CARE (Climate Adaptive Registration)

Towards an integrative instrument for climate-adaptive water management.

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1. Introduction and context

The water system (waterways, barriers and structures) is based on cultural technical standards and laid down in a legally obliged registration instrument (Dutch: “Legger”), which outlines the legal obligations governing the water system, specifying compliance requirements and regulations. The events of the 2021 flood and recent drought challenges underscore the imperative to adapt the water system to the evolving climate, necessitating a holistic examination of its components.

Furthermore, demographic growth, intensified spatial demands, biodiversity loss, shifts in agricultural practices, changing societal values, and other socio-economic trends or events will alter norms governing the water system. These transformations, which transcend borders, are characterized by inherent uncertainties and possess the potential to significantly impact how we manage water. Such consequences extend to space utilization, spatial planning, and the associated institutional frameworks, laws, regulations, as well as the recording of the water system.

This project is part of the EMFloodResilience project, WP3 nr D.T3.3.1, and has been named CARE (Climate Adaptive Registration). In this project we explored the possibilities for transforming the traditional, legally obliged registration into a (more) climate-adaptive registration by which water and soil become more the guiding principles for spatial planning and climate adaptation.

Deliverables

There are three main deliverables:

- Analyses of Environment, actors and issues (Appendix 1 and 2)
- A description of environmental vision CARE criteria with building stones (Chapters 3-5)
- Prototype Care criteria Go/No go (value case Pilot) (Chapters 3-5)

During the trajectory of the project, it appeared increasingly useful to combine the development of the two last mentioned deliverables, developing criteria for climate adaptive registration, and identifying building-blocks that serve to meet these criteria in the form of two instruments.

Within the scope of the CARE (Climate Adaptive Registration) subproject conducted by Waterschap Limburg, a design-focused trajectory unfolded between January and June 2023. CARE is integral to the broader Interreg EMFloodResilience project, aimed at bolstering climate resilience in spatial planning following the 2021 summer flood events in Germany, Belgium, and the Netherlands.

The trajectory's objectives encompass:

1. Examining suitable tools for local and regional climate adaptation in water management, collaborating with diverse stakeholders and building upon existing tools like the 'legger.'
2. Strengthening the trajectory with innovative methodologies, particularly through design-thinking methods.
3. Co-creating with experts and stakeholders to develop well-supported and widely accepted tools.

Initially geared towards enhancing the climate adaptability of Waterschap Limburg's water system, specifically the 'Legger,' the trajectory evolved to consider additional instruments.

The core team, comprising individuals from Waterschap Limburg, Pantopicon, and Savia, oversaw and shaped the entire trajectory, culminating in this comprehensive report.

Reading guide

The report begins with an explanation of the methodology (Chapter 2) and addresses challenges in climate-adaptive water management (Chapter 3). Chapter 4 outlines components of the 'CARE Instrument' ('CARE Onderlegger'), and Chapter 5 focuses on components of the 'Everyone Water Manager' ('Iedereen waterbeheerder').

The 'CARE Instrument' visualizes climate resilience in areas, present and future, guiding effective measures. 'Everyone Water Manager' involves an interactive process, utilizing the 'CARE Instrument,' to assist individuals and entrepreneurs in climate readiness.

Chapters 4 and 5 are interconnected, with the 'CARE Instrument' highlighting vulnerable areas in the water system (Chapter 4) and Chapter 5 focusing on enhancing self-sufficiency.

The trajectory involved three working sessions, with Chapter 3 detailing the first workshop's outcomes and Chapters 4 and 5 presenting refined results from subsequent workshops. Two instruments, the 'CARE Instrument' and 'Everyone Water Manager,' emerged, substantiated by the core team post-workshops.

Chapter 6 outlines the next steps for designing and implementing the 'CARE Instrument' in practice.

2. Process and methodology

During the project three working sessions were organized. Preceding this process, Waterschap Limburg conducted an actor scan with the objective of gaining an overview of the organizations that should be involved in reinforcing climate resilience in Limburg. The outcomes of the actor scan were utilized to compile a list of organizations invited to the working sessions (Appendix 5).

The working sessions were attended by a diverse group of individuals and organizations, detailed in Appendix 5. The three workshops each lasted a half-day. The brief duration required thorough preparation to enable participants to reflect and design in an effective and focused way.

The core team prepared the workshops, and sessions were facilitated and developed by staff from Pantopicon and Savia. Participants utilized pre-printed templates and diverse content on hand-outs to inspire thoughtful discussions, ensuring depth in a limited timeframe.

The workshops were structured as follows:

Design Workshop 1 – Exploration: water systems and current registration tools (March 24, 2023)

The initial session was designed to explore challenges facing climate-adaptive water management in Limburg. Three steps were taken: understanding current challenges (in 2023), assessing challenges arising from new policy directives (local, national, international), and future challenges.

Design Workshop 2 – Developing building-blocks for climate-adaptive water management instruments, Part 1 (April 26, 2023)

Before the second workshop, the core team selected challenges that arose from the first session, as well as the policy analysis conducted by Savia, based on specific criteria:

- Which challenge (or combination of challenges) is most urgent for climate-adaptive water management?
- Which challenge involves missing or poorly functioning instruments?
- Which challenge (and conceivable instruments) involves local, regional (including cross-border) control?
- Which challenge requires a design-oriented approach?

These criteria led to the selection of two main design-oriented challenges for the second and third workshops:

- How can we make the 'Legger' (current registration instrument) more climate-adaptive and effective? Is the 'Legger' the suitable instrument?
- How can we enhance the self-sufficiency and self-directed capability of society concerning climate adaptation?
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The two selected challenges are interconnected: new instruments are needed to operationalize climate-adaptive ambitions, but these instruments alone will be insufficient. The expectation is that citizens and private actors must become more self-sufficient in climate adaptation, given the

likelihood of increased flooding, drought, and heat, with policy measures likely insufficient to fully climate-proof society.

In the second session, two design-oriented challenges were elaborated based on the following questions:

- What is the purpose of the (future) instrument?
- What does the instrument entail?
- Who are the users of the instrument?
- What does the instrument look like concretely (dare to sketch!)?
- When is the instrument used, and in what context?
- What services are linked to the instrument, and who provides them?
- What is needed to operationalize the instrument?
- Who is needed for this?
- What steps need to be taken?
- What else do you want to convey?

Design Workshop 3 – Developing building-blocks for climate-adaptive water management instruments, Part 2 (MAY 26, 2023)

During the third workshop, the emerging instruments were further elaborated using targeted questions prepared by the core team. Subsequently, the instruments were brought to life through the utilization of the *customer journey* method, a technique describing the journey a customer or user of a product or service undertakes in pursuit of a specific goal. This method was employed to further substantiate the 'CARE Instrument' and 'Everyone Water Manager.' The assumption in employing the customer journey approach was that the instrument is ready for deployment in a real context, illustrating how it is used, who is involved, how people come into contact with it, and the results of its use.

To ensure specificity in the development, the case of the Groote Molenbeek was used as it had already been comprehensively studied by Waterschap employees, and suitable map material had been prepared. The Groote Molenbeek area was chosen as a concrete case study to use in designing customer journeys (see Chapters 4 and 5).

Throughout the co-creation process the core team paid particular attention to the following aspects:

Integrated thinking:
The ambition was to approach climate-adaptive water management as comprehensively as possible, employing a systemic approach throughout the trajectory. Systemic thinking, a scientific problem-solving approach, views problems as interconnected parts of a larger system. Thus, systemic thinking is a holistic perspective focused on understanding the interplay of interacting subsystems within a complex system and gaining insight into actionable options. Watersystems are considered part of a broad societal system.

Long-term perspective:
The examination considered future changes that could impact climate-adaptive water management and identified new opportunities and threats for water management.

Tangibility:
Efforts were made to develop the components for climate-adaptive instruments in as tangible and experiential a manner as possible, utilizing design-driven methods, or Design Thinking.

Co-creation:
Co-creation involved a team with a balanced mix of knowledge, expertise, and experience in legal, spatial, economic, societal, technological, demographic, and ecological domains. This team, as mentioned, was assembled based on a previously conducted actor scan by Waterschap Limburg. The process design aimed to create a safe environment where people could work freely and out-of-the-box.

Impressions from design workshops




3. Results of working session 1 – Crucial challenges and design-questions

In the present trajectory, climate-adaptive water management is defined as the timely and effective adjustment to the current or anticipated climate, considering other socio-economic, demographic, ecological, and spatial dynamics. This approach aims to limit damage caused by climate change, with a specific focus on heat, drought, and water overflow in Limburg. It involves preparedness, accurate response to emerging issues, and post-event care if necessary.

Approach

First and foremost, attention was given to the current challenges facing climate-adaptive water management in Limburg. Key questions included:

- How climate-adaptive are the water systems in Limburg (and cross-border) in 2023? What challenges do the systems face today?
- What lessons can be drawn from history? Which significant changes have had a substantial impact on the system?

The above questions were contemplated from an integrated thinking framework (see alongside). New policies have been developed or are in progress that will influence climate-adaptive water management. This policy was explicitly examined with the following questions:

- What (new) policies are relevant for instruments like the "Legger"?
- Which policies are current at different scales (local - European/global policies)?
- What new challenges does the policy pose for climate-adaptive water management?

An overview of the identified policies is provided in Annex 2.

Lastly, consideration was given to future challenges that may arise concerning climate-adaptive water management:

- What gradual demographic, ecological, technological, economic, legal, socio-cultural, and political-institutional changes will impact various types of water systems? What do these changes mean for climate-adaptive resilience?
- What disruptive changes are conceivable? What new solutions and innovations are emerging in the field of climate adaptation?

To inspire participants, and to generate a deeper understanding of the above questions, a range of gradual and more disruptive developments were mapped in advance and presented on pre-printed inspiration cards. These encompassed a broad spectrum of changes that could affect water systems and the climate-adaptive capacity of organizations (i.e., digitalization, political developments, the energy transition, etc.).

Content-related insights

As evident from Annex 3, a multitude of challenges has been identified.
Climate-adaptive water management poses a significant challenge. Many measures that could make a substantial difference, such as retaining runoff, slowing drainage, optimal infiltration, and sponge effects, have not been fully implemented. These measures need better integration with spatial

policies. The idea of steering 'water and soil' sounds appealing, but practical implementation proves challenging, partly due to a lack of suitable local and regional instruments.

Integral information is often lacking, primarily identifying areas insufficiently climate-adaptive (in terms of resistance to heat, drought, and water overflow) and areas at risk in the future. Addressing this challenge requires comprehensive information that is currently not available on maps.

Additionally, there is a lack of insight into the most effective implementation of measures, considering local variations and drawing from experiences elsewhere. This knowledge gap needs to be addressed.

Climate-adaptive water management also poses an organizational challenge: a cultural shift, organizational change, and new approaches are necessary within many organizations to effectively implement climate-adaptive water management (consider, for instance, municipal organizations).

Three major sub-challenges emerge:

- Adopting a more integral and systemic approach to water management (see system approach).
- Taking a more future-oriented approach to water management (thinking long-term and acting short-term).
- Establishing new collaborations to collectively enhance the climate-adaptiveness of water management.

A significant challenge lies in engaging various sectors and target groups in more climate-adaptive practices. Each sector and target group operates based on its own logic, and it is crucial to consider these nuances. Businesses need insights into possibilities and new business models for climate adaptation, along with the costs and benefits of climate-adaptive measures in the short and long term. The agricultural sector, undergoing a significant transition, can make a substantial difference but faces uncertainty. Clarity is needed on how climate ambitions align with this transition. Citizens also play a role, and encouraging climate-adaptive behavior while considering different perceptions (partly culturally determined) of water management is crucial. This begins with raising awareness of current and future issues and understanding one's own sphere of influence (what can I do alone or together with others?), requiring practical and feasible guidelines.

From crucial challenges to design questions

Based on selection criteria (see Chapter 2), we attempted to formulate (combined) design questions:

- How can we make the "Legger" more climate-adaptive and useful? Is the "Legger" a suitable instrument for this purpose?
- How can we enhance the self-reliance and self-steering capability of society regarding climate adaptation?

When developing the two instruments, it is essential to consider other challenges and explore the extent to which the instruments under development also address these challenges.

Based on the first design question, the concept of the "Klimaatonderlegger" (see Chapter 4) was developed. Using the second design question, the instrument "Iedereen waterbeheerder" (Chapter 5) was created.

4. Results of working session 2 – The ‘klimaatonderlegger’

Why develop a ‘klimaatonderlegger’ (CARE instrument)?

Climate change is bringing about more frequent occurrences of heat, extremely wet and dry weather. Recent events, such as the record temperatures exceeding 40°C in July 2019, prolonged periods of drought from 2018 to 2022, and the 'water bomb' in Limburg in July 2021, have made us increasingly aware that climate change is becoming a significant factor in the spatial planning of our country. Simultaneously, it is becoming more apparent that not only climate change but also other major societal challenges, such as the energy and agricultural transition, the construction challenge, and nature challenges (N2000, KRW), place a significant demand on our use of space.

Design decisions addressing one challenge may conflict with other challenges, and decisions made in the present may clash with future circumstances. Therefore, a sustainable perspective requires an integral and far-reaching outlook.

The information needed to make future-oriented, integrated decisions is scattered across various locations and is often under the control of different stakeholders with varying authorities and management areas. For instance, the Water Board has a plethora of detailed maps of the area under its management (with a focus on watercourses), municipalities have information on sewer drainage, spatial developments (e.g., new locations for housing and industrial areas), (potential) water buffers, and urban heat stress in the built environment. Meanwhile, the Province holds extensive landscape information. This compartmentalization of information sources, authorities, and management areas makes it challenging to make future-oriented, integrated decisions.

Furthermore, it should be noted that water management in the Netherlands has traditionally been primarily focused on the swift removal of excess water and preventing water overflow based on drainage standards. Our environment, spatial infrastructure, laws and regulations, and management practices are inadequately designed for water retention and preventing heat stress in the built environment.

Hence, in this project, we explore the possibilities of developing a more comprehensive instrument to enhance climate adaptive capacity for the Water Board, municipalities, the province, and other stakeholders. This comprehensive instrument is called the ‘Klimaatonderlegger’. The ‘Klimaatonderlegger’ aims to support these stakeholders in making informed decisions in the face of climate change and other upcoming developments while guiding water and soil in spatial planning. The emerging instrument therefore focuses on developing a set of supportive tools to enhance climate adaptive capacity in various contexts (assessment, dialogue/communication, planning, promoting self-sufficiency). This instrument consists of both spatial and non-spatial information.

The ‘Klimaatonderlegger’ is rooted in systems thinking. The system central to this project encompasses the interplay of:

- Driving forces in the external environment (such as climate change, economic, and spatial developments)
- Pressure resulting from climatological developments and societal activities (such as drought)

- The influence and often disruption of the state of the system (including air, soil, and subsurface)
- The impacts that this disruption can have on aspects like water safety, livability, or biodiversity
- And the response of governments and other actors to these impacts (e.g., policies, measures, projects)

The Klimaatonderlegger focuses on the entire Limburg management area (with attention to the border region) and adopts a broad systemic approach (of which the water system is a part). The underlying concept is that such an integral approach potentially has a much greater and more sustainable impact than various delimited sectoral approaches and interventions (which often only have local impacts in practice).

The Klimaatonderlegger as it relates to current registration instruments

The Legger has traditionally been a crucial component of water management. It is a map that precisely describes the area that the Water Board manages down to the square meter: the location and dimensions of water bodies, the placement of objects (such as dikes, weirs, and rainwater buffers) that manage or influence water, which rules of the Water Board (under the Omgevingswet) apply where, and who is responsible for maintenance and upkeep. The Legger also includes zones for future developments and protection of the water system.

The Water Board Limburg is responsible for managing 2,645 kilometers of waterways (streams, rivers, canals, ditches) in an area of 2,209 square kilometers, providing sufficient water, clean water, safe dikes, and dry feet for 1,115,895 residents in 31 municipalities.

The Legger, together with the Omgevingswet, is a significant legal instrument for the Water Board, covering aspects such as management, maintenance, enforcement, and permit issuance. It also serves as a public register for entities like municipalities, nature organizations, entrepreneurs, and residents seeking insight into management tasks, maintenance obligations, enforcement, and permit issuance.

The Legger and the Klimaatonderlegger can be viewed as complementary instruments: the current Legger is limited to preserving what exists now, focusing on the water bodies managed by the Water Board and historically designed to expeditiously remove water. In this sense, the current Legger is not adequately equipped to function as an integrated instrument for the water board, municipalities, provinces, and other stakeholders to inform decision-making with regard to climate change and other impending developments. In this project, we explore whether the current Legger can be transformed into an instrument suitable for substantiating informed decisions in the context of climate change.

The Legger could, for instance, be supplemented with areas where water conservation needs to take place, similar to the inclusion of meander zones in the current Legger. However, the exploration revealed that despite the possibility of expanding the current Legger, it is inept for comprehensive integration. Hence, an additional instrument is required: the Klimaatonderlegger.

The Klimaatonderlegger (in development) also anticipates potential future dynamics (from a watershed perspective), places the entire watershed at the center (including plateaus, slopes, hills, and valleys), and combines drainage with water storage and retention. Moreover, the Klimaatonderlegger assumes that the watershed is once again part of a broad societal system.

A Klimaatonderlegger will always be used by the Water Board in conjunction with the Legger, essentially as an underlayer to the Legger.

Characteristics of and building-blocks for the Klimaatonderlegger

The Klimaatonderlegger is an instrument for the Water Board, municipalities, the Province, nature and environmental organizations, and residents. The selection and manner of using components of the instrument in a process depend on the purpose for which the instrument is employed (including planning, assessment, dialogue/communication, enhancing self-reliance), the application phase, the area under discussion, the theme (drought, inundation, heat, floods, or a combination), and the target audience using it.

To function as a comprehensive supportive instrument, the Klimaatonderlegger will ultimately connect various layers of (spatial) information coherently. A preliminary selection of layers includes:

- A description of the water and soil system of the watershed (or subareas), including the challenges and conditions arising from it. This description is based on a set of system maps, including:
- Spatial maps: land use, function allocation, vegetation, land ownership, elevation maps, plateaus, slopes, hills, valleys (contour lines);
- Water/soil maps: morphology/soil types, seepage and infiltration areas, inundation/meander maps, groundwater levels, precipitation statistics, groundwater protection areas, groundwater extraction areas, groundwater withdrawals, areas identified for water retention, water quality standards related to water quality;
- Impact maps: municipal stress-test maps, drought maps, flood maps, maps with level areas/risk areas, basic map of water safety system, out-of-dike flooding maps, nuisance maps, heat maps, heat island effect maps, hydrological situation maps in extreme weather conditions, maps of groundwater-dependent nature, and potential damage in case of water shortage.
- A description of the developments that may occur in the watershed, including the challenges and conditions arising from them. This includes climate scenarios (2100) (KNMI) and future impact maps (drought, heat, inundation, floods) (CAS, Climate Effects Atlas).

The Klimaatonderlegger is based on the principle of 'water and soil as leading priorities' ('water en bodem sturend'), as an ambition pronounced by the Dutch ministry of environment in 2022:

It is based on concrete goals (e.g., reducing drought damage to nature by a certain percentage). It contains generic and specific rules for the (watershed) area (such as climate-adaptive building standards) and their translation into specific locations/areas (for example, where you can build/develop without additional restrictions, where you can build/develop 'if...' and where you cannot build or develop, and where self-reliance can be strengthened in an area/neighborhood).

Ideally, the Klimaatonderlegger also includes:

- Spatial scenarios (2050) (PBL 2023) and environmental visions (with ambitions indicated per area)
- An overview of projects and measures (in preparation, in progress, and completed) that impact climate resilience, represented on a map
- Maps with (new) measures aimed at climate adaptation and associated best practices.

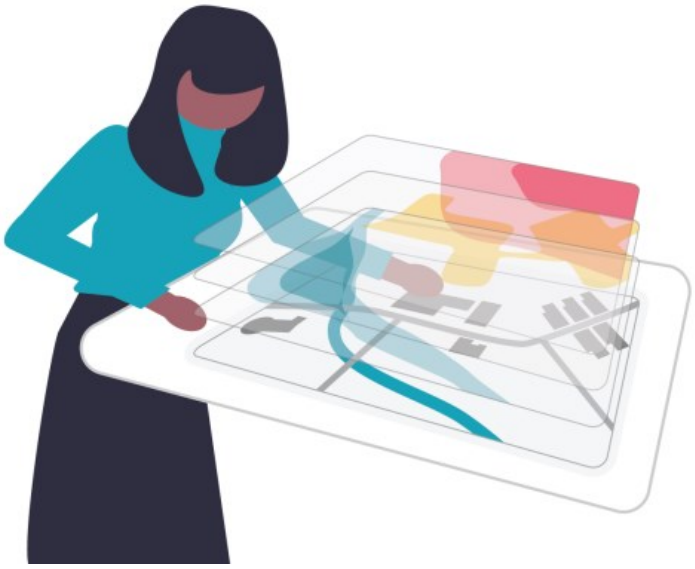
Other supporting information that can be included in the Klimaatonderlegger:

- Legal information about the Omgevingswet (a novel comprehensive aggregation of local regulatory requirements and plans), relevant regulations, other national and European frameworks, conditions, agreements, information about the legal safeguarding of the Klimaatonderlegger
- Financial information such as subsidy maps with an overview of subsidies, conditions, and rules, a financing infographic, and a budgeting aid
- Basic information from the Water Board, such as basic information about the Beekdalbrede Approach.

Appendix 3 shows an overview of the maps needed for the Klimaatonderlegger. This appendix also indicates which maps are already available and which are not. No final decisions have thus far been made on how the Klimaatonderlegger will be designed, and what information should be included.

Various possibilities can be considered for the implementation of the Klimaatonderlegger, such as a digital map set, a digital twin with real-time information, an online portal with information, or possibly a Virtual Reality or Augmented Reality application, etc.

In the following text, we will consider a digital twin. A digital twin is a virtual version of the living environment that includes the water system. It features several different levels of abstraction: you can view an entire province or zoom in to street level. In the case of the Klimaatonderlegger, you can see which areas are climate-adaptive or not, and, for example, based on a scenario simulation, understand how vulnerable areas are to climate change in the future.



The role of the Klimaatonderlegger in climate-adaptive water management

The Klimaatonderlegger aims to support the Waterschap, municipalities, the Province, and other stakeholders in:

- Raising awareness of climate-adaptive capacity in and of the province.
- Making informed choices when climate-adaptively designing the water system, taking into account the ongoing developments, current and future bottlenecks and leverage points, needs, responsibilities, and the agency people have.

Concrete applications of the Klimaatonderlegger include:

- Serving as the basis for dialogue and communication to enhance the engagement, ownership, understanding, and awareness of society regarding climate adaptation.
- Serving as the foundation for the planning and vision formation of municipalities and provinces. Here, the klimaatonderlegger functions as a tool for (integral) anticipation of long-term developments and needs.
- Serving as the basis for assessment for permit issuance, enforcement, subsidy granting, etc.
- Serving as the foundation for implementing climate policy (including measures and best practices included in the Klimaatonderlegger) and, consequently, for enhancing self-reliance (see also 'Iedereen Waterbeheerder') where appropriate.

These applications vary in terms of information needs concerning the Klimaatonderlegger. Planning processes, for instance, may require more detail and different types of information compared to dialogue processes. This, of course, also depends on the tasks, interests, and expertise of the stakeholders using the Klimaatonderlegger.

The Klimaatonderlegger in practice

The Klimaatonderlegger has several potential applications, two of which will be further delineated: the Klimaatonderlegger as an **assessment tool** and the Klimaatonderlegger as a **dialogue and communication instrument**.

It is worth noting that there are diverse conceivable implementations for both of these applications, which warrant careful examination in the context of prevailing methodologies and emerging developments.

The Klimaatonderlegger, as a tool for assessment, uses an integrated map (derived from diverse layers of spatial information) that delineates the risks from an integrated climate-water-soil perspective and suggests approaches to address them. This is particularly pertinent in making decisions related to spatial planning.

The instrument should differentiate between:

- Areas where construction/development is allowed without additional restrictions (green zone)
- Areas where construction/development is allowed "provided that..." (orange zone)

- Areas where construction/development is not permitted (red zone)

The map delineates the rules associated with it and illustrates the regions subject to additional regulations, norms (such as climate-adaptive construction standards), conditions, and responsibilities of current and future users. The Klimaatonderlegger maintains a well-calibrated balance between 'red,' 'orange,' and 'green' zones. The message is not that there are no development possibilities anywhere, but rather that careful consideration should precede developments: For instance, restrictive zones specify alternative opportunities (such as nature-inclusive agriculture in floodplains).

The Klimaatonderlegger targets various stakeholders in the assessment phase, each playing distinct roles, including, at least, the municipality(ies), the Province, and the Waterschap. Depending on the type of initiative, a particular body assumes control. Over the next few years, the collaboration based on the principle of 'water and soil guiding' will take practical shape.

The assessment process typically initiates with a proposal. An individual or organization brings forth a question or initiative (e.g., a property developer or entrepreneur). The initiator first consults with the municipality to understand the possibilities concerning a specific location. A municipality or the Province can also be the initiator, for instance, when a municipality or the Province releases expansion locations. Incremental expansion is also possible, such as a campground expanding with chalets (initiatives with seemingly minor impact evolving over time into initiatives with significant impact).

Subsequently, there are different assessment stages:

1. Location assessment (initial assessment): In this phase, conditions are set for making the right location choice or the right choice for development at specific locations.
2. Assessment of established frameworks;
3. Preliminary assessment of the design;
4. Plan assessment, including based on potential damages;
5. Realization, management & maintenance.

During each of these assessment stages, the 'assessment map' of the Klimaatonderlegger takes precedence: this map indicates what is possible at specific locations and the applicable 'rules' during each stage.

The Klimaatonderlegger, as a tool for dialogue/communication, utilizes different forms of expression compared to the Klimaatonderlegger for assessment, depending on the purpose and target audience. In this case, maps from the digital twin are also used.

These maps cover:

- The current and future situation: Explanation of the water system with issues, risks, vulnerabilities, consequences, opportunities, and responsibilities.
- Proposed plans/interventions (individual/collective, social/technical, spatial and non-spatial measures), also aimed at enhancing people's self-sufficiency.

- Expected effects: Consequences for specific target groups (issues, risks, vulnerabilities, consequences, opportunities).

Additionally, measures and best practices are presented in an experiential manner (e.g., through videos, storyboards, infographics, etc.) for the watershed, a specific planning area, or a neighborhood.

The Klimaatonderlegger for dialogue/communication targets different audiences:

- Municipalities, the Province, and the Waterschap: These parties take the lead. Municipalities and the Province have the most influence in spatial planning, while the Waterschap is responsible for water management. They will need to collaborate closely in the regional implementation of the 'water and soil guiding' principle. The Klimaatonderlegger can serve as a crucial tool in the dialogue process they orchestrate.
- Involved entrepreneurs (including agricultural entrepreneurs), residents, nature and environmental organizations, etc. They can be engaged in various ways, such as:
    - Organized in working groups from the community (voluntarily)
    - Through individual, personal discussions (in advance and when necessary)

5. ‘Everyone’s a water manager’ – improving self-reliance

The need for an instrument for improving self-reliance of private actors

Climate-adaptive water management, both now and in the future, cannot be shaped solely by the measures we currently know. Especially in the case of extreme climatic conditions, such as extreme heat, drought, water excess, and storms, there will be a greater need to rely on the preparedness and self-sufficiency of residents and entrepreneurs. This trend is expected to become more prominent in the future, particularly in light of the IPCC/KNMI scenarios. Currently, there are currently no widely recognized and universally applicable instruments focused on self-sufficiency in climatically extreme conditions.

Self-reliance (and mutual assistance) can be relevant at various stages leading up to and during climatic extremes (heat, drought, water excess), including:

- Prevention/preparation
- Response
- Aftercare

Inspired by successful initiatives both domestically and abroad, the concept of 'Everyone’s a Water Manager' emerged. This comprehensive idea aims to strengthen the self-sufficiency of citizens and entrepreneurs in the context of climatic extremes.

Municipalities are increasingly focusing on climate-adaptive planning. It could be an initiative of the municipality to enhance resilience and self-sufficiency in certain areas (neighborhoods and industrial areas) within the municipality. The policy framework for climate adaptation itself is further refined: regulations change, and the urgency of climate change becomes more tangible in the future for entrepreneurs and citizens.

The 'Everyone’s a Water Manager' instrument is primarily intended to:

- Raise awareness among citizens and entrepreneurs about their current "climate sensitivity" (regarding water excess, heat, and drought) and their impact on others.
- Increase and strengthen the stakeholders' room for action to act more adaptively to climate change.

This involves precautions/prevention, response, and aftercare in the context of water excess, heat, and drought.

The Klimaatonderlegger is the ideal instrument to discover which areas are climate-sensitive and what individuals, as citizens or entrepreneurs, can do to enhance their self-sufficiency and preparedness in this regard (see the previous chapter).

What would the instrument, Everyone’s Water Manager’ look like

The 'Everyone’s a Water Manager' instrument is a process-oriented approach in which the Klimaatonderlegger is used for support. Ultimately, the process aims at awareness and behavioral change so that people know what to do in case of (threats of) climatic extremes. The process is intended to strengthen people's self-sufficiency by providing them with suitable measures.

A key player in this process is the so-called 'climate coach.' A climate coach guides the process with stakeholders. The coach has expertise, provides advice, possesses interpersonal skills, and knows how to use the Klimaatonderlegger. The climate coach has a mandate to raise awareness among citizens and make them more self-sufficient regarding climate change. This requires tailored approaches for each situation. Additionally, the climate coach not only guides but also learns from practical experience (What can we learn from the awareness and behavioral change of individuals and businesses?).

We can learn a lot from energy coaches who have the task of raising awareness among entrepreneurs and citizens about their energy usage and subsequently making them more energy-conscious (behavioral change). One question that arises is whether a separate climate coach should be appointed. With numerous sustainability transitions occurring (energy, mobility, nutrition, etc.), why not deploy an integrated coach in the long run? The question is whether energy coaches can also become climate coaches. This should be further explored.

Stakeholders can include various target groups: residents, (agricultural) entrepreneurs, societal organizations, associations, etc. In this process, we have mainly focused on citizens and entrepreneurs.

The 'Everyone's a Water Manager' process comprises the following major phases:

1. Preparation of the process
2. Stimulating awareness of one's own climate sensitivity (and its consequences for others): How sensitive am I to climate change, and what impact do I have on others?
3. Gaining insight into one's own leeway in climate-adaptive water management: What can I do myself to become more climate-adaptive for myself and for others?
4. Implementing changes in one's own practices
5. Aftercare

'Everyone's a Water Manager' in practice

The process begins with promoting awareness. In the various phases, different elements of the 'Klimaatonderlegger' are utilized under the guidance of the climate coach.

Firstly, the 'Klimaatonderlegger' is used for awareness through maps that indicate potential challenges in the current situation and where opportunities exist to become more climate-adaptive (as a household, business, (agricultural) entrepreneur, or societal institution such as a school or healthcare facility). One can zoom in on their own street or business premises to see the current situation and potential future climate-adaptive capabilities.

Key questions when using the tools include:

- Am I well-prepared for heat, drought, and water overflow? Why or why not?
- Who benefits from or is adversely affected by my own situation regarding climate adaptation?
- What can I do to prevent or mitigate problems in the future?

The format of the ‘Klimaatonderlegger’ is not yet determined. However, if it becomes a digital twin of the area, one could zoom in 3D on a business park or street view, observing features such as commercial buildings and residences. The digital twin reveals how vulnerable a neighborhood or street is to water, heat, and drought (and whether one's own climate resilience affects others). The ‘Klimaatonderlegger’ raises awareness of one's vulnerability and prompts thinking about adjustments to become more climate-resilient. It also illustrates concrete actions (such as infiltration, water retention, water buffering, designing cool spots, de-paving, and greening).

Subsequently, the Climate Coach deploys the ‘Klimaatonderlegger’ to explore one's leeway for action (what can I do in this situation), and best practices are incorporated into the ‘Klimaatonderlegger’. Depending on the type of stakeholder and situation, various best practices for different measures and actions are provided to guide individuals into action. This involves both individual solutions (such as de-paving or installing barriers) and collective solutions (organizing a volunteer water brigade in the neighborhood that acts in emergencies or proactively assists people/businesses).

Key questions when using the Klimaatonderlegger in combination with a Climate Coach are:

- From which practices can I learn?
- What do I learn from them, and how do I translate this into concrete action?
- Who/what do I need for this?
- How can I get started tomorrow?
-

Together with the Climate Coach, follow-up appointments are scheduled, actions are monitored, and changes are implemented. When individuals and businesses embark on enhancing their climate resilience, it is desirable to establish a collective 'learning platform.' This learning platform is intended to follow up on actions and behavioral changes. There will always be questions during the implementation of measures. The platform can provide guidance, and much learning will occur in practice concerning climate-adaptive self-reliance.

Key questions include:

- What will I do tomorrow?
- How will I organize and finance this?
- What challenges might I encounter, and how will I address them?
- Where can I go for assistance?

A crucial question to address is who will pay for the interventions and how. Subsidies are likely available to adapt various elements. A comprehensive subsidy guide and targeted advice could be useful components of the climate coach's role.

In summary, the Climate Coach provides advice, coaching, and follow-up, while consulting the Klimaatonderlegger for guidance (and providing clarification on the content of the Klimaatonderlegger when needed).

6. Conclusions and future steps

This trajectory has resulted in a preliminary conceptualization of, as well as building blocks for two instruments: the *Klimaatonderlegger* and *Everyone's a Water Manager*. While the project yielded promising results, the Klimaatonderlegger does not yet exist in a final form. It still needs further development, which requires time and capacity. Once the Klimaatonderlegger is in place, the climate coach, the key player in 'Everyone's a Water Manager', can commence their work.

What still needs to be done to create the Klimaatonderlegger? This trajectory indicates that stakeholders and experts would like Waterschap Limburg to take a leading role in this regard, collaborating with other organizations and experts.

Looking to the future, the following steps should be taken:

- Establish a team for the development of the Klimaatonderlegger
- Gain insights into similar initiatives (province, safety region)
- Seek alignment and collaboration in Limburg and beyond
- Initiate a co-creation process for the development of the Klimaatonderlegger
- Test prototypes of the Klimaatonderlegger with the intended user groups
- Ensure legal safeguarding of the Klimaatonderlegger

But also:

- Continue building a network committed to climate adaptation (building on the existing network)
- Train individuals to use the Klimaatonderlegger
- Train climate coaches to support individuals, businesses, and organizations in becoming more climate-resilient (making connections to energy coaches and possibly developing communities of practice)

The co-creation trajectory has shown that there is consensus on one crucial point: a paradigm shift is needed. We are at a pivotal moment, transitioning towards more climate-adaptive spatial management.

There is a significant need for the Klimaatonderlegger (and climate coaches) to better prepare for the future. The future will undoubtedly present more challenges with increased heat, drought, and water overflow.

Time is of the essence, and it seems appropriate to come into action, and not to linger too much at the drawing boards. Instead, we suggest taking action using pilot projects, in places where the need is urgent, learn by doing, share experiences widely and diversely, and use these experiences to refine the Klimaatonderlegger further.

Appendices

This section features several additional documents that were produced during or as a result of the co-creation design trajectory of the CARE project.

Appendix 1: Actor analysis

Appendix 2: Issue and policy analysis (Dutch)

Appendix 3: Preliminary list of potential map layers (Dutch)

Appendix 4: List of participating actors