa catchment, to secure common knowledge and understanding of the CCA challenges among stakeholders, and eventually to make the proper decisions, it is necessary to set up a hydrological model. Maximum cohesion and robustness is secured by a number of workshops with experts and stakeholders. The output of this process is a combined groundwater and salt water model

to assess the CCA impacts on the River Grenaa catchment and its hinterland able to assess the cumulative effects and impact of the flooding, saltwater intrusion and other water balance considerations. The model is a dynamic 3-D model (surface-ground water incl. full 3D coupled unsaturated-saturated zone) that can handle the time-related variations in the system. The following data will calibrate the model: rainfall, runoff, time-series for groundwater level, salinity, activities in drainage associations, potential evaporation, drainage, wastewater data, nitrogen / phosphorus etc. Especially in relation to groundwater, more data is needed to set up a model. Furthermore, tenders for model setup will be elaborated.

How:

Phase 1:

The following sub-actions are part of the hydrological modeling:

1. Collection of data and setting up a hydological model
2. Workshop on needs for data to be included in the model. Participants: the C2C CC Advisory Committee, hydrologists, geologists, architects, economists, farmers' organizations, ethnographers, insurance companies, and social science experts.
3. Elaboration of a tender for a model setup

Phase 2 and beyond:

Subsequent phases deal with modelling, calibration, and scenarios (2019-2020) and impact assessment of selected scenarios (2021-2022), among others:

4. Model calculations for risk assessments (based on the UN climate scenarios, cumulative impacts of rises of ground water and sea level as well as increased rainfall. Sensitivity analyzes in order to qualify the risk assessments.)
5. Model calculations for the screening of possible scenarios/combinations for CCA of the agricultural interests, Grenaa City, Kolind and Ryomgaard and other infrastructure. Sensitivity analysis will determine the robustness of the scenarios.
6. Initial socio-economic analyzes (to decide upon the scenarios for further screening analysis).
7. Impact assessment of selected scenarios, both technically and economically.

Where: The project area

When:

Phase 1: activities 1-3

Phase 2 and Phase 3: activities 4-7

C10.2 *Public awareness raising: website and citizens meetings, etc.*

What:

To secure widespread awareness on the CCA challenges of the Grenaa catchment, and empowering stakeholders, eventually leading up to a political decision-making, a website and a portal will be created and citizens meetings held. The website (incl. A dialogue portal) is going to be dedicated interested stakeholders and citizens to provide input and engage in dialogue on the project. The website will also regularly present analyses. Citizens meetings will be set up, where there is a need for a more direct dialogue with citizens in the communities of Kolind, Ryomgård and Grenaa.

How:
Phase 1:

1. Launching of a website incl. Life logo and linked to C2C CC website
2. 1 – 2 Citizens meetings to disseminate results. Depending on how many sign up to the citizens' meetings, one will be in the east and one in the west of the project area to secure that all citizens are heard.

Where: Norddjurs and Syddjurs municipalities; the website, which is a local instrument to serve the action, will be linked to the C2C CC website.

When: This activity is an important element of the project and will take place all years and beyond.

C10.3 *Laying the basis for decision-making*

What:
Finding solutions to the Grenaa catchment CCA challenges not only require thorough analysis and awareness raising, but eventually also a political dialogue – among local stakeholders and across municipal boundaries. A dialogue within the Steering Committee and the Monitoring Group will deal with trade-offs. This dialogue is to create ownership, and continuing discussion and decision on the project and its scenarios. This ensures dialogue with politicians, stakeholders and interest groups represented in either group. And to secure even better basis for decisions, workshops with the participation of representatives from the Advisory Committee will be organised, and findings from C2C CC analyses on the legal and administrative fields will be included. As a result, scenarios to be further investigated in Phase 3 will be chosen.

Phase 1:

1. Public meetings and a conference with representatives from the Norddjurs and the Syddjurs City Councils, discussing scenarios with citizens and other stakeholders to secure political attention and cooperation between the two neighboring municipalities on this issue
2. If need be, local project groups wanting to work deeper on aspects of the project will be established.

Phase 2 and beyond:
In phases 2 and 3, the prioritization tools are supposed to include aspects such as outdoor recreation, recreational, health, tourism, etc apart from the technical assessments, as well as cost-benefit analyzes of the chosen solution. Additional complementary projects will be established.

Where: Norddjurs and Syddjurs Municipalities
When: Phase 1-3 and beyond

Reasons why this action is necessary:
Climate changes put extreme pressure on cities and agricultural areas within the whole project area. CCA must be carried out to the benefit of citizens, society and the area itself. However, within the area, many interests and issues are in conflict, but may eventually complement and match one another. To reach that situation, the landowners, drainage

associations, interested companies including wastewater companies and organizations must be engaged, and a thorough modelling and review analysis including analyses of various parameters, the handling of accumulated effects are necessary to involve stakeholders and to include them in defining the possibility of a solution. The models and tools form the basis for a common understanding among the two municipalities and its stakeholders when having to decide on CCA solutions and its impact on e.g. biodiversity, environment CO_2, socio-economic benefit and legal questions. In addition, the project, in combination with the other C2C CC sub-projects, will provide knowledge and generate manuals and initiate innovative elements for handling CCA that can create value locally, regionally, nationally and in general in the EU. The large project area contains many divergent interests to be weighed and lifted to a common strategy for the area's CCA.

Constraints and assumptions
Over the past years, the Grenaa catchment has been subject to much debate and strong interest in maintaining the existing land use for agriculture, or if old landscapes with wetlands should be restored. These conflicting interests have often been publicly debated, and political debate and strong attitudes and ideologies have been put to the open. The project intends to clarify and provide answers to questions and solutions to the issues that have flourished for many years. Being holistic, the project will help to balance the various interests. A common platform of knowledge to communicate from a common strategy for the region in the long term shall help in this endeavor. Municipalities prioritize that the project is transparent and call for a great deal of dialogue, based on mutual respect. The Steering Committee and the Monitoring Group shall, as well as an ongoing dialogue in the project phase, shall ensure this.

Expected results:
C10.1: Phase 1: Knowledge and a common understanding of the CCA challenges linked to the Grenaa Catchment and the Kolindsund. Total number of hectares screened: 470.

C10.2: Public awareness and public discussion on CCA and the challenges linked to the Grenaa Catchment and the Kolindsund. Number of citizens reached: around 500.

C10.3: Phase 2: Awareness and knowledge is build at political level and dialogue between politicians of the two municipalities is established, and decisions of 1 or more integrated solutions, incl. costs and proposed financing are presented to politicians of both municipalities to be decided on.

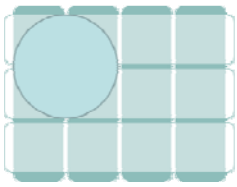
Cost estimation:
Expenses for direct personal costs are based on person days for NDK and SDK personel based on present salaries and pensions, etc. Expenses for external expert help is based on prior experience with external assistance to local projects in the municipalities. External assistance will be used for highly needed expertise in relation to the modeling. During Phase 2 will cover the further development of the model, calibration and calculating various scenarios under various conditions and including socio-economic assessments, incl. environment and nature. During Phase 3 expenses will cover final works on models, comparisons, tools, guidelines, a meeting with citizens.

Deliverables:

Action	***Deliverables***
C10.1	Calibrated hydraulic model for the Grenaa Catchment Idea catalogue with possible solutions and assessments for CCA in the project area Catalogue with selected solutions and their in depth analysis
C10.2	Website incl. a dialogue portal
C10.3	Strategic plan for the area and its climate adaptation

Milestones:

Action	***QuantifiableQuantifiable milestones***	***Date by end of***
C10.1	Phase 1:	
	Workshop held on qualifying data sampling	31/12/2018
	Collection of data for the model and other assessments done	31/12/2018
	Tendering material developed for model and impact assessment	31/12/2018
	Phase 2 and beyond:	
	Elaboration of model and calibrating done	31/12/2022
	Screening and qualifying options incl. risk assessment done	31/12/2022
	Assessment onAon environment, nature and recreational values done	31/12/2022
	Impact assessment of chosen scenarios and prioritization (2021-2022)	31/12/2022
	Solutions for political decision-making identified	31/12/2022
C10.2	Launching of Website incl. a dialogue portal	31/12/2018
	CitizensC meetings held, 500 participants	31/12/2022
C10.3	Public meetings and a conference with representatives from the Norddjurs and the Syddjurs City Councils, 100 participants	31/12/2022



C11: Randers Fjord

Loss of Territory to the Water: Benefit or loss?

According to the Floods Directive, the Randers Fjord is designated a risk area, and risk management plans have been made. The content of this project is to map the areas, and develop a strategy focusing on active integrating CCA, nature, inhabitants, development. and economy. The subsequent implementation of the strategy will lead to a coherent, sustainable, and adequate land use. This action is primarily alignedaligned with governance and tools within seas & fjords and rivers.

Main responsible beneficiary: Norddjurs Municipality Budget: 177.280€

Number of days estimated spent on action in phase 1: 158 Days

Beneficiaries responsible for implementation: Randers Municipality (RK) and Norddjurs Municipality (NDR)

Role of Nordjurs Municipality:

- Is the project manager
- Works with the following dike associations assecondary stakeholders: (at NDR side) Drammelstrup Enges Landvindingslag, Hollandsbjerg-Bode-Stenalt Enges Landvindingslag, Hejbækkens Landvindingslag, Karholme Landvindingslag, Allingåbro Enges Landvindingslag, Vivild-Hevring Enges Landvindingslag, Holbækgård Pumpelag, and (at RK side) Albæk pumpelag, Tjærby- Vestrup pumpelag, Assentoft m.fl. Byers pumpelag, Kristrup enges pumpelag, Dronningborg Tjærby enges landvindingslag, Støvring enges landvindingslag, Udbyneder enges landvindingslag, Romalt enges landvindingslag, Øster Tørslev m.fl. byers, landvindingslag, Råby m.fl. enges landvindingslag, Gjerlev, Ø. Tørslev m.fl. enges landvindingslag, Dronningborg Vestre enges pumpelag,
- Reports and cooperates with PM (CDR) and C12 project manager

Relation to CCA plans

NDR CCA plan pp. 14-16
RK CCA plan p. 35 and risk management plan p. 71.

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

Action C11 Randers Fjord 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, C14 and C18 dealing with the coastal cities of Juelsminde, Horsens 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 C8, C9, C10, C12, 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 C11 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 benfit of action C11. 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 C11 and other actions.

Linked to complementary projects
As of now, no complementary projects have been sought. However, the RK is providing supplementary financing to the C11 action.

Description: What, How, Where, When,
C11 is a cross-border action targeted finding common solutions to a huge CCA risk involving two fjords, a number of cities, of which one is designated flood risk area, and vested interests in dike associations.

According to the Floods Directive, the Randers Fjord is designated a risk area, and risk management plans in both RK and NDK have been made. The content of C.11 is to map the areas, and develop a strategy focusing on active integrating CCA, nature, populations, development and economics. The subsequent implementation of the strategy will lead to a coherent, sustainable, and adequate land use. The strategy must go public and can be used as a manual for other planning authorities in Denmark and the rest of the EU.

The Randers Fjord constitutes the estuary of the River Gudenå and the watercourse Alling Å. A number of communities lie at the fjord e.g. Udbyhøj, Allingåbro, Uggelhuse and Randers, and floodings directly affect around 3,000 people as well as essential infrastructure, values, and large areas of farmland. Finally, Randers Fjord is essential for both tourism and protection of natural areas.

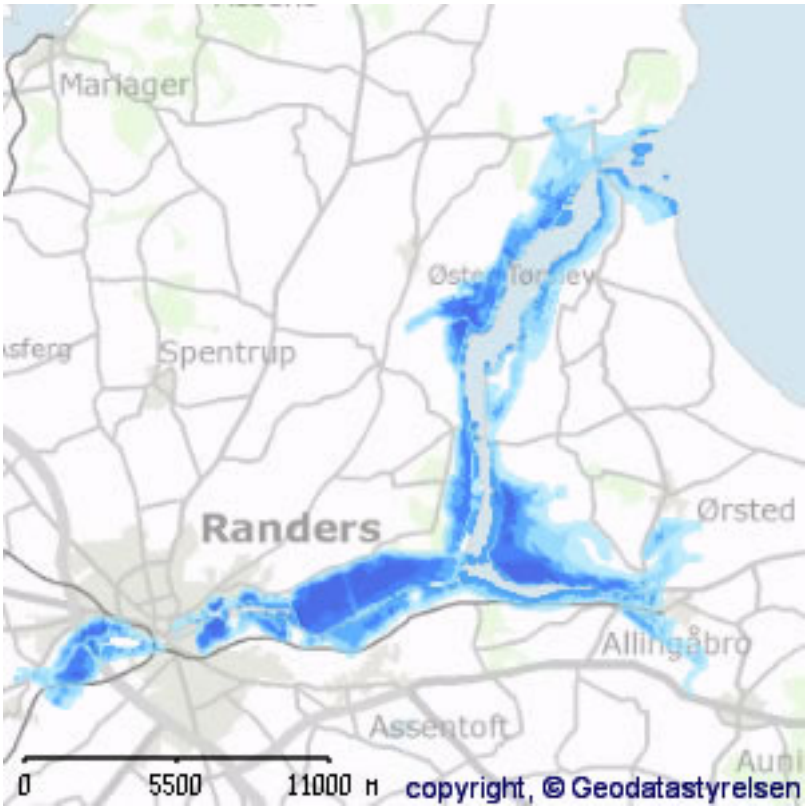


Figure 20. The project area along Randers Fjord, where large values are threatened by extensive flooding in both floods and the term of the term sea level rise.

As a supplement to the river model for the River Gudenåen (C12), a corresponding 'fjord model' calculating the consequences of relationships between runoff from rivers, tides, flooding and air pressure in relation to the topography close to the fjord as well as the urban communities must be developed. The desired set-up of this 'fjord model' is to ensure that future solutions to address flooding in Randers Fjord do not affect ecosystems in the fjord unnecessarily. This is due to the fact that Randers Fjord has several designations (cf. Habitats Directive). Furthermore, since Randers Fjord is the estuary for the River Gudenåen, an altered ecology in the Randers Fjord due to CCA of the fjord may result in ecological impacts upstream in the protected areas.

The project aims at shedding light on this loss of values caused by the floods – both in terms of permanent loss of cultivated areas and acute loss due to flooding.

C11.1 *Development of a 'fjord model' and cost-benefit analyses*

What:
A 'fjord model' is to be developed as a counterpart to the "river model" for the River Gudenå and an interconnection to this. To be coordinated with C.12 relating to illustrate the effects of water retention at field level.
In continuation, a cost-benefit analyses will be conducted, focusing on loss of values as well as gains of how climate change solutions may create added value at local level.

How:

Phase 1

1. Survey and analysis of Randers Fjord at different scenarios for rising sea levels, flooding, runoff, flora / fauna and the effects of inlet and meadows. This together form a fjord model which will connect to the many natural and physio-chemical balances in the fjord.
2. Based on the fjord model we will prepare a cost-benefit analysis. This is a holistic value analysis linking the multilateral considerations that the fjord carries today to ensure a long term climate risk assessment and reduction of risk around Randers Fjord. A value analysis will be based on primarily economical considerations evaluating the different CCA solutions of Randers Fjord.

Phase 2

The activities in Phase 1 will be examined and challenged. Among others, by integrating C11 with related actions, in particular, C12. which is directly related to Randers Fjord.

Where: The project area, figure 20

When
Phase 1: activities 1 and 2

C11.2 *Assessment of the consequences of establishing a sluice*

Concurrently with Actions 1 and 2, a project assessing the possibilities of establishing a sluice on the fjord estuary. Impact on the nature and the environment, economy, tourism, etc. must be assessed. The activity leads to a report that will serve as a feasibility study into a possible subsequent EIA for a dam project.

How:

Phase 1

1. Impact assessment of the effects on the nature and the environment, economy, tourism, etc. For the construction of a tilt lock at Udbyhøj. The activity will culminate in a report that serves as a feasibility study into a possible subsequent EIA for a dam project.

Where: The project area
When: Phase 1

C.11.3 A *strategy for decision-making*

What:

Based on C11.1 and C11.2, a fjord model is designed, and a strategy for the choice of the areas to be protected from water and the areas to be converted to other uses such as nature-based tourism is elaborated. It is determined which areas could add value to nature. It is clarified how the loss of value can be turned into value gain - how the area around Randers Fjord might reverse the trend, attaching new values to the estatuary as the old

values must be abandoned? This activity mainly takes place in phase 2 and beyond.

How

Phase 2

1. Draw up a model and strategy for land use in and around Randers Fjord and its communities.
2. Coupling of the project to other projects around Randers Fjord including Natural Park Randers Fjord.

Where: The project area
When: Phase 2 and Phase 3

Reasons why this action is necessary:
A flooding in the risk areas of Randers Fjord can cause major damage to urban areas. A storm surge event of a 100 year magnitude will directly affect about 3,000 residents in the towns of Allingåbro, Uggelhuse, Udbyhøj and Randers, as well as a number of buildings in the open countryside, highway embankment E45 (at the passage of the River Gudenåen), as well as the railway embankment (at the River Gudenåen's passage). Randers Fjord is designated as a risk area for EU Floods Directive on the basis of a statement of a potential loss in value by storm surge of up to 5.7 billion. DDK. The action will highlight the possibilities of adaptation of the risk area and create better opportunities to prevent future flooding. Whether adaptation occurs through various combinations of the laying of flood areas or barricades to keep water away from certain areas. This will enhance climate resilience of the Randers Fjord area.

Constraints and assumptions
The important and necessary task of analyzing the fjord landscapes and finding viable answers to questions such as: how can land be given up? which areas should be preserved and protected in relation to business? how can land increase its value and change function? must be done in a mutual effort of both municipalities. The largest constraint is financial, since the municipalities do not have the expertise in-house. There is therefore a risk of delay of a few years. The C2C CC project provides the means to initiate this analysis and hence to provide decision-makers with proper analysis.

Expected results:
11.1: A Fjord Model and scenarios for future CCA of the project area, and a complete list of possible solution scenarios and their cost-benefit analyses make it possible to suggest concrete solutions. 11,000 hectares screned.

C11.2: An independent assessment of the scenario of a sluice solution in relation to CCA of the project area will show whether it is feasible.

C11.3: will result in a future and long term strategy and approach for the project area.

Cost estimation:
Expenses for external expert help is expected to amount to 82,675 € based on prior experience with external assistance to local projects in NDK and RK. Estimation of person days for NDK and RK is based on present salaries + pension. Expenses cover the analyses of the Randers Fjord in order to prepare the ‘fjord model’ and impact assessments. External assistance is necessary because neither NDK nor RK have enough

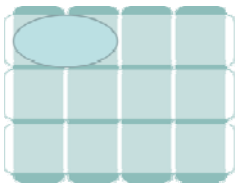
means to deliver the analyses and assessments in-house. During Phase 2 and beyond, expenses are expected to cover the drawing up of the fjord model and the eventual choice among alternatives, depending on how elements are prioritized.

Deliverables:

Activity	**Deliverabless**
C11.1	Phase 1 Report on mappingm and analysis of Randers Fjord at different scenarios for the preparation of the Fjord Model. Technical background report, and a fjord model. Report on costc benefit analysis, a holistic value analysis for climate protection of the fjord, Report assessing the impact on nature, the environment, economy, business mm. the establishment of the sluice at Udbyhøj
C11.2	Phase 1 A feasibility study into a possible subsequent EIA for a dam project
C11.3	Phase 2 Reports on odelling Tools and two municipal strategies for land use in and around Randers Fjord

Milestones

Activity	**QuantifiableQuantifiable milestones**	**Date by end of**
C11.1	Phase 1	
	Data collection for the 'Fjord model'; the preparation of this model done	31/12/2018
	Analyzes of different scenarios for future climate adaptation done	31/12/2018
	Report assessinging the possibility of a sluice solution finalised	31/12/2018
	Phase 2	
	A modeling tool developed for the Randers Fjord, calibrated with respect to the River Gudenå Model.	31/12/2022
C11.2	Phase 1	
	Strategy developed for future land use around Randers Fjord to climate adapt area	31/12/2018
	Stakeholder meetingS meeting held	31/12/2018
C11.3	A model and strategy developed for land use in and around Randers Fjord and its communities.	31/12/2022
	Description of the coupling of the project to other projects around Randers Fjord including Natural Park Randers Fjord	31/12/2022



C12: The River Gudenå

The project is a cross-border project involving the 7 municipalities along the River Gudenå and one utility. A hydrological model is developed for the watercourse, the land use is mapped, the possible actions to handle increased volumes of water is identified. Test scenarios for different solutions in the model will be made. This mapping lays the basis for a common understanding of the consequences of climate change in the catchment. Next step is the creation of a vision and a goal for a CCA approach. Furthermore, stakeholders will prepare conceptual designs for physical solutions in the River Gudenå catchment, and identify suitable approaches to dealing with water. This action primarily links to governance within sea & fjords and rivers.

Main responsible beneficiary: Silkeborg Municipality Budget: 801.946€

Number of days estimated spent on action in phase 1: 618 Days

Beneficiaries responsible for implementation:
Seven partners (municipalities) directly affected by the River Gudenå CCA challenges: Silkeborg (SIK), Hedensted (HEDKOM), Horsens (Horsens), Skanderborg (SK-KOM), Favrskov (FK), Viborg (VK), and Randers (RK). Furthermore, Skanderborg Waste Water Utility (SFV) is partner, since the waterlevel directly affects its operations and systems.

The role of SIK:

- Is the project manager
- Cooperates with the six other municipalities and Skanderborg Waste Water Company
- Works with secondary stakeholders in *each* municipality - such as, in the case of SIK - Vandløbslauget for Gudenåen (Silkeborg til Kongensbro), Grundejereforeningen Sølyst (Silkeborg Langsø), Silkeborg Fiskeriforening, Danmarks Naturfredningsforening (local branch).
- Reports and cooperates with PM (CDR), C11 project manager, and C14 project manager as well as other C2C CC partners

Relation to CCA plans

- HEDKOM: Municipal spatial plan pp. 21-24, 29-30, 61-63, 98-100
- Horsens CCA plan pp. 24 -26 and 30-32
- SK-KOM CCA plan pp. 41-42, CCA action plan pp. 9-18
- SIK CCA plan pp. 21-23 + 37
- FK CCA plan p. 15
- VK Municipal spatial plan p. 14
- RK CCA plan p. 10.

Relation to cross-cutting capacity building actions (C1-C7)
Action C12 River Gudenå 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 Juelsminde, Horsens 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 C8, C9, C10, C11, 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, of which the River Gudenå is an integrated part. 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 C12 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 benfit of action C12. 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 C12 and other actions.

Linked to complementary actions
A number of complementary actions to support C12 will be explored during the project. One type of complementary projects are the ones that support nature-based turism. Another type of project are the ones that focus on CCA at specific areas at the River Gudenå to alleviate high waterlevels (e.g. at Bjerringbro). Some of these projects amount to 6 mio. €, others are smaller – 250,000 €. Expected source of financing: municipalities.

What
The C12 project is a cross-border project involving 7 municipalities along the River Gudenå hereby launching their practical cooperation on CCA because of the work on the C2C CC project.

The River Gudenå is the longest river in Denmark measuring 146 km, running through large part of eastern Jutland. The catchment area is 3,200 km^2. It runs through seven municipalities and ends at the east coast in Randers Fjord (cf. close cooperation with C10). The River Gudenå and its tributaries pass a number of cities and towns such as Tørring, Silkeborg, Ry, Bjerringbro, Hadsten and Randers (cf. cooperation with C14 on SUDS). The catchment area comprises nature, of which 11 Natura 2000 areas exist in the catchment[10], urban settlement and – not least – agriculture. The River is important for water drainage from the cities, the highlands and particularly from low-lying agricultural areas.

Part 1 of the project develops a hydrological model for the watercourse, maps the land use, identifies the possible actions to handle increased volumes of water, and tests scenarios for

[10] http://naturstyrelsen.dk/vandmiljoe/vandplaner/vandplaner-2009-2015/hoeringer/hoering/basisanalyser/15-randers-fjord/,

different solutions in the model. This mapping lays the basis for a common understanding of the CCA issues and thus Part 2, which involves a number of stakeholders, develops a vision and a goal for the CCA approach, prepares conceptual designs for physical solutions in the River Gudenå catchment, and identifies suitable approaches to dealing with water. Finally, the above solutions are related to other issues in the seven municipalities CCA plans.

C.12.1 *Models for the scenario descriptions*

What:
Rising volumes of runoff and heavier cloud bursts due to climate change, increasing amounts of vegetation in parts of the River Gudenå, plus requirements of good ecological status due to the river basin management plans, increase the needs for a better knowledge of the relationship between precipitation, runoff, groundwater and flooding, as well as land use mapping in the areas affected by water level in the river. There is thus a need to assess the effects of a number of actions that could potentially minimize conflict over land as result of rising volumes of runoff and heavier rain events.

Some of the tools already known can be extremely costly. In addition, some of the possible actions may be detrimental to national and international nature conservation interests and efforts to achieve good ecological status of water bodies under the EU Water Framework Directive (WFD). On the other hand, floods inflict damage to buildings, roads and private property, cultural heritage and recreational interests.

Impoundment of water may help to meet the objectives of the WFD. Restoring the natural hydrology can thus reduce nitrogen and phosphorus content in streams, lakes and in the Randers Fjord. Moreover, it may increase biodiversity and provide new recreational opportunities, such as more fishing tourism. Therefore, the project should identify the greatest extent possible of CCA while at the same time living up to the environmental objectives of the WFD. In addition, there is a need to evaluate possible actions from a legal and socio-economic point of view.

How:
Phase 1
A key tool for understanding the dynamics of the river is a hydrological model, which takes its point of departure in historical climate events and is used to predict future events. The present model only covers part of the river and needs to be updated and expanded to the entire river in order to describe the effect of different volumes of runoff. An updated model should also be used as one of several support tools to assess the impact on water levels in the different scenarios for compensatory measures as well as for future protection measures.

Concrete actions:
1. Development of hydrological model
2. Development of reports and catchment tool
3. Web portal with warning and exchange of experiences, lessons mm.
4. Model Setup and scenario runs
5. Catalogue of solutions, costs, etc.
6. Mapping of land use

7. Scenario Run measuring the effect of individual measures
8. Legal and social consequences of possible actions

Related to the establishment of the model, the following data common for the entire river is collected: water flow, elevations, discharge areas, submerged vegetation, water level loggers etc.

The model and the analysis of the surface area are used to evaluate the eventual usage of the following compensating scenarios:

- Retention of water in low-lying areas and the tributaries in the form of wetlands, etc.
- Deepening of river cross profileson parts of the river stretch
- The establishment of a parallel flow on parts of the river
- Removal of any deposits on parts of the river stretch
- Limitation of drainage volumes from fortified and submerged land in the catchment
- Land distribution, acquisitions etc. of low-lying areas
- Intensified watercourse maintenance
- Altered / optimized operation of established barriers in the watercourse
- Other compensatory measures to alleviate the distress due. Elevated water levels

Furthermore, the environmental, legal and societal implications of each scenario will be assessed.

C12 will benefit from two other actions, the C11 Randers Fjord and the C14 Horsens city center. The latter deals with opportunities to retain water in low-lying areas and reducing run-off from paved areas in the catchment as well as from cultivated land.

Where: The entire catchment area

Figure 21: The catchement of River Gudenaa marked with red. The municipal borders are indicated as black lines.

When:
Phase 1, 2 and beyond

C.12.2 *Stakeholder involvement, choice of projects and the development of vision and goals, etc*.

What:
The water challenges in the River Gudenå catchment involves numerous authorities, businesses and citizens, and stakeholder involvement is vital. The project is based on the regional, catchment scale, as the project focuses on cross-border issues and works to handle the challenges pertinent for the whole catchment area, avoiding sub-optimization. This work involves particularly the 7 local authorities in the catchment area. It takes mainly place during Phase 2 and beyond.

How:
This action creates even closer collaboration between stakeholders and the development of a common vision and goals. Eventually, actions will be selected.

Phase 2 and beyond
During these phases, citizens meetings to discuss the model will be helt, meetings and workshops among partners and stakeholders to discuss scenarios from phase 1 and to put forward proposals for concrete measures, and the 3D simulation model will be presented.

Concrete actions:
1. Developing a shared vision for handling the River Gudenå's water.

2. integrating various water challenges of the River Gudenå.
3. Adjusting the scenarios and responses (C.12.1).
4. Agreeing on targets to be set among the Gudenå River municipalities
5. Listing of possible projects
6. Setting goals for water coming in and out of the municipalities
7. Preparation of financing models for compensatory actions

Moreover, work with the citizens and stakeholders can help to achieve a more robust hinterland where flooding occurs controlled. This is done by building the capacity of those involved and those who can do something about the challenge.

Where
In the seven municipalities along the River Gudenå and STF.

When
Phase 2 and Phase 3

Reasons why this action is necessary:
There is a general need in Gudenå hinterland to adapt to climate change. The pressure on the water system is increasing and wetter winters and dry summers make it worse. There is increased demand among stakeholders to act to avoid flooding and loss of values. With such a large catchment area which Gudenåen and the many authorities, there is a risk of sub-optimization that only benefit locally.

The cooperation between the municipalities of the River Gudenå have cooperated for many years – just not on CCA. C2C CC produces knowledge on how the areas along Denmark's longest river, wich is necessary to establish a common understanding of how solutions could be designed to the benefit of all and avoid discussion on data validity etc. Solutions that are holistic and take into account private property and infrastructure, protected natural and recreational interests. Climate resilience is thus enhanced by cooperation, providing data and formulating a common vision on the appropriate solutions.

Constraints and assumptions
C12.1: Development of models depends on data quantity and quality. The models will have to rely on available data. To meet this challenge and ensure the best possible data quality, external expertise must be involved. C12.2: The project's many partners makes it vulnerable to disagreement. The success rate also depends on the will of the local politicians to work together to tackle common challenges and allocate resources. The individual municipalities may have different priorities. For example, one municipality prioritizes improving conditions for salmonides while another prioritizes drainage. Conflicting priorities can be solved by strengthening the political level and work on consensus through common data base and common reference that create common understanding. Finally, it is necessary to put on the agenda how to reach an agreement on financing models for subsequent actions.

Expected results

C12.1: Common knowledge on the CCA challenges and the prerequisites for CCA solutions among the River Gudenå municipalities with the objective of formulating a common understanding and eventually a common vision on CCA solutions.

A common tool for shedding light at a variety of scenarios. The tool will be available in the specific actions to be decided in C.12.2. Furthermore, it will be available for future scenario analyzes and compensating actions. The objective is to create a 'common reference' / 'common language' used by the municipalities of the River Gudenå when making decisions that affect water flow across the basin. The tool designates the effects acts in the hinterland will give the water quantity, quality and costs.

Analyses will be described in a report. Number of hectares to be screened: 2.643 km² (catchment area).

C12.2: Thorough involvement of stakeholders and development of the vision and goals will secure that CCA implementation is practically feasible. A number of workshops held by the Gudenaa municipalities looking towards specific initiatives and actions that can be implemented will concretize solution possibilites. Insights on seconday impacts on biodiversity, environmental effects / nitrogen removal /, CO2, economy-cost benefit, legal aspects will aid decision making for holistic solutions.

The development of a series of targeted information for landowners throughout the River Gudenå system will inform them on the following issues: How can I protect myself against water from the river? What does the course of the river mean for the runoff? Why is the river not just being expanded and deepened? Can the drainage system help to keep the water?

A web portal is created for data and for citizens to share ideas and finding good advice on flooding and create community recilience through bottom up means.

Cost estimation:
All partners are expected to contribute man hours to the project and pay for the implementation of the eventual CCA solution after the end of the Life IP. Estimation of person days for the municipalities working on C12 is based on present salaries + pension. 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. The other partners uses the standard calculation of 1720. The hydrological model to be made is large, and external assistance is necessary. Expenses for this external expert help is expected to amount to 257,770 € based on prior experience with external assistance and based on smaller models made for part of the River Gudenå. In order to create the necessary consensus, quite a lot of meetings and networking is forseen. Expenses build on prior experience in holding workshops and meetings. 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	**Travel for project officers around the region**							
Partners: / *Cost categories:*	**HEDKOM**	**FK**	**Horsens**	**RK**	**SIK**	**SK-KOM**	**SFV**	**VK**
Hotel cost:	100	100	100	100	100	100	100	100
Daily allowances/Payment for meals cost:	25	25	25	25	25	25	25	25

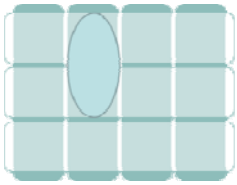
Local transportation costs:	63	63	63	63	63	63	63	63
Total subsistence cost:	188	188	188	188	188	188	188	188

Deliverables:

Action	Deliverables
C12.1.	Phase 1 Report and catchment tool Web portal with warning and exchange of experiences, lessons learned etc. Catalogue of solutions, costs, etc. Phase 2 and beyond: 3D simulation model developed, Project Costs associated with the demonstration projects Other initiatives in Gudenåen's catchment in local CCA plans

Milestones:

Action	QuantifiableQuantifiable milestones	Date by the end of
C.12.1.	Phase 1	
	One report on data analysis for the model	31/12/2018
	Report on the establishmente of a model and calibration of the model	31/12/2018
	Three scenarios developeddeveloped	31/12/2018
	Phase 2	
	Stakeholder Involvement meeting held	31/12/2020
	Political process initiated. Minutes of municipal board meetings	31/12/2020
	Selection of projects done	31/12/2020
	Phase 3	
	MeasuresM in the municipal climate adaptation plans implemented	31/12/2022



C13: The River Storå

The watercourse system Storå upstream at Holstebro has a catchment area of 830 km^2 shared between three municipalities. This project is a cross-border cooperation to test new ways to detain water and thereby avert flooding in Holstebro, which is designated a risk area according to the Floods Directive. Among the new methods are: disconnection of drainage, establishing mini wetlands, periodic increased drainage, and storage of water during different seasons. The project is carried out in cooperation with famers and a local water utility, and examines the combining of a number of CCA approaches, which together with a number of other means will increase biodiversity and ultimately, improve the water environment in the sea by reducing the leaching of nutrients. This action primarily links to governance and tools within rivers.

The project's theme is common with subproject "CCA in the hinterland and in regard to agriculture (C15.2). Parties from this project participate as sparring partners throughout the project. In Phase 2 there will be cooperation with the progress of consultancy assistance to common knowledge processing.

Main responsible beneficiary: Herning Municipality Budget: 161.861€

Number of days estimated spent on action in phase 1: 215 Days

Beneficiaries responsible for implementation: Herning Municipality (HK) and Holstebro Municipality (HbK)

Role of HK:

- Is the project manager
- Cooperates with HbK (partner) and Ikast-Brande Municipality (Primary Stakeholder, participates because the River originates in Ikast-Brande).
- Engages and involves stakeholders such as: Utility companies, landowners, Rådgivningscentret Heden og Fjorden, SEGES (Primary Stakeholder), the local branch of the Danish Society for Nature Conservation, the Danish Nature Agency, etc.
- Enters into special dialogue with a farmer in HK[11] who is being engaged in the project with an area of agricultural land in HK.
- Reports to C2C CC project-leader and cooperates with other C2C CC partners

Relation to CCA plans

- HbK: CCA plan p. 16 (7.2 – 7.4)

[11] The identity of the landowner is known. Negotiations are being held at the moment.

- HK: CCA plan p. 22 (92-93)
- Ikast-Brande: CCA plan p. 27

Relation to cross-cutting capacity building actions (C1-C7)
Action C13 River Storå will gain from actions under C2, where knowledge and experience on CCA and rivers developed under the different actions will be shared and discussed. Modelling, interpretations, analysis and data sampling are similar in the different catchments and C13 will benefit from this knowledge sharing. Scientific aspects currently 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 benfit of action C13. 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 C13 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 C13 directly.

Linked to complementary action
C13 is linked to a complementary project on Climate protection in Holstebro. It is focusing on approaches and installations to catch large amounts of water (up to 3 mio m^3 water) upstream, in the river valley, at a very, very short notice. On the basis of prior dialogue between Holstebro and Forsyningsselskabet Vestforsyning A/S, an application will be forwarded on 15 April. The C2C CC (and C13) will constitute an important factor in this retention effort to stop water, before it reaches the city of Holstebro.
In phase 2 of this project, there will be a cooperation between C13.3 and C15.2 including a systematic exchange of knowledge and a common progress with consultancy assistance.

Description (what, how, where and when):

The watercourse system Storå upstream at Holstebro, constitutes a run-off area of 830 km2 shared between Ikast-Brande, HK and HbK. All three municipalities operate with issues with water management in open countryside, as areas that need attention in their CCA plans. In addition, the three municipalities have established a joint experience and collaboration forum[12] related to the Storaa catchment area. Thus, C13 is a genuine cross-border pilot project to investigate how 'theories' on local storing of rain water in the open landscape works in practice. The specific project area is around 25 ha agricultural area, which belongs to the farmer, participating in the project. Agricultural areas close to the watercourses in the whole catchment are potential project areas.

C13 turns the national development and demonstration project "Landmanden som vandforvalter"[13], and the pilot project "Vandet fra Landet"[14], both focusing on how the open countryside can be used as a way to store the continued increasing volume of precipitation,

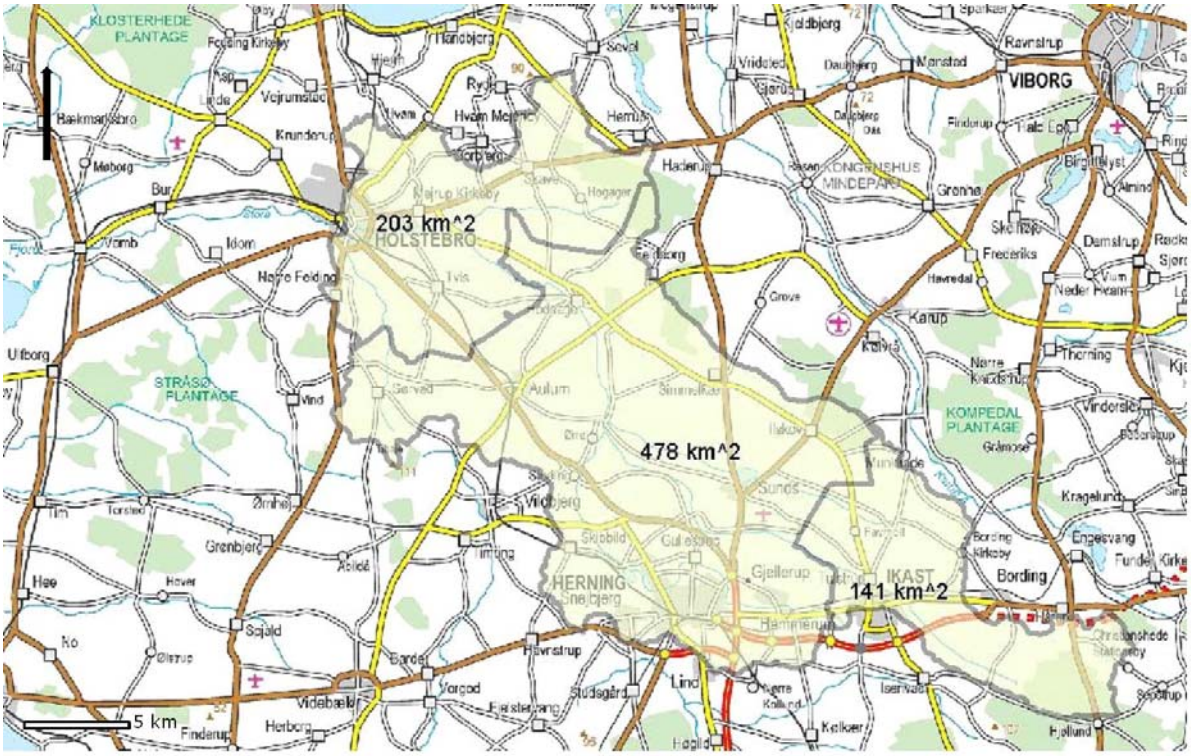
[12] Can be found at www.herning.dk and www.holstebro.dk

[13] https://www.landbrugsinfo.dk/miljoe/landmandensomvandforvalter/sider/startside.aspx (network of farmers acting as water managers)

[14] http://www.klimatilpasning.dk/vandet-fra-landet.aspx (Water from the Country, financed by Danish Forest and Nature Agency)

and thus minimise the risk of flooding in urban areas, into a concrete pilot. To do this, there is a need to investigate how the project ideas work in practice, and how flooding of open areas influences the use of the areas and existing nature reserves. There is thus a need to establish pilot projects (field projects), testing theories in practice, covering the consequences for the areas and for nature as well.

The possibilities for using the disconnection of drainage, establishing mini wetlands, periodic increased drainage and storage of water during different seasons will be examined in more detail, including the effect on famers' operations and any loss of crops. The project examines combining a number of CCA approaches, which together with a number of other means will increase biodiversity and ultimately, improve the water environment in the sea by reducing the leaching of nutrients.



Figur 22: The Store Å catchment

C13.1 *Dialogue with stakeholders, identification of suitable land,*

What
C13 builds on the above two nationally funded projects and engages local stakeholders in a pilot to test its viability in practice. Since 'the solution is not necessarily found, where the problem lies', a dialogue with farmers, landowners, NGOs, etc. is vital to try to avoid flooding in e.g. in Holstebro city further upstream and/or in lowlands. Dialogue with stakeholders takes place in Phase 1, leading up to subsequent testing and the pilot. An important part of this engaging process is a visit to the UK to see how the Rivers Trust has managed to involve farmers in their work. This will also make a link to the EU funded Life IP 'Integrated water management approach to delivery of the North West England River basin management plan'[15].

[15] http://ec.europa.eu/environment/life/project/Projects/index.cfm?fuseaction=search.dspPage&n_proj_id=5439

How

Phase 1

- Right after C2C CC has been approved, workshops will be held for partners and interest-groups to launch the concept and explain the need for carrying out the pilot
- Study trip to the UK with stakeholders to study solutions
- Negotiations with farmers on allocation of land for the pilot project. Other interested farmers having their land in the wider project area are being contacted through local agricultural associations and their adviser

Phase 2 and beyond

In subsequent phases, dialogue is continued in order to secure consensus about the CCA approach. Knowledge, results and the project's progress will be disseminated (at the internet, at themed meetings, and field tours with land associations), and articles will be written.

Where: Dialogue shall take place in the agricultural areas close to the River Storå

When:
Phase 1 (to be continued in Phase 2 and beyond)

C13.2 *Data collection and analyses*

What
Prior to the pilot project, there is a need to map and investigate the designated area in order to assess which approaches will work. This mapping takes place with external assistance from SEGES (who is Primary Stakeholder in the project).

How:

Phase 1

1. Concrete areas in a smaller catchment area will be designated through dialogue with stakeholders and negotiation with the farmers
2. The following issues must be clarified: drainage mapped and drainage conditions. Furthermore, soil conditions, potential dissolved-iron areas and flooding mapped.
3. §3 mapping, amphibian mapping and mapping of habitats and invasive species. This is done by in-house biologists and external consultants
4. Registration of cultivation/area use.
5. Studies in biodiversity and infrastructure, choice of crops, distribution of land, conditions concerning ocher and nutrients, drainage techniques, by agricultural advisers together with knowledge institutions.

Phase 2 and beyond

During the remainder of the C2C CC project, activities will include: monitoring, presentation of possible solutions and results. The effects of solutions regarding retaining of water, crops, biodiversity, washing and nutrients are being evaluated. In this phase, there will be a cooperation between C13.3 and C15.2 including a systematic exchange of knowledge and

a common progress with consultancy assistance. C13 intends to publish results through the C2C CC project.

Where: the project area.

When
Phase 1: activities 1-5
Phase 2 and beyond: activities to be continued

***C13.3** Carrying out the pilot and monitoring*
This the core activity of Phase 2 and beyond. C13.3 builds on results of C13.1 and C13.2, laying the ground for the pilot.

Phase 2 and beyond
During the remainder of the C2C CC phase, activities include the investigation into the possibilities for using the disconnection of drainage, establishing mini wetlands, periodic increased drainage and storage of water during different seasons will be examined in more detail, including the effect on famers' operations and any loss of crops. The project examines combining a number of CCA approaches, which together with a number of other means will increase biodiversity and ultimately, improve the water environment in the sea by reducing the leaching of nutrients. Derived effects with regard to biodiversity and cultivation reliability will be monitored during the project's monitoring phase

Where: as above
When: Phase 2: pilot, and Phase 3: monitoring, etc.

Reasons why this action is necessary:
The future use of land demands a new approach, for a new practice related to area and water management. The challenge is the changed precipitation patterns, which are a consequence of climate change, and the long-established (years) practice and goal of leading water away quickly and efficiently. This creates problems with flooding in urban areas. This is the case in Holstebro, which is regularly hit by floodings because of high water flows in the River Storå, causing major and expensive damages (Holstebro is designated risk prone city in accordance with the flooding directive). The project will collaborate with the farming community and research institutions with practical trials of solutions that focus on agriculture and the open countryside. Water retention at field level cannot by itself and individually solve problems with flooding, but several, individual retentions can be a longterm and sustainable solution, providing local CCA more sustainability.

See also this video: https://www.youtube.com/watch?v=A4tUbQgQAxE

Constraints and assumptions
There is a risk of resistance from landowners. This is dealt with through early inclusion. Possible resistance from green organisations will be dealt with by early inclusion and ongoing transfer of knowledge/communication.

Expected results:
This project will demonstrate that water can be delayed where it falls, thereby reducing flooding in cities. The project is a pilot, which will demonstrate solutions in the long term at the field level in the open countryside. On its own, water retention in one field will not solve the problem of flooding, but combined with other measures, and with more delaying fields, it can be a long-term way to maintain the effectiveness of other CCA efforts by minimizing increased pressure caused by increasing climate challenges in the future and thus extend the durability of local CCA initiatives. Specifically, this project will realise a dialogue with farmers in the River Storaa catchment area, who are prepared to test techniques that can delay the run-off of water in the open countryside. The project will contain a monitoring measure to cover the consequences to cultivation reliability, biodiversity and improvement in the natural countryside.

It involves 3-5 farmers, 2 NGOs and 3-5 stakeholders/landowners, 1-2 representatives from NGOs, 6 municipal professionals, 3 utility professionals, 2-3 knowledge persons

Cost estimations:
Expenses for direct personal costs are based on person days for HK and HbK personel based on present salaries and pensions, etc. Expenses for external expert help is based on a dialogue with SEGES. External assistance will be used for highly needed expertise in relation to the modeling. Budget for meetings and fieldwork is allocated. 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	**Inspirational Trip no. 1 to Southhampton (UK)**		**Inspirational Trip no. 2 To Drenthe (NL)**	
Partners: / *Cost categories:*	**HK**	**HbK**	**HK**	**HbK**
Hotel cost:	225	225	225	225
Daily allowances/Payment for meals cost:	100	100	100	100
Local transportation costs:	175	175	175	175
Total subsistence cost:	500	500	500	500

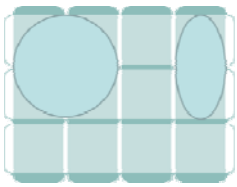
Deliverables:

Action	**Deliverables**
C.13.1	Phase 1: WorkshopW material from meetings with stakeholders; Programme for a Study Trip to the UK – Rivers Trust – together with landowners and other stakeholders. List of the activities used to transfer knowledge and present the project's progress and results.

	Phase 2: List of the activities used to transfer knowledge/present the project's progress and results. Presentations of the project's results on the internet (C2C CC webpage and locally), at themed meetings and field tours with land associations, and to a wider, national audience, previous partner projects "Vandet fra Landet" and "Landmanden som vandforvalter". Transfer of knowledge/presentation in professional journals and at conferences, such as "Natur og Miljø" (Nature and Environment magazine) and Plantekongres (biggest conference on plant production, planning, the environment, etc., in the Nordic Region).
C.13.2.	Phase 1: Report on designation of test areas and mapping of drainage factors; Registration of cultivation/area use. Phase 2: Description of solutions for testing.
C.13.3.	Phase 2: Monitoring report. Results assessment and conclusions.

Milestones:

Action	**QuantifiableQuantifiable milestones**	
C.13.1	Report on designationd of concrete areas in a smaller catchment area. Report on registration of cultivation/area use. Report on Study Trip to the UK – River Trust – together with landowners and other stakeholders, 25 participants ReportReport on possibilities for multi-functionality in the solutions Presentation to webpage done Presentation at thematic meetings done Presentation to other networks done	31/12/2018 31/12/2018 31/12/2018 31/12/2018 31/12/2020 31/12/2020 31/12/2020
C.13.2.	Phase 2: Agreements with farmers Development, establishment and demonstration of solutions SuitableS areas designated	 31/12/2020 31/12/2020 31/12/2020
C.13.3.	Phase 2: DescriptionDescription of specific retention solutions, disconnection of drainage, dividers, dikes, wetlands, done.. KnowledgeKnowledge transferred of the project's progress and results on the internet, Two thematic meetings held Two field study tours with land associations held Phase 3: Report on monitoringm of the transfer of knowledge of/presentation of possible solutions and results. Report on monitoringm of the effect of the solutions on water retention, yields, biodiversity, leaching of nutrients.	 31/12/2020 31/12/2020 31/12/2020 31/12/2020 31/12/2022 31/12/2022



C14: Flood-proofing Horsens Town Centre

The town of Horsens is threatened by floods, because a major part of the town centre is lower than 1.5 meter above the normal sea level in the Horsens Fjord. With rising sea levels and amounts of water from watercourses in the hinterland due to increasing precipitation and more powerful downpours, there is an urgent need for securing the lowest lying parts of the town against flooding. This action analyses and lays out scenarios containing all relevant issues regarding flooding from the fjord, the watercourses and handling of the sewer systems. It also deals with the development of the port area, which is being converted into a residential, recreational and commercial area. This action is primarily linked to governance and tools within most areas of the hydrological cycle apart from groundwater.

Main responsible beneficiary: Horsens Municipality Budget: 709.302€

Number of days estimated spent on action in phase 1: 220 Days

Beneficiary responsible for implementation: Horsens Municipality is the overall project manager.

Role of Horsens Municipality:

- Is project manager
- Has the contact to C2C CC project management
- Coordinates with HEDKOM on exchange of data about diverted water amounts from walled areas and on the possibilities for retaining water in the catchment area as well as with Vejle Municipality on similar information.

Relation to CCA plans

In the municipality's CCA plan, Horsens town centre is designated as focus area 12, cf. Figure 1 (page 34 in the CCA plan). The figure shows that the focus area is the most critical, assessed on the basis of the parameters risk of flooding and highest value, and it is therefore very important to make it flood-proof.

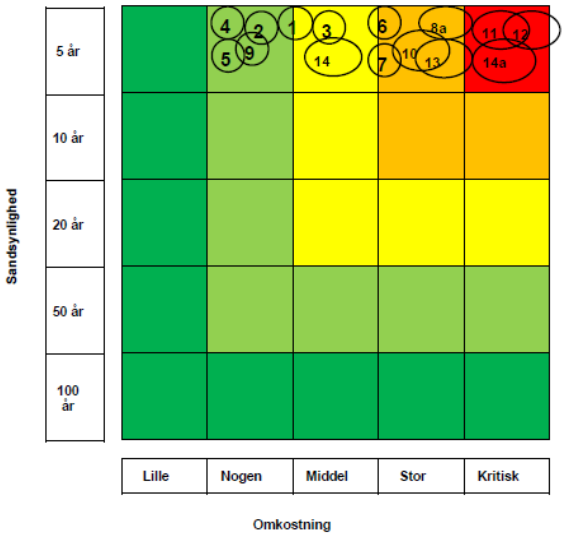


Figure 23: In Horsens Municipality's climate change adaptation plan, Horsens Town Centre is focus area 12, the most critical.

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

Action C14 Flood-proofing Horsens Town Centre 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 and C18 dealing with the coastal cities of 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, 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 C14 may benefit from this knowledge sharing in relation to the Bygholm cathment area (figure 25). 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 C14. Under Action C4 Rainwater, C14 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 C14 and other actions.

Linked to Complementary Actions

C14 will coordinate with Horsens wastewater utility on the integration of an urban hydrological model of the sewer system of Horsens town, which will be completed during 2017.

Description (What, how, where, and when)

What:

Horsens town is threatened by floods, because a major part of the town centre is lower than 1.5 meter above the normal sea level in Horsens Fjord. With rising sea levels and now with more water from watercourses in the hinterland due to increasing precipitation and more powerful downpours, there is a great need for securing the lowest lying parts of the town against flooding, cf. Figure 24 and 25.

Figure 24: Picture of flooding at the outlet of Bygholm Å and in Bygholm Park in December 2013

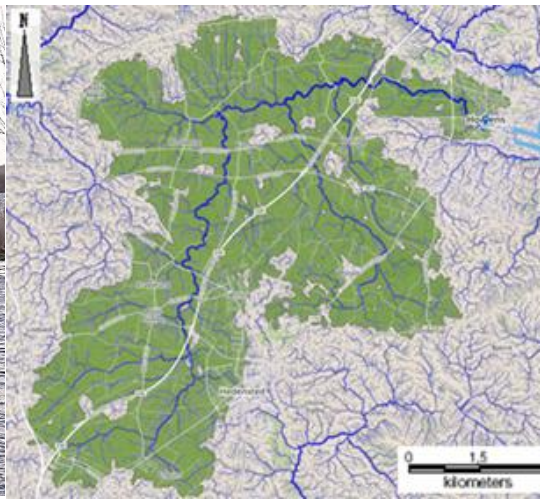


Figure 25: Map of Bygholm catchment area

The aim of C14 is to secure Horsens town centre against flooding when there is a storm surge and/or extreme flows in the three watercourses Dagnæs bæk, Bygholm and Hansted Å, which all run through the town. It requires overall considerations and scenarios of flooding for the fjord, watercourses and sewer systems, and holistic planning and coordination in relation to the port area Nordhaven, which is being converted into a residential, recreation and commercial area. An initial project was carried out by Horsens Municipality (ends April 2016) forms the basis of C14 with the purpose to carry out a detailed project design for flood proofing of Horsens town. The initial project, hereafter the 2016 project, included a simple watercourse model and involves an outline of proposed solutions to prevent flooding from precipitation, watercourses and sea levels under saturated and stationary conditions, respectively. The possible solutions are outlined for short-term flood proofing at a level off 1.8 meter above normal sea level, and a politically adopted long-term flood proofing at a level of 2.6 meter above normal sea level, se example in Figure 24. The results of the '2016 project' proposes water retention in the catchment area and dike solutions using sluices and pumps in Horsens town. However, political reality are likely to change, and there has been discussions on establishing a small-scale barrier solution on the sea floor in Horsens' outer fjord, inspired by the Mose Project in Venice. The '2016 project' sets the basis of C14.

Action C15 supplements action C14 by its nuanced approach to the drainage of water, so that the production potential of farming is developed, and the towns do not end up

functioning as delay reservoirs, when the watercourse has high flows. We expect that the two actions can greatly benefit from each other. The aim of C14 is furthermore to provide inspiration to the development of other solutions in other coastal towns that are threatened by rising sea levels and/or water from the hinterland catchment area.

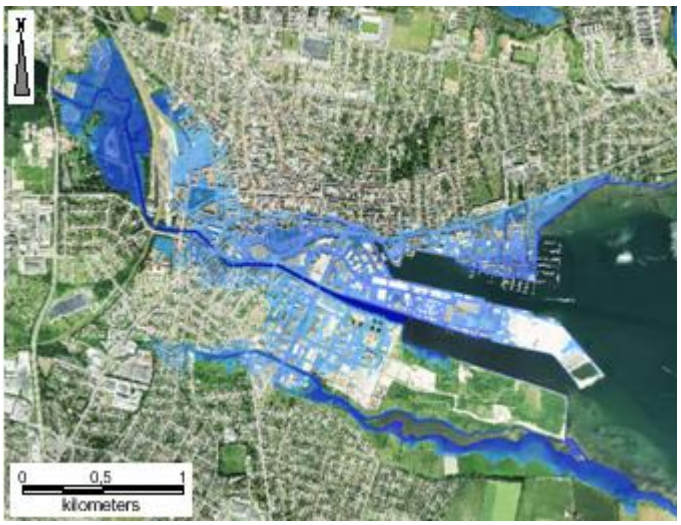


Figure 26: Consequence map for flooding with preliminary outlined proposal that will protect Horsens town in the short term?, equivalent to flood-proofing at a level of 1,8 meter DVR90. The floof proofing will be established using a high tid wall earth dykes and mobile water tubes.

How:
C14 will be contain the following activities: preparation of tender material and tender phase for external expert assistance for step 2 to 5; provision of knowledge in the form of status, data collection and model set-up; scenario calculations and initial stakeholder involvement; preparation of proposals and stakeholder involvement; preparation of project design and invitation to tender material for contractors; flooding related to watercourse Store Hansted Å and the northern part of Horsens town.

C14.1 *Preparation of tender material and tender phase for external expert assistance for activity 2 to 5*
This activity is based upon the above mentioned pilot project and the purpose is to find the most suitable and cost efficient external expert to aid in the following four activities.
Preparation of tender material.

C14.2 *Provision of knowledge in the form of status, data collection and model set-up*
The following sub-activities are involved:

1. A workshop for Horsens Municipality's steering group for CCA, where the status of the pilot project is processed and potential solutions and recommendations to be worked further in C2C CC is decided.
2. The pilot project is based on a simple hydrological model, and it is expected that there is a need for setting up a dynamic model, which can calculate the total flooding for watercourses, the sewer system and seawater. The model will be calibrated at a detailed level and can be used as the basis for the creation of an overall plan for avoiding flooding in Horsens town centre. It may be necessary to conduct further data collection in the form of e.g. water flow measurements, water levels, measurement of the terrain and watercourse, etc.
3. Establishment of an online portal with connection to the portal of C2C CC. The portal will be maintained on an ongoing basis in accordance with the agreement with the C2C CC project management.

4. Preparation of a communication plan of C14 involving when and how stakeholders and citizens can be involved and heard in the action on an ongoing basis. Communication may take place for example, via digital media, written material, stakeholder and citizen meetings, e.g. meetings with NGOs in the municipality, etc.

C14.3 *Scenario calculations and initial stakeholder involvement*

2. Scenarios will be calculated for the contemporary and future climate, which will be used to provide the basis for planning and making decisions for the management of floods. Scenarios will be calculated with the clarification of consequences of:
3. Storing water in the catchment area.
4. Using the lake Bygholm Sø as a reservoir. It is today possible to lower the water level 0.5–1.0 m and thus achieve a significant reservoir capacity.
5. Establishing permanent and mobile dike solutions in the town.
6. Establishing permanent sluices and pumps in the inner port, alternatively in the outer port.
7. The scenarios will be carried out as a combination of the above for the purpose of optimising the most beneficial solution.
8. Selecting optimal areas for storing water and assess retention potential in the catchment. Storing of water contributes to achieving goals in the EU's WFD. The natural hydrology shall be recreated in the catchment area through periodic flooding of low-lying areas along the watercourses. This will reduce the risk of flooding in Horsens town and reduce discharge of nitrogen and sulphur into Bygholm Sø and Horsens Fjord, and benefit achievement of the WFD goals of obtaining a good environmental state (Synergies with C12 and C15).
9. Dialogue with stakeholders:
10. Coordination and knowledge exchange with Action C12 and C15.

1. Dialogue between HEDKOM and Vejle Municipality about the possible retention of water in their part of the catchment area. This activity may also involve an
2. Preliminary dialogue and survey of locations with the affected landowners, e.g. farmers, for the purpose of establishing a broad ownership of the results.
3. Preliminary dialogue with the affected businesses and citizens in the town centre.
4. If required, inspirational trips for a committee of representatives from the municipalities. A trip could be for example, a visit to England for the purpose of finding inspiration in learning how the English EU LIFE project River Trusts work with the overall water management within major catchment areas.
5. Outlining of solutions: based on model scenarios and the effect of different means (permanent high tide walls, earth dikes, mobile water tubes and dikes, sluices and pumps), and visualisation of reduced flooding in the form of a consequence map.

C14.4 *Preparation of proposals and stakeholder involvement*

1. Preparation of proposals:
2. Decision on the most suitable solution for Horsens town
3. Architectual visualisation of solutions and possible film sequences illustrating the level of flooding before and after protection.
4. Budgeting of construction costs and calculation of other cost-benefits considerations in relation to prioritised protection of assets.
5. Stakeholder involvement: Visiting other coastal cities in Denmark with politicians, with similar climate adaption challenges.

6. Coordination with the municipality's emergency services and contingency planning team on the use of mobile protection measures.
7. Workshops with HEDKOM and Vejle Municipality on retention possibilities in Vejle Municipality and HEDKOM.
8. Continued dialogue with stakeholders.
9. Workshop/seminar with the C2C CC partners with presentation of the results of C14.
10. Stakeholder agreements:
11. Agreements with Horsens waste water utility on the financing obligations.
12. Agreements with Vejle and HEDKOM on responsibility and financing between the affected municipalities.
13. Potential action on development of a system for smart management of sluices and pumps (inspiration from on-going industrial PhD project).

C14.5 *Preparation of project design and invitation to tender material for contractors*

1. Preparation of a conceptual design and invitation to tender material for contractors for the selected solutions.

2. In year 2021-22 C14 will focus on flooding issues in other parts of the municipality (Horsens CCA plan pp. 25-35) with special attention to floodings related to the watercourse Store Hansted Å, including the northern part of Horsens town, where houses close to the watercourse periodically are flooded.

Where:

The project area covers Bygholm Å catchment area and extends to HEDKOM and Vejle Municipality, cf. Figure 27. Bygholm Å catchment area drains into the watercourses that flow through Horsens town centre and out to Horsens Fjord. The main focus is on Horsens town centre and covers the port, parts of the inner town and Bygholm Park, which will be flooded with a 5-year storm surge event in 2050 (2.4 m DVR90), cf. Figure 28.

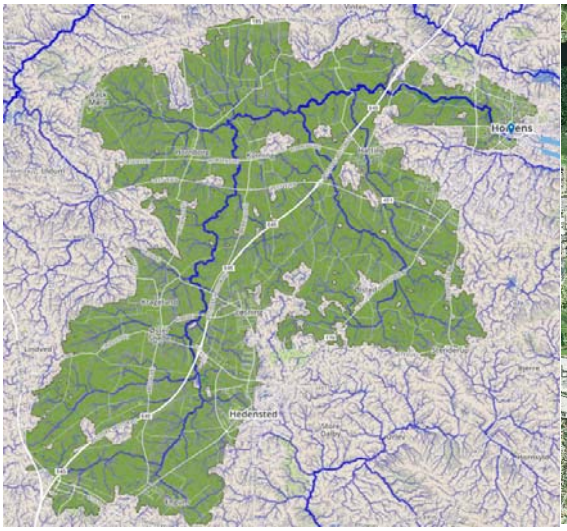


Figure 27 All of the Bygholm Å catchment area with flow paths on terrain.

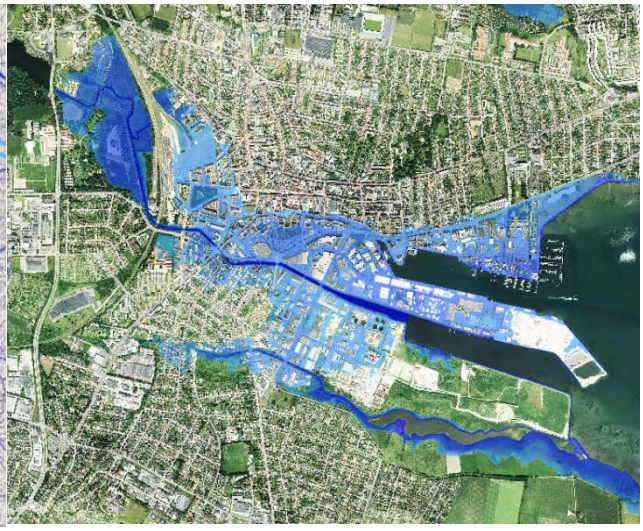


Figure 28 Flooding in Horsens town with a 5-year storm surge event in 2050, equivalent to 2.4 m above normal sea level (Horsens CCA plan p. 34).

When:
Phase 1: Activity 14.1-14.3
Phase 2 and beyond: Activity 14.4-14.5

Reasons why this action is necessary:
Horsens town centre covers central town functions, including homes, companies, technical installations and a town park. The area consist of major economic assets that are at risk (Horsens CCA plan p. 21, cf. risk map). The project benefits the overall aim of C2C CC in creating a climate resilient town by implementing the local CCA plan's most prioritised challenge and in collaboration with the affected parties.

Constraints and assumptions:
C14 will coordinate with Horsens wastewater utility on the integration of an urban hydrological model of the sewer system of Horsens town, which will be completed during 2017.
C14 may be delayed according to the schedule of this model, since it shall be included as an integrated part of C14 model. In relation to the integrated model carried out in C14, it may be necessary to conduct further data collection (see activity 2), which could affect the schedule.
Initial correspondence with the municipalities of Vejle and HEDKOM on C14 has taken place, however, resistance to upstream solutions may occur if win-win solutions are not defined. This issue is counteracted by including technicians and politicians from the two municipalities in the project.
Uncertainty related to financing implementation of solutions: internally in Horsens Municipality, between Horsens Municipality and Horsens Waste Water utility, and between the municipalities of Horsens, Vejle and HEDKOM. Early involvement of the established steering group for CCA and politicians will aim to find a fair solution for financing.

Expected results:
The action will result in basis for decision making on which outlined solution possibilities will be worked further and clarify which additional matters that need to be clarified, whereas it is possible to define long-term solutions for protecting Horsens town centre from flooding that meet the politically adopted level of protection for the municipality (stated in the CCA plan).

The following will be defined: Designated local sites and solutions for retaining water in the catchment area in one or several locations. Designated most suitable positioning of dike reinforcements that protect Horsens town centre. Calculated filling times for any reservoirs, and calculated dimensioning of pumps and sluices with different scenarios in the current and future climate. A smart pump and sluice control system. Solutions for water flow and for the catchment area that promote biodiversity as much as possible, improve water quality and provide recreational options for local residents. With Nordhavnen under redevelopment, solutions shall be provided for traffic connections to the port area and the central neighbourhood. Dikes, sluices and pumps are designed to be visually inspiring and to provide recreational urban spaces, and integrated into the urban life of Horsens town.

Cost estimations:
Expenses for direct personal costs are based on person days for Horsens personel based on present salaries and pensions, etc. Expenses for external expert help is based on prior

experience. External assistance will be used for highly needed expertise in relation to scenario calcultaions.

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	**Trip for project manager**	**Trip no. 1 for project officer**	**Trip no. 2 for project officer**	**Trip no. 3 for project officer**	**Trip no. 4 for project officer**
Partners: / *Cost categories:*	**Horsens**	**Horsens**	**Horsens**	**Horsens**	**Horsens**
Hotel cost:	0	0	0	0	0
Daily allowances/Payment for meals cost:	180	180	180	180	180
Local transportation costs:	120	120	120	120	120
Total subsistence cost:	300	300	300	300	300

Deliverables:

Action	Delivrables
C14.1	Phase 1: Status report for pilot project Report on model formfor scenarios for the total flooding
C14.2	A status report of the '2016 project'. Minute stating steering group decision on outlined solution Report with requirements and expectations for the C14 model Online portal connected with C2C CC online platform incl. LIFE Logo. Communication plan for stakeholder involvement
C14.3 and 14.4.	Technical background report of model methodology and results Background report with designated local sites and solutions Technical report on calculated filling times for reservoirs and dimensioning of pumps and sluices Background report on solutions for water flow and for the catchment area that promote biodiversity as much as possible, improve water quality and provide recreational options for local residents. Design material of dikes, sluices and pumps that inspire to provide recreational urban spaces.
C14-5	Report on conceptualc design and tender materials for construction project. Final report in the form of a complete description.
C14-6	To be decided

Milestones:

Action	QuantifiableQuantifiable milestones	Date by end of
C14.1 and C14,2	ConsultantC for the execution of the four projects selected, Collection of data finalised, AA model is set-up toto calculate scenarios for the total flooding from the sea, watercourses and sewage systems	31/06/2017 31/12/2017 31/06/2018

C14.3	Phase 1 PossiblePossible solutions identified for retaining water in the catchment area, including both in the open countryside and from the urban areas. Specific solutionsss proposed for water retention, dikes, pumps and if required, barriers in the fjord.	 31/12/2018 31/12/2018
C14.4	Phase 2 Financial estimation for construction solutions finalised, Cost-benefit analysis finalized in relation to the assets that shall be protected, Involvement of citizensc and politiciansin the development of the solutions done, Final political approval of the described solutions done	 31/06/2019 31/06/2019 31/06/2019 31/12/2019
C14.5	Detailed project description finalised InvitationI to tender material for contractors finalised	31/06/2020 31/06/2020

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 procuction, 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 linkes 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

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.
- 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 benfit 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 economic models as a basis for prioritising focus areas, efforts, and means and financing models. Specifically, a barometer for added value will be devised, which can be used with the prioritisation 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 barometer 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 and beyond:
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 4: 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 5: 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 1and1and knowledge about:

- What happens underground, between the cultivated soil and the watercourses;;
- Which initiatives can best help optimise the cultivation reliability of elevated cultivated land in relation to changed precipitation patterns;;
- What is the optimal design of the watercourse and the drainage system in the transition zone between elevated land and the watercourse?

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:

- 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
- Survey of the farmers' experiences of: Changed precipitation and cultivation conditions, the drainage systems' function, the drainage systems' maintenance
- Scenarios – we put water onto elevated land.
- What will happen if the following is changed: Choice of crop, optimisation 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
- Assessment and recommendation: Environment, nature and technical solutions, economy and financing, and responsibility and collaboration.
- Preparation of a leaflet for submission to field- and drainage ownwers.

It is expected that C15.2 will finish with planning and changed water conditions in one or several test areas.

Phase 2 and beyond

Where: Gesager Å river system

When: Phase 2 and Phase 3

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), will be used to look at the water catchment area around Tørring. At the same time, the barometer 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 barometer for C15.2, and the organisational model that is chosen in C15.3.

How
Based on existing knowledge and results from C15.1 and C15.2, C15.3 assesses which areas are attractive to work with. An organisational proposal will be prepared and together with the local areas, the following will be assessed: CCA challenges, local need for CCA, demarcation of climate proofing areas, local goals in relation to climate proofing (Assets, added values, development, and responsibility and influence), and local organising.
It is expected that C15.3 will finish with planning of climate proofing in one or several test areas. The project will be executed in collaboration with local stakeholders, knowledge institutions and companies. A rinal 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.

Phase 2 and beyond
Where: Tørring town

When: Phase 2 and Phase 3

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 economic models as a basis for prioritising focus areas, efforts, and means an added value barometer 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 apsects 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 optimisingising cultivation under new climate conditions involving 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 inoptions 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. The added value barometer is also applied in involvement of several citizen groups. The

result is definition of local goals og 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. A local climate proofing plan formulated by citizens.

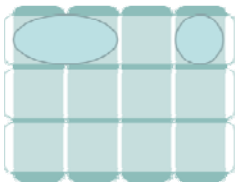
Cost estimation:
Expenses for external expert help is based on prior experience with external assistance to local projects. Estimation of person days for HEDKOM is based on present salaries + pension etc. Expenses will cover consultation for all of the points, with supplementary professional experts 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	Technical background reports (bullet 1 and 2) An added value barometer for Hedensted, including a method description A catalogue of examples of added values with CCA Stakeholder map (bullet 4) The stakeholders' (Citizens) local climate proofing plan(s) forHEDKOM.
C.15.2.	1 leaflet with recommendations (bullet 5 and 6) Technical report on drainage systems and scenario results for one area.
C.15.3.	A process report/description on how climate proofing and the setting of goals has occurred through local organising. An added value barometer forTørring, including a method description Stakeholder map The stakeholders' (Citizens) local climate proofing plan(s) forTørring. 1-3projectproposals

Milestones:

Action	QuantifiableQuantifiable milestones	Date by end of
C.15.1	Phase 1:	
	Risk and value mapping done	31/12/2017
	Interest and stakeholders mapping done	31/12/2018
		31/12/2018
	Phase 2 and beyond:	
	Added value barometer done	
	Stakeholder integration done	31/12/2019
	Local plans finalised	31/12/2019
	At least one project is prepared	31/12/2020
	At least one project is ready for execution	31/12/2021
		31/12/2022
C.15.2.	Phase 2 and beyond:	
	Technical report for one area on elevated land done	31/07/2021
	Leaflet about elevated land donedone	31/07/2022
C.15.3.	Phase 2 and beyond:	
	Risk and value mapping done	31/12/2020
	Stakeholder mapping done	31/12/2020
	More value barometer done	31/12/2020
	Local organization finalisedorganization 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
	ReviewR of the project finalisedfinalised	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 tender 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

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 cathment 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.

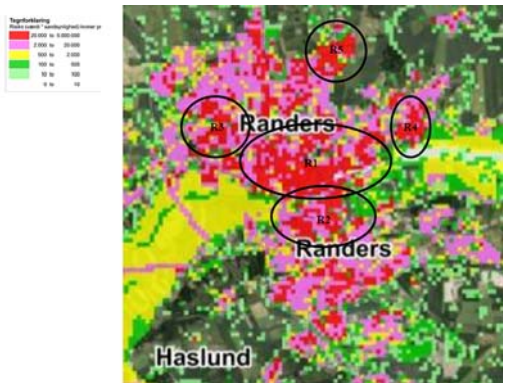


Figure 37. With 62,000 inhabitants (the 6th largest city in DK), Randers is situated at the river mouth of the northern part of the River Gudenå at the estuary of Randers Fjord, between the hillsides of the vally of the River Gudenå to the north and south.

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 agaings flooding by storm surge, while keeping direct and close contact with unique nature and future acces 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.

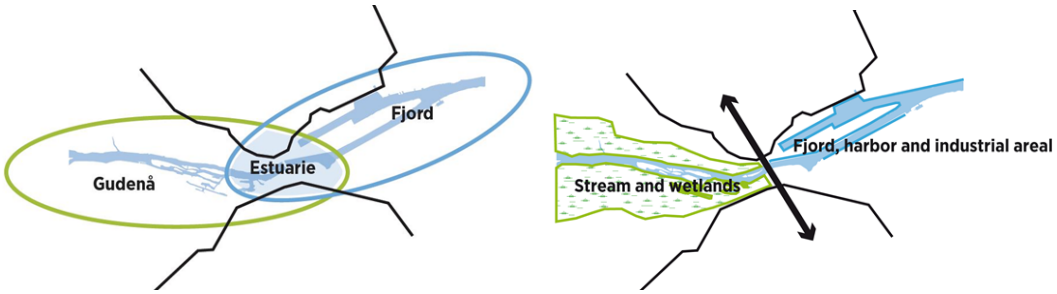


Figure 38: the merger of the two types of water – the fresh water of the River Gudenå and the salty water of Randers Fjord

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 tender 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 the tender documents for the international tender (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.

When:
Phase 1: activities 1 - 3

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 *International tender*

What
This activity deals witha highly professional international tender (with prequalification of external experts and 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 tender 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 solutions for the Climate Ribbon will be an inspiration for both ports and coastal cities in the EU

The tender should attract professionals within climate change, innovative people across disciplines from landscape achitects to hydrologist, biologist and engineers. Solutions should be found in the interaction between disciplines, and adapted to the specific socio-cultural-natural surrondings 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 tender will be used for public dissemination of ideas for citizens and the city council.

How:

Phase 1

- An international tender on the Climate Ribbon underlining the holistic approach, resulting in innovative and visionaly CCA solutions as exemplary projects for other port and coastal cities of the EU
- The tender takes place in 2018 and the best CCA solution will be selected by a jury of professional judges, local politicans etc.

Phase 2 and beyond

The following phase deals with communication and awareness raising, where investors, citizens, politicians and other stakeholders get information on the solution and CCA effects on city-life in general.

When: this takes primarily place during Phase 1, in 2018

Where: As above

C16.3 *Establishing of a showroom and workroom*

What:

C16.1 focuses on communicating and branding the Climate Ribbon's vision for innovative solutions. A showroom/workroom in the city will be established conveying the tender results. The showroom will consist of models of the possible solutions as well as a digital communication in the form of e.g. a hologram illustrating the risk of flooding by any storm and the CCA solutions for the protection of the city. The workroom will be a workshop-like area, where the solutions are tested in models and digitally in co-creation with schools, the universities, the Museum, etc. Methods of communication should be examined with a view to the application of digital forms of communication such as holograms, 3D-models, etc, in cooperation with schools, learning institutions, universities and museums with expertise in the area. 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 the maintenance of contact with nature. The goal is to tell about the Climate Ribbon’s solutions locally, nationally and internationally. This activity continues into 2021 and 2022 and beyond. Schools and universities are offered information and study possibilities in order to ensure sustainability.

How:

1. Communication of solutions, methods and experiences through the establishment of a showroom/workroom

Where: as above
When: Phase 2 and Phase 3

C.16.4 *Development of financial plans*

C16.4 focuses on co-creating and 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. I relation to this, an investigation of financing models and options is launched.

How:

1. Further development of the communication with a view to the realisation of CCA solutions in co-creation with city residents, investors, and property owners.

Where: the city of Randers

When: Phase 2 and Phase 3

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, embarkments, 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 to visit the Climate Ribbon showroom.

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/arhictectual tender (C16.2) will cost an estimated €187.796. We expect to attract the best innovative teams from all over Europe. We will need a sum of €134.128, for buying the rights of the three best proposals in the tender. Additonal 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 prossional help for writing up the programme description and tender rules, transalation of the material for the selection committee, meetings and public presentations of the tender 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:

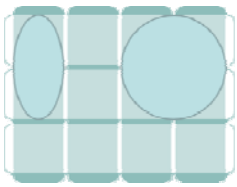
Travels	**Study travel to relevant location in DK**	**Study travel to relevant location in EU**	**Travel to project meetings**
Partners / *Cost categories:*	**RK**	**RK**	**RK**
Hotel cost:	0	578	0
Daily allowances/Payment for meals cost:	100	0	150
Local transportation costs:	163	0	120
Total subsistence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

Deliverables:

Action	Deliverables
C16.1	Phase 1 Report on best practice from other EU projects, similar international and national projects and other knowledge (01/06/2016) 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)**
C16.2	Phase 1 Publication of program for an international professionel tender on the Climate Ribbon (01/01/2018) Phase 2 Publication of summary report from Climate Ribbon Tender ("Klimabåndsudbuddet") (01/01 2019)
C16.3	Phase 2 Report on best practice from showroom/workroom og events, seminars as well as methods for development of digital forms of communication (01/12/2019)
C16.4	Phase 2 and beyond Reports, investigations and masterplan for elements of the Climate Ribbon, incl. expected concrete planning for parts and publication of accumulating reports with best practice from methods of communication, incl. with the showroom/workroom. (no later than 2022)

Milestones:

Action	QuantifiableQuantifiable milestones	Date by end of
C16.1	ReviewReview of existing knowledge from other EU projects, international and national projects and experiences finalised. AreaA of the Climate Ribbon identified. Analyzes A and studies of geographical and biological conditions within the Climate Ribbon finalised StudiesS of groundwater layers, former depot grounds, soil, pollution, foundations opportunities finalised	01/06/2017 01/10/2017
C16.2	Programme for an international professional tender for the Climate Ribbon's future content, design and realization opportunities publicized. Prequalification of 4-6 teams done LaunchingL competitive process done Announcement of the winner of the international "Climate Band Tender" Publication of summary report "Climate Band Tender"	01/01/2018 01/03/2018 01/03/2018 01/10/2018 01/01/2019
C16.3	Opening the show room / workroom 2 annual events and a seminarheld held MethodsM for the use of digital communication developed	01/04/2019 01/04/2019 01/04/2019
C16.4	Financial plan developed for the Climate Ribbon MasterM plan developed for the Climate Ribbon	31/12/20222022



C17: Thyborøn City and Harbour

As well as the Harboøre Tange

The town of Thyborøn is amont 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 pipelines will feauture 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 Tange[16]

Role of LVS

- is responsible for cooperation on innovative development on flexible pipes.

Relation to CCA plans

Lemvig Municipality CCA plan p 26.

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

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

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 infrastrukture 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 choises of future investments in coastal areas. 2.9 mio € are allocated to this project.

Description (What, how, where, when)

Heavy or prolonged rain events becoming an increasingly problem in Thyborøn. The top soil layer is saturated, and the water can neither infiltrate nor derived. 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.

Phase 2 and beyond

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 wind conditions. This includes: analysis and the modeling of the interaction between rainwater, groundwater and seawater on the basis of a simplified hydrogeological model. The model will form the basis for an assessment of the impact from the contaminated areas facing the vulnerable natural areas at Harboøre Tange.
5. The subject for the C18 ("Citizen-driven climate adaptation in Juelsminde") is the 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. Wind 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, the local monitoring.
7. The dynamic adaptation model must be a user-friendly tool for both professionals and lay people, providing an overview of climate changes 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 1-3
Phase 2 and Phase 3: activities 4-7

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 a good 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 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 2 and Phase 3

C.17.3. *Development of innovative 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 flexible pipelines that last for many years despite local subsidence. It will require a development project initiated in cooperation with the competent manufacturers of pipelines, since these pipelines do not exist today. The

project must build on sustainable solutions that take account of the specific sensitive natural areas (eg Natura 2000, the Ramsar area and the Limfjord).

How

Phase 1 and 2

1. An innovation work is initiated together with knowledge institutions and private actors in order to develop flexible pipeline material that have long life with limited maintenance in environments characterized by landsætning.
2. Together with specialists, clear requirements specifications for pipes must be formulated, which can form the starting point for the development work.
3. The work forms the basis for designing long-term and sustainable solutions preventing the spread of the contamination in the area.

When

2018-2020

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

Phase 2 and beyond

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 skitseprojekt 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

2019-2022

Where: the project area around Harboøre Tange and Thyborøn

Reasons why this action is necessary:

The town of Thyborøn is amont 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 waterlevel 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 costructively. 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 digelag 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 and essential insight in the actual development. Phase 2: A dynamic adaptation model describing the interaction between e.g. rainwater, groundwater, seawater, and pollution 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 a flexible pipeline, which has a long life expectancy in a sub-terrain 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	**Inspirational trip for staff and politicians**		
Partners: / *Cost categories:*	**CDR**	**LK**	**LVS**
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

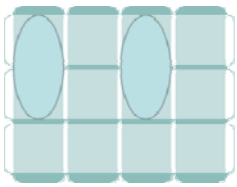
Deliverables:

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

Milestones:

Action	QuantifiableQuantifiable milestones	Date by end of
C17.1	Kick-off meeting with project group done. Counselor contracted for deliveringa detailed program for investigation and surveilance Counselor contracted for delivering a dynamic CCA model Reporting on dynamic CCA model delivered, incl. modeling on contaminated areas at Harboøre Tange	28/02/2017 30/04/2017 30/06/2018 30/04/2018 31/10/2019

C17.2.	1st large citizens meeting done 1st workshop for stakeholders and decision-makers done 2nd large citizens meeting done 2nd workshop for stakeholders and decision-makers done 3rdrd large citizens meeting done 3rd workshop for stakeholders and decision-makers done 4th large citizens meeting done	31/02/2018 30/06/2018 30/06/2019 31/12/2019 31/12/2020 31/02/2022 31/04/2022
C17.3.	Contract with private company and counselor on development of new, flexible pipes done Reporting on development of new pipes finalised	30/04/2018 31/10/2020
C17.4	Counselor contracted for assistance with preparation of material for architectural competition Launching a design competition donedone A number of conceptual designs developed, that can solve the climate challenges in Thyborøn and Harboøre Tange and contribute with added value	30/11/2020 30/04/2021 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: 81.437€

Number of days estimated spent on action in phase 1: 89 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 exiting 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 ation C5 specific training courses, workshops and masterclasses, with point of departure in the challenges experienced by the partners will be implemented for the benefiot 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

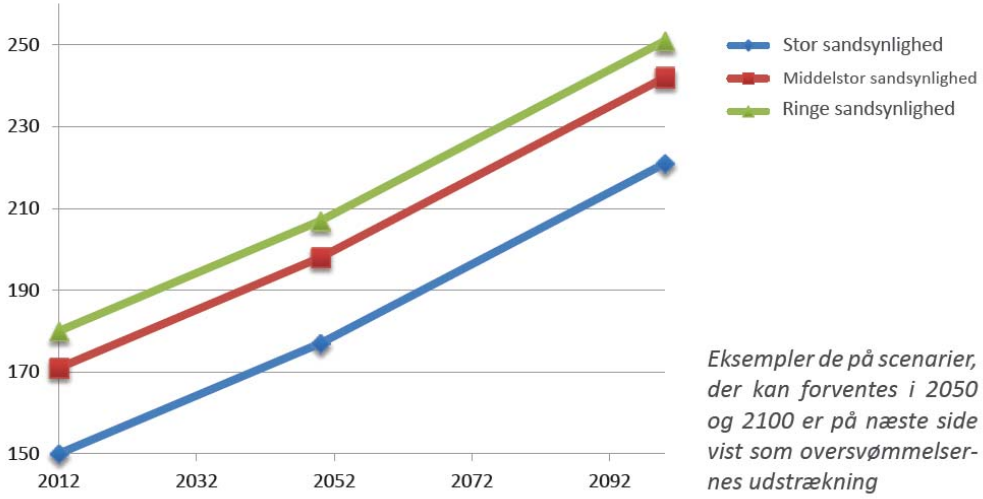


Figure 39: Sea level is expected to rise by up to 0.7 m by 2100 (Source: DMI).

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 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 programme), 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. Fugure 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

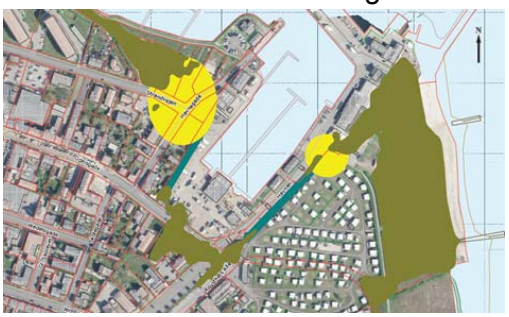


Figure 41: Juelsminde harbour. In the yellow areas, it must be ensured that those areas are protected from the sea penetrating the town, with a medium-large probability already today

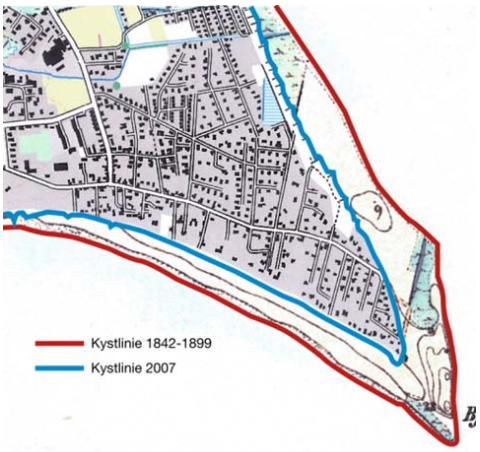


Figure 42: Juelsminde was protected by a coastal headland 150 years ago. Today, the coastline is close to homes and holiday homes

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 800â€“1000 m from the coastline. The data loggers must cover wide geographical conditions â€“ 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.

Phase 1
Activities related to 1 and 3

Where: selected local sites in Juelsminde and between Juelsminde and Glud Håb.
17.1
When: January 2017 - December 2018
Phase 2 and beyond
Activities related to 2 and 3

C18.2 *Organising 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 mange 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 utilise the establishment of the new coastal protection as an opportunity to create an epicentre for our 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 mobilising 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 (the old ferry harbour, at the harbour and at the existing dike).

Phase 1: Activities related to 1 and 2
Phase 2 and beyond: Activities related to 3 - 8

Where: Town of Juelsmine, 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 organisation is necessary in an area like Juelsminde. At the same time, the organisation should be tested 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 mobilising 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 screned.

The local organising in Juelsminde will result in increased social recilience 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 177,651 € based on inquiries. Estimation of person days for LK is based on present salaries + pension etc. C18 will mean expenses for purchasing and setting up data logging equioment 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

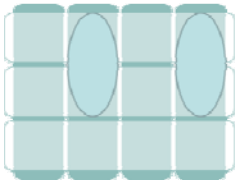
days per year. C18.2 will mean external expert consultation for all of the points with supplementary professional experts from HEDKOM to insure integration with local know-how.

Deliverables:

Action	**Deliverables**
C.18.1	Phase 1: Technical reports on data collection and data processing Phase 2 and beyond: Technical reports on data collection and data processing Hydrological model of the risk of rising groundwater (saltwater) after high tides Recommendations Booklet about rising groundwater in coastal areas Articles for international periodicals, e.g. Journal of Hydrology Conference material from presenting results Continued monitoring and verification of hydrological model for C18.1.
C.18.2.	Phase 1: Process description for the establishment of a new dike association. Articles of dike association and reimbursement model. Phase 2 and beyond: Evaluation of local organisation for climate change adaptation and development in Juelsminde related to the three main challengeschallenges

Milestones:

Action	QuantifiableQuantifiable milestones	Date by end of
C18.1	Data loggers established and data logging started. Continued monitoring and verification of hydrological model for C18.1 done Midway evaluation. First tool for local use is prepared. The project is finished with model/tool for general use.	31/07/2017 31/07/2019 31/07/2019 31/12/2022
C18.2	Dike association created Evaluation done of local organisation for climate change adaptation and development in Juelsminde related to the three main challenges	31/12/2019 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 Sørenden from a drainage channel into a real watercourse. Sørenden have originally gone to Stavns Fjord, but to protect Stavns Fjord against pollution by nutrients and sewage, Sørenden's water has been pumped to Kattegat via sea pipes since 1976. The recovery of Sørenden 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. Stakeholder and citizen involvement on the design of SUDS to create added value. Development of new methodologies for citizen involvement that are more network based. The stakeholder involvement will as a minimum include: Ballen Town and Harbour Forum, The Citizen Association, and The Boat Association.
3. Based on bullet 2 and 3, a conceptual design of the SUDS is developed and tender material is prepared.

Phase 2 and beyond:

4. 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.
5. Stakeholder and citizen involvement on the design of SUDS, recovery of Sørenden, 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 and beyond
Activities 4-6

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.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.

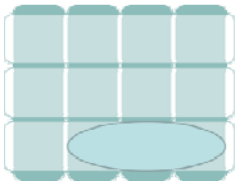
Cost estimation:
Expenses for external expert help is expected to amount to 7,000 € based on prior experience with external assistance to local projects. Estimation of person days for SAK is based on present salaries + pension etc. SAK has ample experience with communication – also in cooperation with the Energy Academy.

Deliverables:

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

Milestones:

Action	QuantifiableQuantifiable 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 finalised.	31/06/2017
	Hydraulic modelling incl. zero-alternative, coupled events and climate scenarios done.	31/12/2017
	Conceptual Design finalised	31/06/2018
	Tender material finalised	31/12/2018
	Phase 2 and beyond: 2019:	
	Preliminary investigations and initial stakeholder involvement done	20192020
	Technical background report for modelling finalised	
	Hydraulic modelling incl. zero-alternative, coupled events and climate scenarios done.	2021 2022
	Conceptual Design finalised	



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, quatror 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 differenty 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.

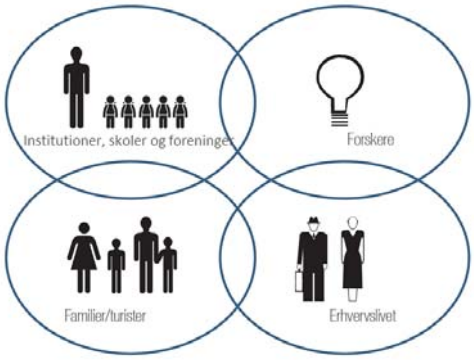


Figure 44: AquaGlobe is an innovation house for insitutions/Schools, researchers, families and tourists, and businesses.

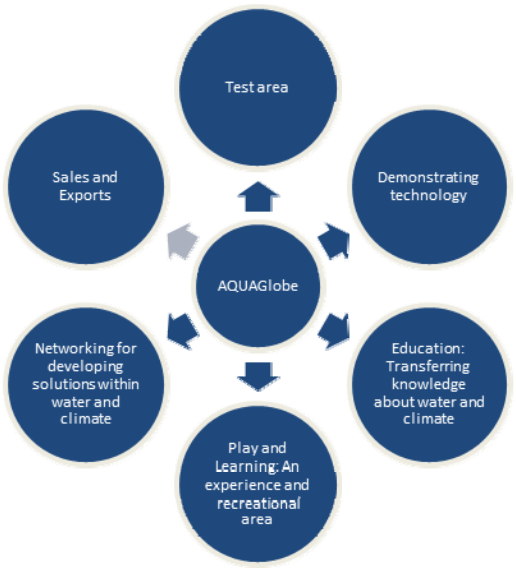


Figure45: The activities of AguaGlobe

To establish AquaGlobe, several stakeholders are to be involved, the following stakeholder catagories 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.

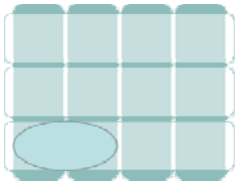
In relation to the estimation of costs, it is estimated that there will be an average hourly cost of DKK 500 per man-hour for project management, administrative work, etc.

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 cathment 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 turists 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 architectual 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 institutionens, 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 preseneted 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, offical 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)**	
Partners: / *Cost categories:*	**LVS**	**LK**	**LVS**	**LK**
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

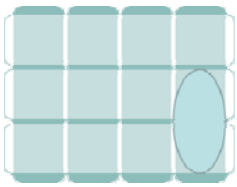
Deliverables:

Action	Deliverables
C21	A list of potential companies and knowledge institutions. 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. 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. A feasibility study of tourism documented in a report. Design criteria for the purpose of the house documented in a report. A zoning plan (digital and pdf.) Conceptual design documented in a report.

Milestones:

Action	QuantifiableQuantifiable milestones	Date by end of
C.21	AnalysisA 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: 359.547€

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 and beyond
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 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 and beyond
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 envestigated. 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:

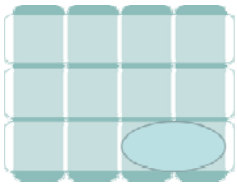
Action	Deliverables
General	Phase 1 (2017-2018): An online portal with LIFE logo and link to C2C CC main portal Workshop results: PPT presentations published on the portal.
C.22.1	Phase 1 (2017-2018): Test installation Phase 2 and beyond (2019-2022): Ongoing reporting on the individual permeable surfacing's 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 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.	Phase 2 and beyond (2019-2022): Recommendations: Reports and simple handbooks, which are published on the project portal. The results will be presented to conferences in Denmark and aboard. The intention is that this will be executed in collaboration with existing innovation networks, like "Vand i Byer"."(Water in urban areas). Finishing conference: Knowledge sharing across municipalities and stakeholders. PPT presentations published on the online portal. Complementary projects: complementary project proposals, which is sent for example to EUPD or MUDP.

Milestones:

Action	QuantifiableQuantifiable milestones	Date by end of
C22.1	Phase 1: One pilot climate road established Baseline established for monitoring programme Bestablished for First season measurements are evaluated Report on recommendations prepared in connection with the establishment of the climate road. Phase 2 and beyond: Third season monitoring results are evaluated and reported. GuidelinesG and recommendations are finalised ResultsResults presented on two workshops and one conference	 31/12/2017 31/12/2017 31/12/2018 31/12/2018 31/12/2020 31/12/2020 31/12/2020

C22.2	Phase 1: A workshop with stakeholders and knowledge institutions is donedone Phase 2 and beyond: January 2021 – December 2022. Planning of meetings with politicians and stakeholders done Field trip done Stakeholder integration donedone Workshops held and working groups meet. RecommendationsR to the municipalities and stakeholders prepared in report Finishing conference done Pilot project descriptionsdescriptions prepared. At least one complementary project description ready for execution.	 31/08/2017 31/08/2021 31/12/2021 31/12/2021 31/12/2021 31/12/2020 31/08/2022 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 advise 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 to10 meters of the ground surface. Relevant stakeholders will be involved in 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 his 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 to10 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's 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.

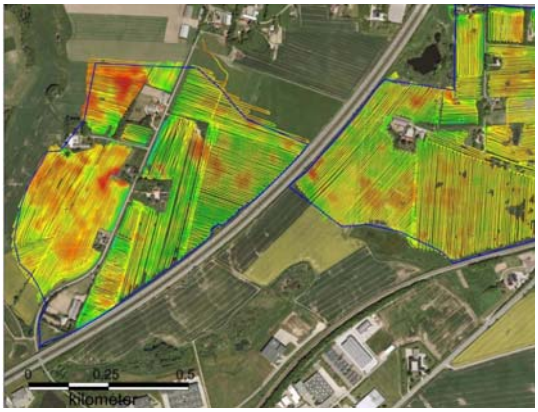


Figure 51: Example of geophysical mapping. Red areas are sandy areas and green areas are clay-dominated areas.

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: January 2017 – December 2018
Phase 1: It is planned that action C23.1 will be executed over the first two years (2017-2018)

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 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 and beyond: January 2019 – December 2019.

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 organsaition 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 and beyond

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

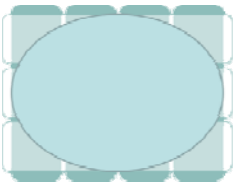
Deliverables:

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	QuantifiableQuantifiable milestones	Date by end of
C23.1	Report on quantitativeqclarification of the individual deposit's infiltration capabilities finalised.	31/12/2017
	Report on quantitativeq correlation between the geological descriptions from the drillings and the deposits' infiltration capabilities finalised	31/12/2017
	Report on quantitativeq correlation between the deposits' electrical resistivity and infiltration capabilities done.	31/12/2017
	InfiltrationI potential map for the urban development areas done.	31/12/2018
	Full overview of infiltration potentials in Horsens municipality finalised.	31/12/2018
	Integrated municipal plan in Horsens on how to use infiltration for future urban development drafteddrafted	31/12/2018
C23.2	MeetingsM with 200 stakeholders done	31/08/2019
	One field tripf to selected sites done	31/08/2019
	Stakeholder integration of 200 stakeholders done	31/08/2019
	Workshops held and working groups met.	31/12/2019
	Recommendations Reprepared for stakeholders	31/12/2019
C23.3	Final stakeholder conference. 200 participants	31/08/2020
	At least one pilotp projects prepared.	31/08/2020
	At least one project description ready for execution.	31/12/2020
	Final review of the project done	31/12/2020

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 fro 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 canvass 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 (Fruergaard 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 adaptions, 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 projectexcavation, 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).

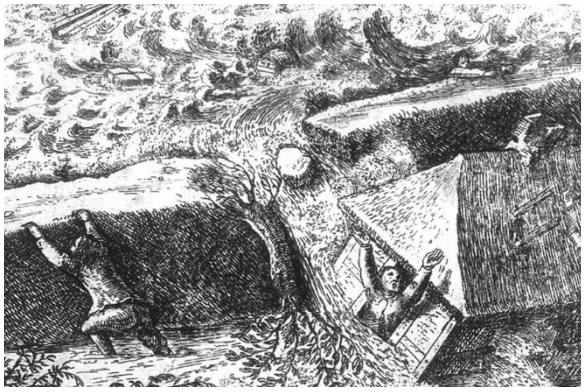


Figure 54: Dyke rupture at the River Elbe in northern Germany during the storm surge in 1661. Engraving by H.M. Winterstein.

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. Historical maps primarily held at the University Library in Aarhus and the Royal Library in Copenhagen will be digitised and subsequently archived at Aarhus University Library/State Library, where they will be publically accessible. 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 be 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 Moesgård Museum's Exhibition Laboratory and the Region of Central Jutland's many relevant museums as well as 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 identify-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: AU's Exhibition Laboratory at Moesgård Museum, 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
N/A

Expected results:
The coupling of natural and cultural heritage provides a platform for disseminating and discussing the challenges, knowledge and solution options, all in fora close 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.

Minimum number of visitors to the exhibition: 10% of the participating museum's visitors to the C2C CC climate exhibitions (see http://www.dst.dk/da/Statistik/emner/museer-og-kulturarv/museer).

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).

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Deliverables:

Action	Deliverables
C24.1 and C24.2	Phase 2 and beyond: 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. 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.
C24.3.	Phase 2 and beyond: 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 – tomorow: Facing the climate challenges of the future. Data on storm flood pillars archived at http://historiskatlas.dk and at the Aarhus University Library/State Library (31/12/2019). Teaching materials regarding climate and environmental history for high school level (31/10/2021). Climate tourism brochure for the Region (31/10/2021). Exhibition about climate history and culture history in the Region of Central Jutland (31/10/2022). 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).

Milestones:

Action	Quantifiable milestones	Date by end of
C24.1	***Phase 1 (2017-2019)*** Milestone 1.I – Nomination of staff responsible for Sub-project 1 Milestone 1.II – data review complete (30/6/2019) ***Phase 2 (2020-2021)*** Milestone 2.I – target publications complete Milestone 2.II – conference presentation delivered ***C2C CC phase 3 (2022-2023)*** Milestone 3.I – the synthesis over the Region's coupled natural and cultural heritage and the C2C CC contributions published	 31/3/2017 30/6/2019 31/10/2021 31/10/2021 31/12/2023
C24.2	***Phase 1 (2017-2019)*** Milestone 1.I – Nomination of staff responsible for Sub-project 2 Milestone 1.II – digitisation of historical maps and records complete ***Phase 2 and beyond*** Milestone 2.I – target publications complete Milestone 2.II – conference presentation delivered Milestone 3.I – the synthesis over the Region's coupled natural and cultural heritage and the C2C CC contributions published	 31/3/2017 31/12/2018 31/10/2021 31/10/2021 31/12/2023
C24.3	***Phase 1 (2017-2019)*** Milestone 1.I – Nomination of staff responsible for Sub-project 3 Milestone 1.II – Workshop 1: Coupling of cultural and natural history in the Region	 31/3/2017 1/6/2019

	Phase 2 and beoynd	
	Milestone 2.I – Workshop 2: The role of cultural heritage in climate adaptation	1/6/2021
	Milestone 3 – Climate history brochure for the Region complete	31/10/2021
	Milestone 2.I – Workshop 3: Museums and climate adaptation	
	Milestone 2.II – Exhibition opens	1/6/2022 31/10/2022